

Original Article

Caudal-to-cranial Approach for Laparoscopic Right Hemicolectomy – MMH Experience

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Key Words

Caudal-to-cranial approach;
Laparoscopic right hemicolectomy

Purpose. The lateral-to-medial approach is typically used in open surgery of right hemicolectomy. Laparoscopic right hemicolectomy is performed in medial-to-lateral approach conventionally and it is challenging for inexperienced surgeons. This study evaluated the outcomes of laparoscopic right hemicolectomy involving the lateral-to-medial and caudal-to-cranial approaches.

Materials and Methods. From April 2016 to October 2016, 16 patients underwent laparoscopic right hemicolectomy with radical lymph node dissection in the lateral-to-medial and caudal-to-cranial approach for cecal, ascending colonic and proximal transverse colonic lesions. We retrospectively analyzed the data obtained from the Mackay Memorial Hospital database.

Results. In this study, 9 male and 7 female patients were examined. The mean patient age was 63.4 years (37-89 years), and the mean operating time was 164 minutes (99-260 minutes). Furthermore, the mean blood loss was 56 ml, and the mean number of harvested lymph nodes was 23.8. The mean hospital stay was 7.5 days. No case was converted to open surgery. Post-operative morbidity occurred in 5 patients, including acute exacerbation of chronic obstructive pulmonary disease, urinary tract infection and wound infection. No post-operative mortality was reported within 30 days after surgery.

Conclusions. Our results reveal the safety and feasibility of the caudal-to-cranial approach in laparoscopic right hemicolectomy, particularly for inexperienced surgeons. This technique provides more precise access to adequate dissection plane, protection of retroperitoneal organs, dissection of lymph node along the superior mesenteric vein and ligation of the middle colic vessels at the root.

[J Soc Colon Rectal Surgeon (Taiwan) 2018;29:29-34]

Laparoscopic surgery for colon cancer was first published in 1991.^{1,2} Several prospective trials have reported that the short-term and long-term out-

comes of laparoscopic surgery for treating colorectal cancer are identical to those of conventional open surgery.²⁻⁴

Received: June 29, 2017.

Accepted: January 8, 2018.

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Laparoscopic right hemicolectomy conventionally involves the medial-to-lateral approach. The lateral-to-medial approach is typically used in open surgery. The initial step in such laparoscopic right hemicolectomy is to enter the moderate dissection plane and ligate the ileocolic vessels at the root. This procedure is challenging, particularly in patients with a thick mesocolon or for inexperienced surgeons. The duodenum or ureter may be injured if the wrong dissecting plane is entered. Laparoscopic right hemicolectomy emphasizing complete mesocolon excision (CME) for right colon cancer was reported.⁴ However, it remains challenging for novice surgeons.

Recent studies have reported caudal-to-cranial and lateral-to-medial approaches in laparoscopic right hemicolectomy.^{1-4,6,7,9} The present study was conducted to determine the efficacy and feasibility of the caudal-to-cranial and lateral-to-medial approaches in laparoscopic right hemicolectomy for right colon lesions.

Materials and Methods

We retrospectively analyzed the data obtained from the Mackey Memorial Hospital database on 16 consecutive patients who had undergone laparoscopic right hemicolectomy involving the lateral-to-medial and caudal-to-cranial approaches from April 2016 to October 2016.

The procedure required two 5-mm working ports (one each at right and middle lower abdomen) and one 10-mm supra-umbilical camera port (Fig. 1). A pneumoperitoneum was established with 12-15 mmHg intra-abdominal pressure. The initial step involved entering Toldt's space by dissecting from the white line. The lateral-to-medial dissection was continued to approach the root of the ileocolic vessels and the superior mesentery vein (SMV). Ileocolic mobilization with the lateral traction of the cecum contributed to the tenting effect, facilitating ligation at the root of the ileocolic vessels. Thereafter, dissecting lymph nodes along the SMV in an upward direction made the identification of the root of the right and middle colic vessels safer and easier. For dissecting lymph nodes on the pancreatic head and duodenum, either the medial-

to-lateral or lateral-to-medial approach was used (Fig. 2). Subsequently, the division of the right branch of the middle colic artery (MCA) or the root of the MCA

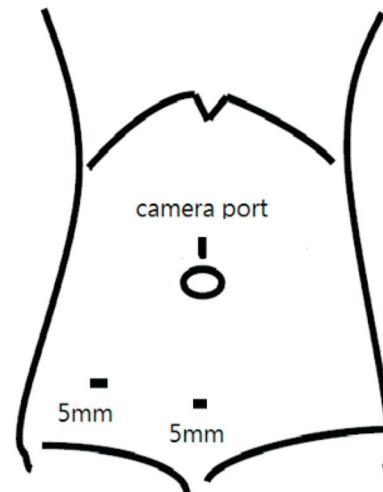


Fig. 1. The two 5-mm working ports were inserted at RLQ and MLQ area. The 10-mm camera port was inserted at supra-umbilical area.

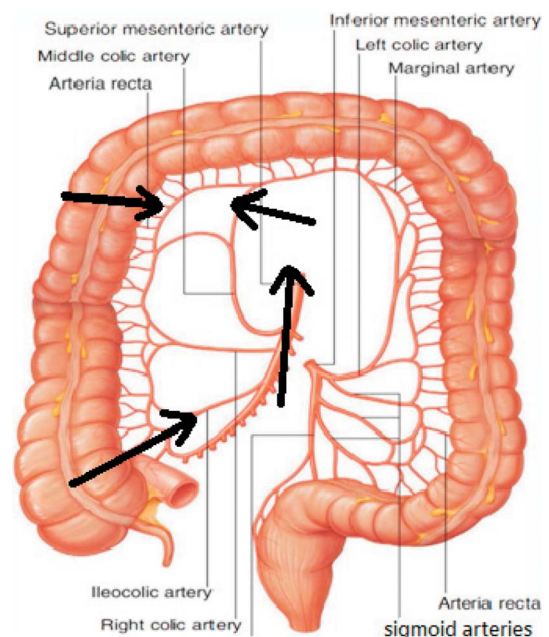


Fig. 2. The initial step involved entering Toldt's space by dissecting from the white line. The lateral-to-medial dissection was continued to approach the root of the ileocolic vessels and the superior mesenteric vein (SMV). Thereafter, dissecting lymph nodes along the SMV in an upward direction was performed. For dissecting lymph nodes on the pancreatic head and duodenum, either medial-to-lateral or lateral-to-medial approach was used.

was achieved, and more precise lymph node dissection and complete mesocolon excision were thus accomplished (Fig. 3).

Extracorporeal anastomosis was performed after the supra-umbilical wound was extended to 4-5 cm. Finally, a silicone drain tube was inserted through the right lower abdominal working port (Fig. 4).

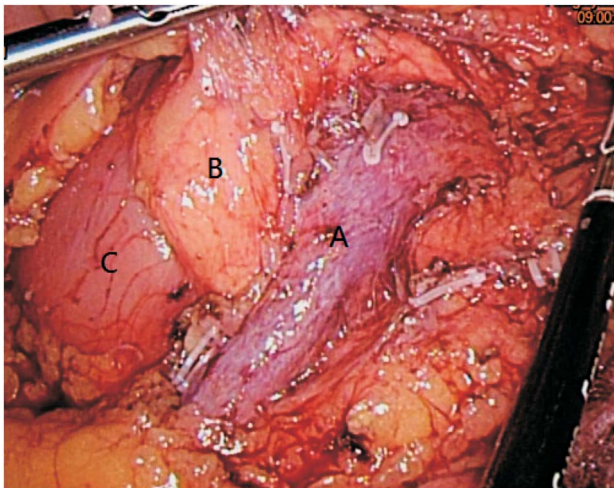


Fig. 3. Dissecting lymph nodes along the SMV (A) in an upward direction facilitates identification of the root of the right and middle colic vessels around pancreatic head (B) and duodenum (C). CME was done.



Fig. 4. Supra-umbilical wound was extended to 4-5 cm to perform extracorporeal anastomosis. Thereafter, a silicone drain tube was inserted through the RLQ 5 mm working port.

Results

From April 2016 to October 2016, we performed laparoscopic right hemicolectomy involving lateral-to-medial and caudal-to-cranial approaches for 16 patients (9 men and 7 women; mean age: 63.4 years [37-89 years]). Seven patients were older than 65 years, including 2 patients older than 80 years. One patient was diagnosed as having appendix mucocele; 3 patients were diagnosed as having lateral spread tumor; 1 and 11 patients were diagnosed as having carcinomas in situ and adenocarcinomas, respectively. Among the patients diagnosed as having malignancies, 2 were classified to have pT4 tumor. The mean number of harvested lymph nodes was 23.8 (17-40; Table 1). The mean operating time was 164 minutes (99-260 minutes), and the mean blood loss was 56 mL (50-200 mL). The mean wound length was 4.4 cm (4-7 cm; Table 2). We noted no intraoperative compli-

Table 1. Pathologic outcome

	Number
Appendix mucocele	1 ^a
Lateral spread tumor	3 ^b
Carcinoma in situ	1
Colon cancer	11
pT1	1
pT2	0
pT3	7
pT4	2
pN (+)	5
pN (-)	6
No. of harvested LN	23.8 (17-40)*

* Mean (range).

^a 6 cm appendix mucocele. ^b Size of lateral spread tumor are 3 cm, 4 cm and 6 cm in diameter.

Table 2. Surgical outcome

	Number
Open conversion	0 (0%)
Operation time (min)	
< 120	2
121~180	9
> 180	5
Average	164
Blood loss (ml)	
< 50	13
50~100	1
100~200	2
Length of wound (cm)	4.4 (4-7)*

* Mean (range).

cations, conversion to open surgery or post-operative 30-day mortality.

Discussion

Compared with open surgery, laparoscopic right hemicolectomy remains challenging for novice surgeons. In the medial-to-lateral approach, precisely entering Toldt's space may be difficult for inexperienced surgeons, particularly in patients with a thick mesocolon. The third portion of the duodenum or retroperitoneal organs may be injured during the identification of the ileocolic vessel roots.

By combining the caudal-to-cranial and lateral-to-medial approaches, novice surgeons may perform the dissection from the white line, in the same manner as that in open surgery. Thereafter, the mobilization of ileocolic vessels with lateral traction of the cecum contributes to the tenting effect, which makes the identification of the ileocolic vessel root easier and safer. For young surgeons, this is a safe method for laparoscopic right hemicolectomy and potentially has a short learning curve.

Approaching the root of middle colic vessels in laparoscopic surgery is a great concern for novice surgeons. Entering the inadequate plane may result in injury to the pancreas and duodenum or may easily cause bleeding. Extended right hemicolectomy is indicated for colon cancer at the hepatic flexure or proximal transverse colon. Identification and ligation at the root of middle colic vessels are crucial for radical surgery in such patients. The previous dissection of lymph nodes along the SMV in an upward direction makes the identification of middle colic vessels easy and safe. In our experience to dissect the lymph nodes on the pancreas and duodenum, surgeons must be familiar with the lateral-to-medial and medial-to-lateral approaches. Locally advanced cancer and adhesion may complicate dissection. The aforementioned approaches are used based on individual condition.⁵

In our study, the mean operating time was 164 minutes (99-260 minutes), including that of two cases of extended right hemicolectomy, and the mean blood loss was 56 mL. We performed laparoscopic right he-

micolectomy with the caudal-to-cranial approach in a patient with a body mass index of 39 (height: 151 cm and weight: 90 kg). In this case, the operating time was 136 minutes, and the blood loss was 200 mL. The combination of lateral-to-medial and caudal-to-cranial approaches facilitates entering the adequate plane safely. We reviewed previous studies on laparoscopic right hemicolectomy. Bac et al. reported a mean operating time of 119 ± 38 minutes.¹ Cho et al. and Baker et al have reported mean operating times of 210 ± 80.1 minutes,⁶ and 107.2 minutes,⁷ respectively.

In our study, no intraoperative complications or conversion to open surgery occurred. However, 5 patients developed post-operative complications. The complication rate was 31.3% (5/16). Among the 5 patients, 1 was diagnosed as having acute exacerbation of chronic obstructive pulmonary disease. A female patient (age: 84 years) was diagnosed as having pneumonia and urinary tract infection; she had the longest hospital stay (32 days). The remaining 3 patients were diagnosed as having wound infection; these patients were subjected to trans-umbilical incisions. Cho et al. reported a complication rate of 19.9% (31/156).⁶ and Bac et al. reported a complication rate of 23.2% (13/56).¹ Our complication rate is higher than those reported in previous studies; however, our post-operative complications were mostly related to patients' underlying diseases and old age. No anastomotic leakage, surgical reintervention or post-operative 30-day mortality was noted. The results suggest the safety and feasibility of laparoscopic right hemicolectomy with the caudal-to-cranial approach, even for patients with obesity.

Kanemitsu et al reported that D3 lymphadenectomy allows curative resection and yields long-term survival in a cohort of patients with right-sided colon cancer. D3 lymphadenectomy involves the complete dissection of regional lymph nodes, including pericolic, intermediate, and main nodes along superior mesenteric vessels, as defined by the Japanese Society for Cancer of the Colon and Rectum.^{5,8}

Laparoscopic right hemicolectomy with D3 lymph node dissection is difficult and challenging. In our study, the caudal-to-cranial approach was mainly used to obtain an eradication rate equal to that of open sur-

gery. After the ligation of ileocolic vessels, we performed sharp dissection for removing the lymph nodes along the SMV in the caudal-to-cranial approach. This approach facilitates the identification of the root of right colic vessels and right branch of the middle colic vessels. Thereafter, we ligated the vessels at the root of pedicles, which is the principle of radical lymph node dissection. The mean number of harvested lymph nodes was 23.8. A maximum of 47 lymph nodes was harvested through laparoscopic extended right hemicolectomy. Cho et al. and Li et al. have harvested 27.4⁶ and 37.3⁹ lymph nodes, respectively, through laparoscopic right hemicolectomy. Compared with these findings, our results are valid and feasible.

In our study, the mean wound length was 4.4 cm. The wound length depends on the tumor and colon size. We routinely performed extracorporeal anastomosis which required bigger wounds than those in intracorporeal anastomosis. Among our patients, the largest wound was 7 cm because of the large size of the colon.

Notably, a meta-analysis reported that intracorporeal anastomosis in laparoscopic right hemicolectomy is associated with reduced short-term morbidity and decreased length of hospital stay suggesting faster recovery.¹⁰ We will investigate intracorporeal anastomosis in laparoscopic right hemicolectomy in our next study.

Conclusions

Our results reveal the safety and feasibility of the caudal-to-cranial approach in laparoscopic right hemicolectomy, particularly for inexperienced surgeons. The results suggest that the approach is a safe alterna-

tive to the conventional approach. This technique provides more precise access to adequate dissection plane, protection of retroperitoneal organs, dissection of lymph node along the superior mesenteric vein and ligation of the middle colic vessels at the root.

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原 著

腹腔鏡右側大腸切除手術 – 馬偕醫院經驗

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目的 傳統開腹手術進行右側結腸切除與淋巴廓清手術，作法為由身體外側面至內側面進行廓清手術，而腹腔鏡手術的作法則相反，由內側面至外側面進行廓清手術，對於年輕醫師而言，使用腹腔鏡進行右側大腸手術一直是個挑戰。本研究在分析腹腔鏡右側大腸切除手術使用外側面到內側面進行淋巴廓清手術的安全性與可行性。

方法 自 2016 年 4 月至 2016 年 10 月，腹腔鏡右側大腸切除與淋巴廓清手術，我們採用由身體外側面至內側面之作法進行廓清手術，總共 16 位病患接受手術以治療右側大腸腫瘤。我們統計及比較病人年齡、手術時間、失血量、廓清淋巴結數、平均住院天數以及是否產生術後併發症。所有病人資料皆從馬偕醫院資料庫取得並使用回溯式分析進行研究。

結果 在我們的研究中，共有 9 位男性病人及 7 位女性病人。其平均年齡為 63.4 歲 (37-89 歲)。而平均手術時間為 164 分鐘 (99-260 分鐘)。平均失血量為 56 毫升。平均廓清淋巴結數量為 23.8 顆。平均住院天數為 7.5 天。無術中轉為傳統開腹手術之病人。這 16 位病人中有 5 位病人發生術後併發症，為慢性阻塞肺病變急性發作、泌尿道感染以及傷口感染，但並無手術後 30 天內死亡之個案。

結論 關於年輕醫師進行腹腔鏡右側大腸切除與淋巴廓清手術，運用由身體外側面至內側面進行廓清手術是安全與可行的。此作法運用如同傳統剖腹手術的方式進行腹腔鏡淋巴結廓清手術。優點為較容易精準完整切除大腸腸繫膜、降低誤傷後腹腔器官之機率以及達到最佳淋巴結廓清率。

關鍵詞 腹腔鏡右側大腸切除手術。