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Contents

Monthly Volume 15 Number 6 June 27, 2023

OPINION REVIEW

REVIEW

MINIREVIEWS

ORIGINAL ARTICLE

Basic Study

Retrospective Cohort Study

World Journal of Gastrointestinal Surgery

Monthly Volume 15 Number 6 June 27, 2023

Contents

World Journal of Gastrointestinal Surgery

Monthly Volume 15 Number 6 June 27, 2023

Contents

World Journal of Gastrointestinal Surgery

Monthly Volume 15 Number 6 June 27, 2023

Contents

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ORIGINAL ARTICLE

Retrospective Cohort Study

Fascia- *vs* vessel-oriented lateral lymph node dissection for rectal cancer: Short-term outcomes and prognosis in a single-center experience

Wei Zhao, Zhi-Jie Wang, Shi-Wen Mei, Jia-Nan Chen, Si-Cheng Zhou, Fu-Qiang Zhao, Ti-Xian Xiao, Fei Huang, Qian Liu

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Abstract

BACKGROUND

For the management of lateral lymph node (LLN) metastasis in patients with rectal cancer, selective LLN dissection (LLND) is gradually being accepted by Chinese scholars. Theoretically, fascia-oriented LLND allows radical tumor resection and protects of organ function. However, there is a lack of studies comparing the efficacy of fascia-oriented and traditional vessel-oriented LLND. Through a preliminary study with a small sample size, we found that fascia-oriented LLND was associated with a lower incidence of postoperative urinary and male sexual dysfunction and a higher number of examined LLNs. In this study, we increased the sample size and refined the postoperative functional outcomes.

AIM

To compare the effects of fascia- and vessel-oriented LLND regarding short-term outcomes and prognosis.

METHODS

We conducted a retrospective cohort study on data from 196 patients with rectal cancer who underwent total mesorectal excision and LLND from July 2014 to August 2021. The short-term outcomes included perioperative outcomes and postoperative functional outcomes. The prognosis was measured based on overall survival (OS) and progression-free survival (PFS).

RESULTS

A total of 105 patients were included in the final analysis and were divided into fascia- and vessel-oriented groups that included 41 and 64 patients, respectively. Regarding the short-term outcomes, the median number of examined LLNs was significantly higher in the fascia-oriented group than in the vessel-oriented group. There were no significant differences in the other short-term outcomes. The incidence of postoperative urinary and male sexual dysfunction was significantly lower in the fascia-oriented group than in the vessel-oriented group. In addition, there was no significant difference in the incidence of postoperative lower limb dysfunction between the two groups. In terms of prognosis, there was no significant difference in PFS or OS between the two groups.

CONCLUSION

It is safe and feasible to perform fascia-oriented LLND. Compared with vessel-oriented LLND, fascia-oriented LLND allows the examination of more LLNs and may better protect postoperative urinary function and male sexual function.

Key Words: Rectal cancer; Lateral lymph nodes; Lymph node excision; Fascia anatomy; Treatment outcome; Prognosis

Core Tip: There is a lack of studies comparing the efficacy of fascia-oriented and traditional vessel-oriented lateral lymph node dissection (LLND). To compare the effects of fascia- and vessel-oriented LLND regarding the short-term outcomes and prognosis, we conducted a retrospective cohort study based on seven years of data. We found that it is safe and feasible to perform fascia-oriented LLND. Compared with vessel-oriented LLND, fascia-oriented LLND allows the examination of more lateral lymph nodes and may better protect postoperative urinary and male sexual function.

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INTRODUCTION

Since Gerota first proposed the existence of lateral lymphatic drainage in the rectum in 1895, lateral lymphatic drainage has been proven to be an important lymphatic drainage pathway in the middle and lower rectum. The occurrence of lateral lymph node (LLN) metastasis in newly diagnosed rectal cancer patients ranges from 8.6% to 49%[1-3]. Neoadjuvant chemoradiotherapy (nCRT) and LLN dissection (LLND) are two strategies for the management of LLN metastasis advocated by Western and Japanese scholars, respectively. However, nCRT cannot completely eliminate metastatic tumor cells in LLNs[4]. On the other hand, LLND causes a high incidence of postoperative urinary and sexual dysfunction but has a low postoperative pathological positive LLN rate[3,5]. Therefore, depending on imaging findings in patients with enlarged LLNs, a combination of chemoradiotherapy and selective LLND is gradually being accepted by Chinese scholars[3,4,6,7].

With the expansion of fascial anatomy research, the concept of membrane anatomy-guided surgery has become accepted by surgeons. Theoretically, zoning the lateral space of the rectum and performing LLND guided by the fascia can establish a clear surgical plane and dissection boundary and prevent insufficient and excessive dissection. At the same time, dissociation along the fascial margin can prevent a breach into the lymphoid tissues, preventing the spread of metastatic cancer cells and helping to protect the pelvic autonomic nerves. Therefore, fascia-oriented LLND follows anatomical theory regarding radical tumor resection and protection of organ function and is also conducive to the popularization and quality control of lateral dissection[8]. Although several published studies have demonstrated that fascia-oriented LLND is safe in the perioperative period[9-13], these studies either did not explore the effect of fascia-oriented LLND on postoperative neurological function and prognosis or had relatively small sample sizes. In addition, there is a lack of evidence-based medical studies comparing the efficacy of fascia-oriented and traditional vessel-oriented LLND. Through a preliminary study with a small sample size[14], we found that fascia-oriented LLND was associated with a lower

incidence of postoperative urinary and male sexual dysfunction and a higher number of examined LLNs. In this study, we increased the sample size, refined the postoperative functional outcomes, and further analyzed the clinical data from rectal cancer patients undergoing treatment with two different anatomical approaches for LLND at a high-volume center in China to compare their effects on short-term outcomes and prognosis.

MATERIALS AND METHODS

Patients

In this retrospective cohort study, clinical data from 196 patients with rectal cancer who underwent mesorectal excision with curative intent and simultaneous LLND in the Department of Colorectal Surgery, Cancer Hospital Chinese Academy of Medical Sciences from July 2014 to August 2021 was collected. All patients in this study underwent rectal magnetic resonance imaging (MRI) before neoadjuvant therapy and before surgery. All operations were performed by experienced surgical specialists in colorectal oncology at our center. The surgical approach (fascia-oriented or vessel-oriented LLND) used was determined at the discretion of the individual surgeon.

The patient inclusion criteria were as follows: (1) Pathological diagnosis of rectal cancer; (2) Lower tumor margin below the peritoneal reflection; and (3) Preoperative clinical suspicion or clinical diagnosis of LLN metastasis.

The patient exclusion criteria were as follows: (1) A history of pelvic surgery (including rectal cancer surgery); (2) Preoperative urinary, sexual, lower limb, or anorectal dysfunction; (3) Tumor invasion of adjacent organs or preoperative distant metastasis; (4) Non-R0 resection; and (5) No rectal MRI data or incomplete data collection.

The final analysis comprised 105 patients, divided into two groups: The fascia-oriented group with 41 patients and the vessel-oriented group with 64 patients. Figure 1 shows a flowchart of patient enrollment.

Procedures for LLND

Procedures for fascia-oriented LLND: During fascia-oriented LLND, dissection was performed along the fascia of the three pelvic sidewalls [ureterohypogastric nerve fascia (UNF), vesicohypogastric fascia (VF), and parietal pelvic fascia]. This technique included 4 key steps: First, the lateral side of the UNF was isolated to establish the medial border of No. 263 Lymph node dissection (Supplementary Figures 1 and 2A); second, the fascia covering the muscular surface of the pelvic wall was isolated to establish the lateral border of No. 283 Lymph node dissection (Supplementary Figures 2B and 3); third, the VF was dissociated to reveal the main branches of the internal iliac artery inside the facia according to the orientation of the VF and UNF; fourth, en bloc resection of the No. 263 Lymph node and No. 283 Lymph node was performed. Supplementary Figure 4 shows the intraoperative view after LLND.

Procedures for vessel-oriented LLND: The internal iliac artery and its main branches were exposed through intrathecal dissection. In the obturator region, the lymphatic and fatty tissue around the main internal iliac artery and its main branches were dissected. The obturator nerve was exposed throughout the whole process.

If bilateral LLND was performed, the superior or inferior bladder arteries on one side were preserved as much as possible. To prevent adverse effects from prolonged or improper patient placement in the lithotomy position on the patient's lower limb function to the greatest extent, all surgeries followed the AORN Guidelines for patient positioning[15].

Outcome measures

The short-term outcomes included the following two aspects: (1) Perioperative outcomes, including operation time, intraoperative blood loss, incidence of perioperative surgical complications of grade II or higher[16,17], incidence of perioperative mortality, incidence of reoperation, length of postoperative hospital stay, number of examined LLNs, and LLN metastasis rate; and (2) Postoperative functional outcomes, including urinary function, defecation function, male sexual function, and lower limb motor and sensory function. The prognosis was measured based on overall survival (OS) and progression-free survival (PFS).

Postoperative urinary function, defecation function, and male sexual function were assessed according to the International Prostate Symptom Score (IPSS)[18], the low anterior resection syndrome score[19-21], and the International Index of Eerectile Function (IIEF-5)[22,23], respectively. Patients with one of the following symptoms were considered to have postoperative lower limb dysfunction: Gait disorder caused by thigh adductor weakness or movement disorders of the lower limb; loss of sensation, numbness, or radiating pain in the lower limb that was aggravated by extension and abduction or inward rotation of the thigh[24,25]. OS and PFS were defined as follows: OS referred to the duration from the date of surgery until the date of death from any cause, while PFS referred to the duration from the date of surgery until the occurrence of local or regional recurrence, distant

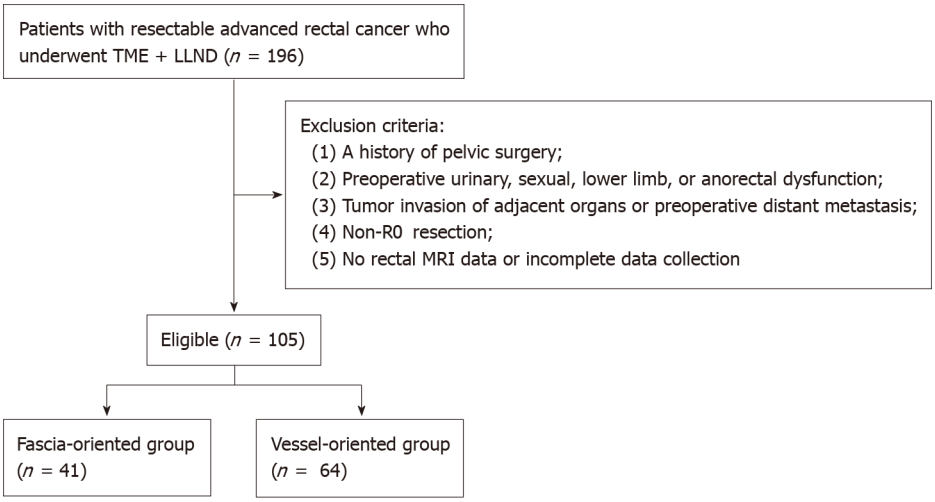

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Figure 1 Flow chart of patient selection. TME: Total mesorectal excision; LLND: Lateral lymph node dissection; MRI: Magnetic resonance imaging.

metastases, or death from any cause.

Follow-up

The follow-up methods included telephone interviews and outpatient examinations. Regarding postoperative functional outcomes, follow-up regarding urinary function was performed by telephone interviews on the 14th day after the operation, follow-up on motor and sensory function of the lower limbs was performed by physical examination or telephone interviews 1 mo after the operation, and follow-up on male sexual function was performed by telephone interviews 1 year after the operation. The last follow-up date was November 31, 2021.

Statistical analyses

The median [interquartile range (IQR)] was used to present continuous variables, while numbers and proportions were used to present categorical variables. The Mann-Whitney U test was used to compare continuous variables, and the χ^2 or Fisher exact test was used to compare categorical variables.

To assess risk factors for postoperative functional outcomes, univariate logistic regression was conducted on the relevant variables. The multivariate logistic regression analyses included the surgical method, potential confounding factors that could impact postoperative functional outcomes, and any baseline factors that were imbalanced between the two groups. Drawing from previous research and our clinical experience, we posited that several factors, aside from the surgical method, could potentially influence postoperative urinary, male sexual, and lower limb function. Specifically, we hypothesized that intraoperative blood loss and single/bilateral LLND may affect postoperative urinary function[5,26], while age, preoperative radiotherapy, and single/bilateral LLND may impact postoperative male sexual function[27,28]. Lastly, we also considered age and single/bilateral LLND as potential factors that could affect postoperative lower limb function, based on our clinical experience and previous studies[24,25,29].

The survival differences among groups were examined using the Kaplan-Meier method and the log-rank test. The reverse Kaplan-Meier method was used to analyze the median follow-up. Cox proportional hazards regression models were employed to select predictive factors for OS and PFS, and the multivariable Cox proportional hazards models included the surgical method, pathological LLN metastasis, and factors with a *P* value lower than 0.05 in the univariate analyses to identify independent risk factors for OS and PFS. IBM SPSS statistics software program, version 23 (IBM, Somers, NY, United States) was used to conduct the statistical analysis.

RESULTS

Clinical and pathological characteristics

Table 1 presents the clinical and pathological characteristics of the patients. The two groups were comparable in terms of age, BMI, neoadjuvant and adjuvant therapy, laparoscopic surgery, bilateral LLND, and each pathological tumor stage. All clinical and pathological characteristics were well balanced between the two groups.

Table 1 Baseline characteristics of the entire cohort (*n* = 105)

Variables	Fascia-oriented group (*n* = 41)	Vessel-oriented group (*n* = 64)	*P* value
Age (yr), median (IQR)	58.0 (48.0, 65.0)	58.5 (47.0, 65.0)	0.908
Sex, *n* (%)			0.728
Male	21 (51.2)	35 (54.7)	
Female	20 (48.8)	29 (45.3)	
BMI (kg/m^2), median (IQR)	24.8 (21.6, 27.8)	24.2 (21.3, 27.5)	0.510
Distance to tumour from AV (cm), median (IQR)	4.0 (3.0, 7.0)	4.0 (3.0, 5.0)	0.358
Pathological type, *n* (%)			0.837
Adenocarcinoma	40 (97.6)	62 (96.9)	
Non-adenocarcinoma	1 (2.4)	2 (3.1)	
Preoperative radiotherapy, *n* (%)			0.356
Yes	10 (24.4)	21 (32.8)	
No	31 (75.6)	43 (67.2)	
Preoperative chemotherapy, *n* (%)			0.698
Yes	17 (41.5)	29 (45.3)	
No	24 (58.5)	35 (54.7)	
Surgical procedure, *n* (%)			0.371
Laparoscopic surgery	40 (97.6)	60 (93.8)	
Conversion to open surgery	1 (2.4)	4 (6.2)	
Surgical approach, *n* (%)			0.571
Dixon	23 (56.1)	31 (48.4)	
Miles	18 (43.9)	32 (50.0)	
Parks	0 (0)	1 (1.6)	
LLND, *n* (%)			0.137
Unilateral dissection	33 (80.5)	43 (67.2)	
Bilateral dissection	8 (19.5)	21 (32.8)	
Pathological tumor stage[a], *n* (%)			0.808
0-I	6 (14.6)	10 (15.6)	
II	7 (17.1)	8 (12.5)	
III	28 (68.3)	46 (71.9)	
Adjuvant therapy, *n* (%)			0.544
Yes	32 (78.0)	53 (82.8)	
No	9 (22.0)	11 (17.2)	

[a]The eighth edition of the American Joint Committee on Cancer TNM staging system.
IQR: Interquartile range; BMI: Body mass index; AV: Anal verge; LLND: Lateral lymph node dissection.

Short-term outcomes

Perioperative outcomes: The lack of a significant difference was found in operation time and length of postoperative hospital stay between the two groups, with respective *P* values of 0.908 and 0.435. The vessel-oriented group had a higher proportion of patients with intraoperative blood loss of ≥ 300 mL compared to the fascia-oriented group (9.4% *vs* 2.4%). Nevertheless, the observed difference was not statistically significant with a *P* value of 0.242. The fascia- and vessel-oriented groups had incidences of perioperative surgical complications of 9.8% and 7.8%, respectively, and the difference between the two groups was not statistically significant (*P* = 0.852). There were no cases of reoperation or perioperative death in either group. Table 2 shows that the fascia-oriented group had a significantly higher median

Table 2 Surgical outcomes of the entire cohort (*n* = 105)

Variables	Fascia-oriented group (*n* = 41)	Vessel-oriented group (*n* = 64)	*P* value
Operation time (min), median (IQR)	245.0 (220.0, 270.0)	269.5 (210.0, 300.0)	0.908
Blood loss (mL), *n* (%)			0.242
≥ 300	1 (2.4)	6 (9.4)	
< 300	40 (97.6)	58 (90.6)	
No. of examined LLN, median (IQR)	9.0 (7.0, 13.0)	6.5 (3.0, 10.3)	0.020
Pathological LLN, *n* (%)			0.720
Positive	9 (22.0)	16 (25.0)	
Negative	32 (78.0)	48 (75.0)	
Surgical complications[a], *n* (%)			0.852
Yes	4 (9.8)	5 (7.8)	
No	37 (90.2)	59 (92.2)	
Urinary dysfunction, *n* (%)			0.015
Yes	9 (22.0)	29 (45.3)	
No	32 (78.0)	35 (54.7)	
Male sexual dysfunction, *n* (%)			0.019
Yes	9 (42.9)	26 (74.3)	
No	12 (57.1)	9 (25.7)	
Lower limb dysfunction, *n* (%)			0.554
Yes	10 (24.4)	19 (29.7)	
No	31 (75.6)	45 (70.3)	
Post-operative hospital stay (d), median (IQR)	7.00 (7.00, 8.00)	8.00 (7.00, 9.00)	0.435
Perioperative mortality, *n* (%)	0 (0)	0 (0)	1.000
Reoperation, *n* (%)	0 (0)	0 (0)	1.000

[a]Specific surgical complications in the fascia-oriented group, *n* (%): Anastomotic bleeding, 1 (2.4); anastomotic leakage, 1 (2.4); lymphorrhagia, 1 (2.4); delayed wound healing, 1 (2.4). Specific surgical complications in the vessel-oriented group, *n* (%): Anastomotic leakage, 3 (4.7); ileus, 1 (1.6); abdominal infection, 1 (1.6).

IQR: Interquartile range; LLN: Lateral lymph nodes.

number of examined LLNs than the vessel-oriented group (9.0 *vs* 6.5, $P = 0.020$). However, there was no significant difference in the positive pathological rate of LLNs between the two groups (22.0% *vs* 25.0%, $P = 0.720$).

Postoperative functional outcomes: (1) Urinary function: Among the 105 patients, the incidence of postoperative urinary dysfunction was 36.2%. The rate of postoperative urinary dysfunction was significantly lower in the fascia-oriented group than in the vessel-oriented group (22.0% *vs* 45.3%, $P = 0.015$), as shown in Table 2. Multivariate logistic regression analysis, after adjustment for intraoperative blood loss and single/bilateral LLND, showed that vessel-oriented LLND increased the risk of postoperative urinary dysfunction (OR = 2.897, 95%CI = 1.163–7.213, $P = 0.022$), as shown in Supplementary Table 1;

(2) Male sexual function: Among the patients included in the final analysis, 56 were male, including 21 in the fascia-oriented group and 35 in the vessel-oriented group. The percentage of patients who received unilateral LLND was significantly higher in the fascia-oriented group than in the vessel-oriented group (85.7% *vs* 65.7%, $P = 0.015$); other clinical and pathological characteristics were well balanced between the two groups, as shown in Supplementary Table 2.

Among male patients, the incidence of postoperative sexual dysfunction was 62.5%. The incidence of postoperative sexual dysfunction was significantly lower in the fascia-oriented group than in the vessel-oriented group (42.9% *vs* 74.3%, $P = 0.019$); additionally, the incidence of sexual dysfunction was significantly lower among patients treated with preoperative radiotherapy than patients not treated

with preoperative radiotherapy (41.2% *vs* 71.8%, P = 0.030). Multivariate logistic regression analyses showed that vessel-oriented LLND increased the risk of postoperative male sexual dysfunction (OR = 5.109, 95%CI = 1.078–24.206, P = 0.040), while preoperative radiotherapy decreased the risk of postoperative male sexual dysfunction (OR = 0.118, 95%CI = 0.024–0.577, P = 0.008), as shown in Supplementary Table 3;

(3) Lower limb function: Among the 105 patients, the incidence of lower limb dysfunction was 27.6%. The incidence of lower limb dysfunction in the fascia- and vessel-oriented groups was 24.4% and 29.7%, respectively. The difference was not statistically significant (P = 0.554), as indicated in Table 2. Multivariate logistic regression analyses showed that vessel-oriented LLND, age ≥ 65 years, and bilateral LLND did not increase the risk of postoperative lower limb dysfunction, as shown in Supplementary Table 4;

And (4) Defecation function: As of the last follow-up, 64 (61.0%) of 105 patients had temporary or permanent enterostomies, including 20 (48.8%) in the fascia-oriented group and 44 (68.7%) in the vessel-oriented group. Since defecation function evaluations were not available for these patients, this study did not compare defecation function between the two groups.

The prognosis

All patients were followed up. The median follow-up time was 32.6 mo. The 2-year OS rate of all 105 patients was 91.6%. The 2-year OS rates in the fascia- and vessel-oriented groups was 89.7% and 92.8%, respectively. Among all 105 patients, the 2-year PFS rate was 81.7%. In the fascia- and vessel-oriented groups, the 2-year PFS rates were 79.8% and 82.9%, respectively.

Kaplan–Meier curves for OS and PFS are shown in Figures 2 and 3. There was no significant difference in OS (log-rank P = 0.918) or PFS (log-rank P = 0.709) on the log-rank test between the fascia- and vessel-oriented groups.

The results of Cox regression analyses for univariate and multivariable are presented in Tables 3 and 4. For OS, univariate Cox regression analysis showed that vessel-oriented LLND, age ≥ 65 years, female sex, pathological LLN metastasis, and postoperative adjuvant therapy did not affect OS; however, pathological stage III disease was a risk factor for poor OS (HR = 9.98, 95%CI = 1.32–75.55, P = 0.026). After adjusting for pathological LLN metastases and pathological tumor stage, the multivariable Cox regression analyses showed that vessel-oriented LLND (HR = 0.94, 95%CI = 0.35–2.48, P = 0.893) and pathological LLN metastases (HR = 1.14, 95%CI = 0.39–3.31, P = 0.807) were not independent risk factors for poor OS, while pathological stage III disease independently increased the risk of poor OS (HR = 9.66, 95%CI = 1.25–74.66, P = 0.030).

For PFS, univariate Cox regression analysis showed that vessel-oriented LLND, age ≥ 65 years, female sex, pathological LLN metastasis, and postoperative adjuvant therapy did not affect PFS; however, pathological stage III disease was a risk factor for poor PFS (HR = 2.99, 95%CI = 1.02–8.76, P = 0.045). After adjusting for pathological LLN metastases and pathological tumor stage, the multivariable Cox regression analyses showed that vessel-oriented LLND (HR = 1.16, 95%CI = 0.51–2.66, P = 0.729) and pathological LLN metastases (HR = 0.83, 95%CI = 0.31–2.22, P = 0.714) were not independent risk factors for poor PFS, while the presence of pathological stage III disease was associated with a significant decline in PFS (HR = 3.16, 95%CI = 1.04–9.60, P = 0.042).

DISCUSSION

In this retrospective cohort study, we compared the impact of fascia-oriented and vessel-oriented LLND on short-term outcomes and prognosis in newly diagnosed rectal cancer patients. Our results indicated that the median number of examined LLNs in the fascia-oriented group was notably higher than that in the vessel-oriented group. Simultaneously, there was no notable discrepancy in the rate of pathological LLN metastasis, operation time, intraoperative blood loss, incidence of perioperative surgical complications, or length of postoperative hospital stay. In terms of postoperative functional indicators, the incidence of postoperative urinary and male sexual dysfunction was significantly lower in the fascia-oriented group than in the vessel-oriented group. In addition, there was no significant difference in the incidence of postoperative lower limb dysfunction between the two groups. In terms of prognosis, no significant difference was observed in either PFS or OS between the two groups.

In this study, we found that compared with traditional vessel-oriented LLND, fascia-oriented LLND did not increase the operative time, length of postoperative hospital stay, or incidence of perioperative surgical complications, and there were no cases of reoperation or perioperative deaths in either group, which is consistent with previous studies[9,10,11-13]. The proportion of patients with intraoperative blood loss ≥ 300 mL was higher in the vessel-oriented group than in the fascia-oriented group (9.4% *vs* 2.4%). Although the observed difference did not reach statistical significance, it likely reflects the inherent advantages of the surgical procedure for fascial-oriented LLND in reducing bleeding events. Using fascia as an anatomical landmark makes it easy to identify anatomical locations and important blood vessels and perform separation on the avascular plane during LLND. The incidence of grade II or higher perioperative surgical complications in the fascia-oriented group was 9.8%, which is consistent

Table 3 Univariable and multivariable Cox regression analyses of overall survival of the entire cohort (*n* = 105)

	Univariable		Multivariable	
	HR (95%CI)	*P* value	HR (95%CI)	*P* value
LLND method				
Vessel–oriented LLND	Reference		Reference	
Fascia–oriented LLND	0.95 (0.36–2.50)	0.918	0.94 (0.35–2.48)	0.893
Age				
< 65	Reference		–	
≥ 65	2.56 (0.87–7.51)	0.088	–	
Sex				
Male	Reference		–	
Female	0.78 (0.30–2.06)	0.621	–	
p/yp tumor stage[a]				
0–II	Reference		Reference	
III	9.98 (1.32–75.55)	0.026	9.66 (1.25–74.66)	0.030
Pathological LLN				
Negative	Reference		Reference	
Positive	1.82 (0.64–5.18)	0.264	1.14 (0.39–3.31)	0.807
Adjuvant therapy				
No	Reference		–	
Yes	–	0.202	–	

[a]The pathological tumor stage was based on the eighth edition of the American Joint Committee on Cancer TNM staging system.
LLND: Lateral lymph node dissection; LLN: Lateral lymph nodes; HR: Hazard ratio.

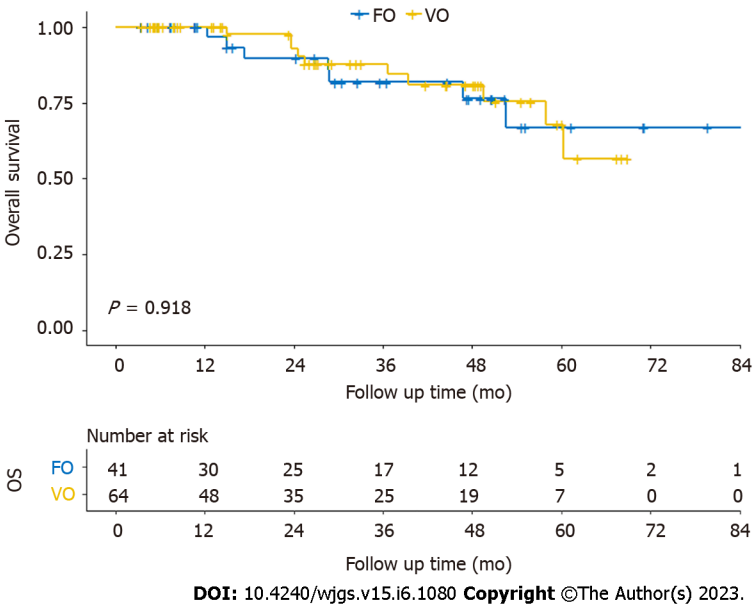

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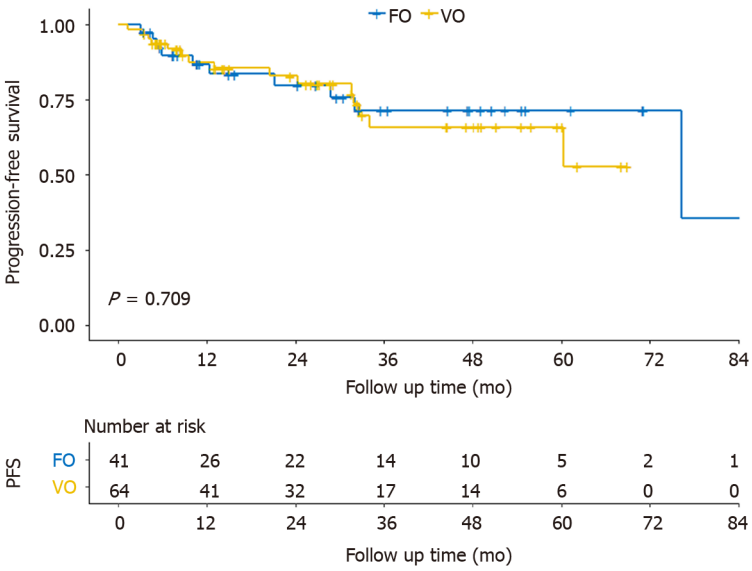
Figure 2 Kaplan–Meier curves of overall survival for the two groups. OS: Overall survival; FO: Fascia-oriented; VO: Vessel-oriented.

with previous studies[13]; additionally, this rate is lower than that reported for laparoscopic LLND[30]. In this study, the 2-year OS and PFS rates were 91.6% and 81.7%, respectively, consistent with previous reports[31,32]. The above results indicate that fascia-oriented LLND is safe and feasible.

Table 4 Univariable and multivariable Cox regression analyses of progression-free survival of the entire cohort (*n* = 105)

	Univariable		Multivariable	
	HR (95%CI)	*P* value	HR (95%CI)	*P* value
LLND method				
Vessel–oriented LLND	Reference		Reference	
Fascia–oriented LLND	1.17 (0.51 - 2.68)	0.709	1.16 (0.51–2.66)	0.729
Age				
< 65	Reference		–	
≥ 65	1.20 (0.47 - 3.07)	0.706	–	
Sex				
Male	Reference		–	
Female	0.7 (0.31-1.55)	0.374	–	
p/yp tumor stage[a]				
0–II	Reference		Reference	
III	2.99 (1.02–8.76)	0.045	3.16 (1.04–9.60)	0.042
Pathological LLN				
Negative	Reference		Reference	
Positive	0.83 (0.33 - 2.12)	0.703	0.83 (0.31–2.22)	0.714
Adjuvant therapy				
No	Reference		–	
Yes	2.08 (0.62-7.02)	0.239	–	

[a]The pathological tumor stage was based on the eighth edition of the American Joint Committee on Cancer TNM staging system.
LLND: Lateral lymph node dissection; LLN: Lateral lymph nodes; HR: Hazard ratio.



DOI: 10.4240/wjgs.v15.i6.1080

Figure 3 Kaplan–Meier curves of progression-free survival for the two groups. PFS: Progression-free survival; FO: Fascia-oriented; VO: Vessel-oriented.

The median number of examined LLNs in the fascia-oriented group was 9.0, consistent with previous studies on laparoscopic LLND[30,33]; furthermore, this number was significantly higher than that in the vessel-oriented group (9.0 *vs* 6.5). In terms of the surgical method, this difference may be related to the

thoroughness of lymph node dissection. Vessel-oriented LLND consists of a fragmented and sporadic dissection, which is likely to lead to the omission of lymph nodes and does not conform to the principle of en bloc tumor resection. In fascia-oriented LLND, clear boundaries of medial and lateral dissection are established when dissecting the No. 263 and No. 283 Lymph nodes, which is conducive to guiding the removal of lymphoid tissue in the lateral space and makes it easier to achieve en bloc resection and prevent the omission of lymph nodes. Previous studies have shown that increasing the number of examined lymph nodes may improve the accuracy of tumor staging[34]; therefore, fascia-oriented LLND may be beneficial for assessing of the severity of rectal cancer patients with LLN metastasis.

The incidence of postoperative urinary dysfunction and male sexual dysfunction was much lower in the fascia-oriented group than in the vessel-oriented group. Although the incidence of lower limb dysfunction was comparable between the two groups, the incidence was less than 30% in both groups. Multivariate analyses showed that vessel-oriented LLND was an independent risk factor for postoperative urinary dysfunction and male sexual dysfunction. The above results indicated that compared with vessel-oriented LLND, fascia-oriented LLND effectively prevents intraoperative pelvic nerve damage, which may be attributed to several factors.

First, since the surface of the pelvic autonomic nerve is covered with the UNF, this provides a fascial marker for autonomic nerves protection during surgery. In establishing the medial boundary of LLND, the tissue is separated along the lateral side of the UNF, which protects the integrity of the UNF and prevents injury to the autonomic nerve. Second, the obturator nerve can be exposed after dissociating along the pelvic parietal fascia to the obturator foramen. The surrounding tissue can be dissected from far to near along the obturator nerve so that the obturator nerve can be safely exposed throughout the process of LLND. Similarly, dissociating along the pelvic parietal fascia and the VF can reveal the neurovessel bundle, effectively reducing the probability of nerve damage during surgery.

Limits of the study

This study had several limitations. First, this was a retrospective study with a small sample size. Thus, selection bias may have been a concern and prospective studies including more patients enrolled will be needed in the future to verify the conclusions drawn in this study. Second, regarding the assessment of postoperative urinary dysfunction, although the IPSS is widely used in clinical work because of its simplicity and feasibility, it is more accurate to evaluate urinary dysfunction through the residual bladder volume. Third, there is currently no uniform standard for evaluating female sexual dysfunction; therefore, this study did not perform postoperative sexual function evaluations in female patients.

CONCLUSION

In conclusion, this study demonstrated that it is safe and feasible to perform fascia-oriented LLND at experienced high-volume centers. Compared with vessel-oriented LLND, fascia-oriented LLND allows the examination of more LLNs and may better protect postoperative urinary function and postoperative male sexual function. The conclusions drawn need to be verified in future prospective studies including more patients.

ARTICLE HIGHLIGHTS

Research background

There is a lack of studies comparing the efficacy of fascia-oriented and traditional vessel-oriented lateral lymph node dissection (LLND). Through a preliminary study with a small sample size, we found that fascia-oriented LLND was associated with a lower incidence of postoperative urinary and male sexual dysfunction and a higher number of examined lateral lymph nodes (LLNs). In this study, we increased the sample size and refined the postoperative functional outcomes.

Research motivation

For the management of LLN metastasis in patients with rectal cancer, selective LLND is gradually being accepted by Chinese scholars. Theoretically, fascia-oriented LLND both allows radical tumor resection and protects organ function. However, there is a lack of evidence-based medical studies comparing the efficacy of fascia-oriented and traditional vessel-oriented LLND. The present study will provide information for surgeons regarding the selection of the optimal surgical procedure for LLND.

Research objectives

This study aimed to compare the effects of fascia- and vessel-oriented LLND regarding the short-term outcomes and prognosis.

Research methods

We conducted a retrospective cohort study on data from 196 patients with rectal cancer who underwent total mesorectal excision and LLND from July 2014 to August 2021. The short-term outcomes included perioperative outcomes and postoperative functional outcomes. The prognosis was measured based on overall survival (OS) and progression-free survival (PFS).

Research results

Regarding short-term outcomes, the fascia-oriented group had a higher median number of examined LLNs compared to the vessel-oriented group. However, there were no notable differences in other short-term outcomes. The fascia-oriented group had significantly lower rates of postoperative urinary and male sexual dysfunction compared to the vessel-oriented group, and there were no significant differences in postoperative lower limb dysfunction between the two groups. As for prognosis, there was no significant disparity in PFS or OS between the two groups.

Research conclusions

Our study suggests that fascia-oriented LLND is a safe and feasible option for patients with rectal cancer. Although no significant difference was observed in prognosis compared to vessel-oriented LLND, fascia-oriented LLND may allow for the examination of more LLNs and potentially offer benefits in preserving postoperative urinary and sexual function.

Research perspectives

While our study supports the use of fascia-oriented LLND for rectal cancer, it is important to verify our conclusions with larger prospective studies. Further research is needed to confirm the potential benefits of fascia-oriented LLND, including preserving postoperative urinary and sexual function.

FOOTNOTES

Author contributions: Zhao W and Wang ZJ contributed equally to this work; Liu Q contributed to the study conception and design; material preparation, data collection and analysis were performed by Zhao W, Wang ZJ, Mei SW, Chen JN, Zhou SC, Zhao FQ, Xiao TX, and Huang F; the first draft of the manuscript was written by Zhao W and Wang ZJ, and all authors commented on previous versions of the manuscript; All authors read and approved the final manuscript.

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