

Original Article

Unnecessary High Arterial Ligation in Colorectal Surgery May Proved by Inferior Mesenteric Artery Peeling

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Key Words

Colorectal surgery;

High arterial ligation;

Peeling

Purpose. This retrospective study investigated the necessary of nature of high ligation in colorectal surgery by positive rate of lymph nodes metastases from peeling of inferior mesenteric artery.

Methods. Between April 1st, 2013 to April 30th, 2016, 216 patients were diagnosed with sigmoid colon, rectosigmoid colon and rectal cancer and received operation whether laparotomy or laparoscopic method at Kaohsiung Veterans General Hospital. After excluding patient with pure high ligation without peeling, 120 patients were enrolled in our study. Of the 120 patients, 86 patients were received peeling in colon cancer group and 34 patients were received peeling in rectal cancer group. After then, we compared clinicopathological characteristics of patients, number of retrieved lymph node from peeling and positive rate of lymph nodes metastases from peeling of inferior mesenteric artery in each group.

Results. Patient received peeling of inferior mesenteric artery by laparotomy or laparoscopic colectomy. Obviously, the retrieved lymph nodes from peeling by laparoscopic operation are more than laparotomy operation. Even though steady harvested amount of lymph node from peeling of inferior mesenteric artery, there is still only 0% of positive rate of lymph nodes metastases from peeling in colon cancer group and 2.94% of positive rate of lymph nodes metastases from peeling in rectal cancer group.

Conclusions. From origin of inferior mesenteric artery to location just below the origin of the left colic artery is a short distance and those extremely low numbers of retrieved lymph nodes and low incidence of positive rate of lymph nodes metastases around inferior mesenteric artery were revealed in our study. Therefore, the unnecessary of high arterial ligation should be considered due to it will undertake risks of low blood flow perfusion, leakage of anastomosis and damage of nerve.

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Colorectal cancer is the third most common malignant cancer in incidence (9.7%) and fourth most common malignant cancer in mortality (8.5%) in this world; and is the third most common cancer in men (746,000 cases, 10% of the total) and the second

in women (614,000 cases, 9.2% of the total).¹ Most incidences of all colorectal malignancies are left side colonic or rectal cancers. Currently, main proper treatment is surgery, with removal of the tumor, proper length of bowel and lymph nodes along its blood sup-

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ply. The positive or negative expression of lymph node metastases is the most important prognostic factor.²

Traditionally, routes of metastasis are concerned by the four routes as lymphatic spread, hematogenous spread, transcoelomic and canalicular spread and former two routes are most considerations during operation. The lymphatic drainage and route of metastatic spread for tumor of the left side colon and rectum is along inferior mesenteric artery and vein to the aortic then systemic system.³ The radical extent to removal of the proximal inferior mesenteric artery related lymph nodes is pursued. Nevertheless, inferior mesenteric artery ligation might compromise blood flow to the bowel anastomosis, potentially increasing anastomotic leakage rate or even without real oncological benefits. Therefore, the problem of tie off the inferior mesenteric artery at its origin (high ligation) or just below the origin of the left colic artery (low ligation) in radical surgery for left side colon and rectal cancer has been debated and the level of arterial ligation still varies among hospitals and patients.⁴

Nowadays, the surgery for sigmoid colon and rectal cancer treatment (anterior resection, lower anterior resection) has been well standardized in both laparotomy and laparoscopic surgery. The Japanese Society for Cancer of the Colon and Rectum defines as high ligation as a section of inferior mesenteric artery at its root including apical nodes and low ligation as the level below left colic artery origin from inferior mesenteric artery.⁵ The examination of the minimum of 12 lymph nodes to accurately identify staging of colorectal cancers had been recommended by American Joint Committee on Cancer and the College of American Pathologists.⁶ Although the harvested number of lymph nodes has been widely examined but the oncological demands and benefits in associating vascular ligation has not been questioned yet. In Japan, lymph nodes are dissected along the vessel and the ligation and division of a blood vessel distal to the dissected area is commonly performed. This surgical procedure is carried out lymph node dissection around the origin of the inferior mesenteric artery on the central side and preserve the left colic artery with preserving anastomotic perfusion.

Herein, this retrospective study is to present the

value and role of existence of lymph nodes in high ligation by peeling which was a complete lymphadenectomy obtained from inferior mesenteric artery. In this study, we investigated whether the positive rate of lymph node metastases around the origin of the inferior mesenteric artery of patients who underwent peeling with low ligation in addition to comparing numbers of retrieved lymph nodes from peeling between laparotomy and laparoscopic operation.

Materials and Methods

This study subjects were 216 patients who were diagnosed with colorectal cancer from stage I to stage III by pathological report between April 1st, 2013 and April 30th, 2016. They underwent open or laparoscopic surgery including anterior resection, low anterior resection and abdominoperineal resection for colorectal cancer at sigmoid colon and rectum. They were divided into two groups: the cancer located at colon ($n = 138$) and at rectum ($n = 78$). There are two subgroups were divided in each group as open operation group which underwent colectomy by laparotomy way and laparoscopic operation group which underwent colectomy by laparoscopic way. No matter laparotomy or laparoscopic way of operation, the patient all received low ligation at origin of the left colic artery combined with lymph node dissection around the origin of the inferior mesenteric artery. The low ligation without peeling was excluded from this study. The level of ligation of inferior mesenteric artery was decided by the operator.

Our patients were operated by either an open method or laparoscopic method. About the peeling, we traced inferior mesenteric artery cephalad to its root. From 5 mm of the aortic origin, we approach the loose layer between the vascular sheath and the tunica adventitia of the inferior mesenteric artery with Metzenbaum scissor or laparoscopic scissor, peeling lymph nodes tissue all around the vessel (Fig. 1). All sigmoid arteries are isolated at their origin from inferior mesenteric artery and sectioned. The left colic artery is always preserved. When sigmoid mesentery transection, the inferior mesenteric vein is identified, double

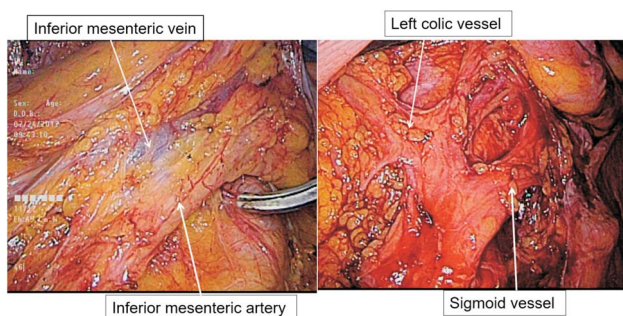


Fig. 1. Vessel trunks after peeling.

clipped or tied by line and sectioned. For guaranty most retrieved rate of lymph nodes around inferior mesenteric artery, the colonoscopic tattooing where is just 1cm below the cancer submucosally with carbon black tattooing ink (non-india tattooing ink) had been received to each patients (Fig. 2).

We performed a retrospective analysis of these two groups which were peeling group in colon ($n = 86$) and rectum ($n = 34$) considering clinicopathological factors, retrieved number of lymph nodes from peeling by laparotomy or laparoscopic method between groups of colon and rectum and positive metastatic rate of lymph nodes from peeling. The clinicopathological factors included age, gender, number of total retrieved lymph nodes, depth of invasion of cancer, staging of lymph nodes and finally pathology staging. The histopathological diagnosis of surgical specimens was performed by pathologists and pathological assessment was performed on the basis of the UICC (Union Internationale Contre le Cancer) TNM Classification (7th edition). Patients of stage 0 and stage IV were excluded from the study. All study procedures were performed in accordance with the Declaration of Helsinki.

Results

The Table 1 had been showed those various clinicopathological characteristics of patients for both two groups which were peeling group in colon and rectum. Most depth of invasion in both groups are to the pericolorectal tissue. The N0 of staging of lymph nodes are in majority of both groups. However, most

pathological staging in peeling of colon group is stage IIA and another in rectum group is stage I. In the Table 2 had been revealed as there were 1.82 ± 1.88 retrieved lymph nodes from peeling by laparotomy method of colectomy and 2.28 ± 2.25 retrieved lymph nodes from peeling by laparoscopic method of colectomy in colon group. Similarly, there were 1.36 ± 1.19 retrieved lymph nodes from peeling by laparotomy method of colectomy and 2.33 ± 1.63 retrieved lymph nodes from peeling by laparoscopic method of colectomy in rectum group. Obviously, more retrieved number of lymph nodes from peeling in laparoscopic method of colectomy. However, the rate of lymph node metastasis-positive cases from peeling was 0 ($0/86 = 0\%$) in the colon group and 1 ($1/34 = 2.94\%$) in the rectum group. Comparison the anastomosis leakage rate between non-peeling and peeling group, they are 0% ($0/52$) versus 1.16% ($1/86$) in colon group and 0% ($0/44$) versus 0% ($0/34$) in rectal group. Comparison the post operation recurrence rate between non-peeling and peeling group, they are 0% ($0/52$) versus 0% ($0/86$) in colon group and 2.27% ($1/44$) versus 0% ($0/34$) in rectal group.

Discussion

In radical operation treating sigmoid colon cancer or rectal cancer, the ligation level of the inferior mesenteric artery that should be ligated at the root of the inferior mesenteric artery (high ligation) or just below the origin of the left colic artery (low ligation) has been still debated. The high ligation used in colectomy for sigmoid colon or rectum has been reported that the incidence of anastomotic leakage after surgery is about 5 to 26%.⁷⁻⁹ The high ligation is more possibility to damage the nerve plexus around the root of inferior mesenteric artery, resulting in autonomic nervous system disorders such as urinary dysfunction.¹⁰ Besides,

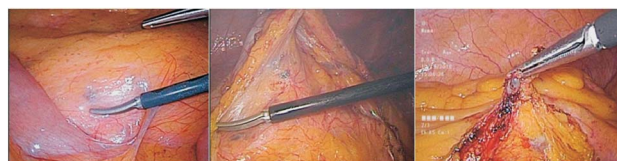


Fig. 2. The enhanced tattooing lymph nodes around inferior mesenteric artery.

Table 1. Clinicopathological characteristics of patients

	Group A (n = 86)	Group B (n = 34)
Sex		
Male	52 (60.47%)	23 (67.65%)
Female	34 (39.53%)	11 (32.35%)
Age (year) ± SD	61.00 ± 9.38	62.59 ± 10.16
Number of total retrieved lymph nodes		
Mean	19.58	18.38
SD	6.68	8.08
Anastomosis leakage	1 (1.16%)	0 (0%)
Post operation recurrence	0 (0%)	0 (0%)
Depth of invasion		
Submucosa (T1)	17 (19.77%)	9 (26.47%)
Muscularis propria (T2)	16 (18.60%)	8 (23.53%)
Pericorectal tissue (T3)	49 (56.98%)	17 (50%)
Penetrate the surface of visceral peritoneum (T4a)	3 (3.49%)	0
Directly invades or adherent to other organs or structures (T4b)	1 (1.16%)	0
Staging of N		
N0	48 (55.81%)	21 (61.76%)
N1a	11 (12.79%)	4 (11.76%)
N1b	15 (17.44%)	4 (11.76%)
N1c	2 (2.33%)	1 (2.94%)
N2a	5 (5.81%)	2 (5.88%)
N2b	5 (5.81%)	2 (5.88%)
Pathological staging		
Stage I	22 (25.58%)	12 (35.29%)
Stage IIA	26 (30.23%)	9 (26.47%)
Stage IIB	0	0
Stage IIC	0	0
Stage IIIA	10 (11.63%)	5 (14.71%)
Stage IIIB	24 (27.91%)	6 (17.65%)
Stage IIIC	4 (4.65%)	2 (5.88%)

Group A: peeling in colon group; Group B: peeling in rectum group. n: number, N: regional lymph node.

Table 2. Number of retrieved lymph node from peeling of inferior mesenteric artery

	Colon	Rectum
Laparotomy		
Number ± SD	1.82 ± 1.88	1.36 ± 1.19
Medium number	1	1
Laparoscopy		
Number ± SD	2.28 ± 2.25	2.33 ± 1.63
Medium number	2.5	2.5

there is no clear significant difference in prognosis between the procedures of high ligation and low ligation.¹¹⁻¹³

The nature of high ligation is most extent of blocking routes of metastases and retrieving number of lymph

nodes. In our study, we investigated the necessary of nature of high ligation by positive rate of metastases in peeling from inferior mesenteric artery in operation whether laparotomy or laparoscopic method. According to data from the Japanese Society for Cancer of the Colon and Rectum, the positive rate of lymph node metastases around the origin of inferior mesenteric artery is 3.6% in pT3/T4 sigmoid colon cancer and 5.1% in rectal cancer.¹⁴ In addition, another study has been reported the rate of positive lymph nodes at the root of the inferior mesenteric artery in rectal cancer patients is ranging from 0.3 to 11.1%.¹⁵ The Chen et al. reported, the positive rate of inferior mesenteric artery lymph nodes metastases in different staging are revealed as 0% (pT1), 1.0% (pT2), 2.6 (pT3) and 4.3% (pT4) by

of TNM staging.¹⁶ As our result, no positive rate of lymph nodes metastases was noted in peeling of inferior mesenteric artery of colon group and 2.94% as positive rate of lymph nodes metastases was noted in peeling of inferior mesenteric artery of rectum group. The higher positive rate of lymph nodes metastases in rectal cancer group than in colon cancer group from peeling of inferior mesenteric artery is probably due to small including patient numbers in rectal group and there is only one positive finding of lymph node from inferior mesenteric artery. In our study, the case who is the only case of positive finding of lymph nodes metastases received abdominoperineal resection with end colostomy on July 22nd, 2015. After then, this 74 years old male patient has regular follow-up in our out patient department of colorectal department and received completed course of adjuvant chemotherapy with Capecitabine. Unfortunately, the patient died on Oct. 14th, 2016 due to septic shock secondary to pneumonia. There was no any evidence of local relapse or distant metastasis until the end of his life. Those numbers are negligible even though higher retrieved number of lymph nodes from peeling by laparoscopic method of operation.

The Yasuda et al. reported, there were 23.8% of case of recurrence in the high ligation group and 20.4% of case of recurrence in the low ligation group with apical lymph node dissection group, with no statistically significant difference between two groups.¹⁷ As long as there was no statistically significant difference, the oncological benefit of prevent recurrence from high ligation of inferior mesenteric artery might disappeared but the complications from high ligation were still existed. In the Liang et al. reported, the lymph node dissection of inferior mesenteric artery with preservation of the left colic artery can be performed with good technical efficiency by robotic-assisted surgery and presenting of surgical outcomes by maintaining the blood supply to the proximal colon and the anastomotic failure can be prevented for the surgery of distal rectal cancer which was requiring a very low colorectal anastomosis. Moreover, the lymph node dissection over the root of the inferior mesenteric artery and left colic artery can achieve an adequate harvest of lymph nodes (26.1 ± 7.2) which was implied

that the surgical technique about left colic artery was preserved didn't compromise the oncologic efficacy. However, the harvest number of lymph nodes from root of inferior mesenteric artery and overall survival had not been mentioned in this study.¹⁸ Under the circumstances, high ligation of inferior mesenteric artery during operation should be considered by surgeons.

The most important limitations of this study are the small size of the study population and retrospective nature of the study design. We think that a large scale of randomized controlled study is necessary.

Conclusions

According to the very low positive rate of lymph nodes metastases obtained by peeling from inferior mesenteric artery in radical operation for sigmoid colon cancer and rectal cancer, the role of blocking metastases from lymphatic spread by high ligation is believed that's might not necessary. Our study is a retrospective study and a large-scale randomized controlled trial is expected to be performed to determine the level of ligation of the inferior mesenteric artery during radical operation for sigmoid colon and rectum.

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原 著

於大腸直腸手術中非必要性之高位動脈結紮術 可由下腸繫膜動脈根部組織剝離術證明

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目的 此回顧性研究是藉由研究從下腸繫膜動脈根部組織剝離術中取得的轉移性淋巴結陽性反應率，來探討在大腸直腸手術中高位結紮術本質上的必要性。

方法 從 2013 年 4 月 1 日到 2016 年 4 月 30 日，在高雄榮民總醫院有 216 名患者分別被診斷為乙狀結腸癌及直腸癌，該患者們皆接受手術不論是剖腹或腹腔鏡的方式。排除單純接受高位結紮術，並無接受根部組織剝離術的患者後，最後有 120 位患者列入本研究當中。再依照癌症發生位置分成 2 組，分別有 86 名患者接受根部組織剝離術在大腸癌組及 34 名患者接受根部組織剝離術在直腸癌組。我們比較各組患者臨床病理特徵、剖腹或腹腔鏡方式根部組織剝離術得到的淋巴結的數目及從下腸繫膜動脈根部組織剝離術得到的淋巴結轉移的陽性反應率。

結果 患者皆為接受剖腹或腹腔鏡方式的大腸直腸癌切除手術並在手術中接受下腸繫膜動脈根部組織剝離術。明顯的，利用腹腔鏡手術下取得的淋巴結數目多於用剖腹手術取得的淋巴結數目。然而即便從下腸繫膜動脈根部組織剝離術中可以穩定收穫到一定數量的淋巴結，在大腸癌組，其由下腸繫膜動脈根部組織剝離術中得到的淋巴結轉移陽性反應率為 0%，又直腸癌組得到的淋巴結轉移陽性反應率為 2.94%。

結論 從下腸繫膜動脈的起始處到左結腸動脈起始處下緣是一段很短的距離，從我們的研究中可以看出從此段下腸繫膜動脈週圍得到的淋巴結數目是極少的，又淋巴結轉移的陽性反應率也是極低。因此，在要承擔低血流灌注、吻合處滲漏及神經傷害的風險之下，不必要的高位結紮術是應該要被仔細考慮的。

關鍵詞 大腸直腸癌手術、高位動脈結紮術、根部組織剝離術。