



Lymphadenectomy with venation is preferred compared to skeletonization for patients with rectal and sigmoid colon cancer: a retrospective cohort study

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Background: For patients with rectal and sigmoid colon cancer, dissecting No. 253 lymph nodes and preserving the left colic artery are the essentials of radical surgery. In clinical work, some surgeons prefer to dissect lymph nodes with skeletonization, believing that lymph nodes can be dissected completely by this method, while other surgeons prefer to dissect lymph nodes with venation. They believe that their method can not only dissect lymph nodes completely but also ensure the safety of patients. This study aimed to investigate whether lymphadenectomy with skeletonization is superior to lymphadenectomy with venation for patients with rectal and sigmoid colon cancer.

Methods: We performed a retrospective cohort study between August, 2017 and October, 2019 at the Department of General Surgery, the Affiliated Hospital of Nanjing University Medical School. The inclusion criteria were as follows: diagnosed as rectum or sigmoid colon adenocarcinoma by electronic colonoscopy and histopathology; 18–80 years of age; underwent radical resection. The exclusion criteria were as follows: received neoadjuvant therapy before surgery; combined with distant metastasis. According to the method of lymph node dissection, patients were divided into the skeletonization group and venation group. We then compared the curative effect and safety between the 2 groups.

Results: A total of 211 patients were recruited in this retrospective study and assigned as follows: 62 cases to the skeletonization group and 149 patients to the venation group. There were no statistical differences in the total number of lymph nodes ($P=0.082$), number of positive lymph nodes ($P=0.097$), total number of No. 253 lymph nodes ($P=0.096$), number of positive No. 253 lymph nodes ($P=0.813$), and nodal staging ($P=0.254$) between the 2 groups. However, the amount of bleeding in the skeletonization group was significantly higher than that in the venation group ($P\leq 0.001$), and the operation time in the skeletonization group was also significantly longer than that in the venation group ($P\leq 0.001$).

Conclusions: Lymphadenectomy with venation is preferred in the radical resection of patients with rectal and sigmoid colon cancer.

Keywords: Colorectal cancer (CRC); lymphadenectomy; skeletonization; venation; rectal cancer

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Introduction

Colorectal cancer (CRC) is one of the most common gastrointestinal malignancies worldwide, accounting for the second largest number of gastrointestinal tumors. Nowadays, the incidence of CRC is increasing by 4% every year, seriously threatening human health. At present, radical resection is the main treatment method for CRC. With the gradual development of radical surgical techniques for CRC, the resection rate and radical treatment rate of CRC have increased significantly, and the mortality rate of patients has also decreased significantly (1,2). However, the 5-year survival rate of CRC is still low owing to metastasis and recurrence after surgery. The most common route of CRC metastasis is through lymph nodes. Therefore, complete lymph node dissection and accurate assessment of lymph node metastasis in patients with CRC is crucial for the development of reasonable postoperative chemoradiotherapy regimens and cycles, which can improve the prognosis and the 5-year survival rate (3,4).

For patients with rectal and sigmoid colon cancer, dissecting No. 253 lymph nodes and preserving the left colic artery are the essentials of radical surgery. In clinical work, some surgeons prefer to dissect lymph nodes with skeletonization, believing that lymph nodes can be dissected completely by this method, while other surgeons prefer to dissect lymph nodes with venation. They believe that their method can not only dissect lymph nodes completely but also ensure the safety of patients. The strengthen of lymphadenectomy with skeletonization is that the perivascular tissue could be completely excised. The limit is that it is easy to injury the blood vessels and cause bleeding. However, the strengthen of lymphadenectomy with venation is safe. The limit is that it retains the vascular sheath. Up to now, there have been no studies showing whether lymphadenectomy with skeletonization is superior to lymphadenectomy with venation. The aim of this study is to explore this problem. A preprint has previously been published (5). We present the following article in accordance with the STROBE reporting checklist (available at <https://jgo.amegroups.com/article/view/10.21037/jgo-22-545/rc>).

Methods

We performed a retrospective cohort study between August, 2017 and October, 2019. The inclusion criteria were as follows: diagnosed as rectum or sigmoid

colon adenocarcinoma by electronic colonoscopy and histopathology; 18–80 years of age; underwent radical resection. The exclusion criteria were as follows: received neoadjuvant therapy before surgery; combined with distant metastasis. Between August, 2017 and August, 2018, patients who underwent lymphadenectomy with skeletonization were assigned to the skeletonization group. Patients between September, 2018 and October, 2019 who underwent lymphadenectomy with venation were assigned to the venation group. The number of cases meeting the inclusion criteria during the study period determined the sample size. For enrolled patients, we collected information including age, gender, diagnosis, operation, the number of lymph nodes harvested, the number of positive lymph nodes harvested, amount of bleeding, operation time, side injury. All methods were carried out in accordance with relevant guidelines and regulations. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the institutional review board (IRB) of Nanjing Drum Tower Hospital, the Affiliated Hospital of Nanjing University Medical School (No. 162-02). Written informed consent was obtained from all subjects. All participants in our department were followed every 3 months in the first 2 years after hospital discharge, every 6 months in the subsequent 3 years, then every year until death. As the indicators of this study were short-term outcomes, they could be obtained before discharge. Therefore, follow-up was not necessary in this study.

Procedures

Participants in the skeletonization group underwent radical surgery. The vascular sheath was excised completely when cleaning the No. 253 lymph nodes, as shown in *Figure 1*. The left colic artery was preserved in all patients, while in the venation group, the vascular sheath was preserved when cleaning the No. 253 lymph nodes, as shown in *Figure 2*. The difference between the 2 groups was whether the vascular sheath was retained. All the operations were performed by the same group of surgeons.

Outcomes

We compared the 2 groups in terms of curative effect and safety. The primary endpoints of curative effect were total number of No. 253 lymph nodes, number of positive No. 253 lymph nodes, total number of lymph nodes, number of positive lymph nodes, and nodal staging. The primary

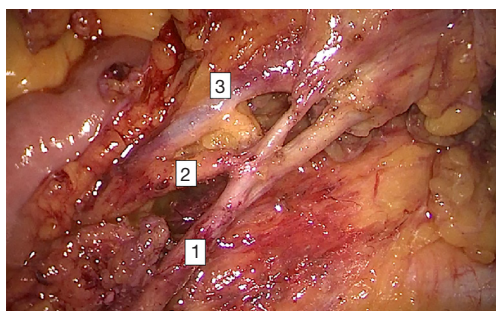


Figure 1 The vascular sheath was excised completely when cleaning the No. 253 lymph nodes (1: inferior mesenteric artery; 2: left colonic artery; 3: inferior mesenteric vein).

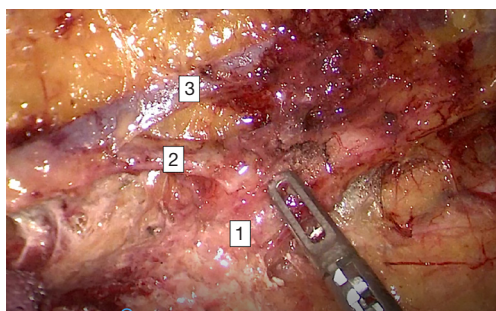


Figure 2 The vascular sheath was preserved when cleaning the No. 253 lymph nodes (1: inferior mesenteric artery; 2: left colonic artery; 3: inferior mesenteric vein).

endpoints of safety were the amount of bleeding, operation time, hospital stay, and rate of anastomotic leakage. Nodal staging was in accordance with the guideline of the Chinese Society of Clinical Oncology (CSCO 2019). Patients with no lymph node metastasis were regarded as N0, those with 1 to 3 lymph node metastases were regarded as N1, and those with more than 3 lymph node metastases were regarded as N2.

Statistical analysis

The baseline data were balanced by propensity score matching (PSM), with a caliper value of 0.05. This study adopted the nearest neighbor matching method in which substitution was not allowed and the patient was matched only once. Age, sex, T stage, N stage, and total stage were utilized for matching. The balance between datum line covariates in both the matched and unmatched cohorts was scanned by standardized differences, and <10% was

adequately credible. Data are presented as mean [$\pm$ standard deviation (SD)] for continuous variables and as frequency (%) for categorical variables. For comparisons, we used the two-tailed Student's *t*-test to evaluate the continuous variables and the Chi-square test or Fisher's exact test for categorical variables. Patients with missing data were deleted during the statistical analysis. $P < 0.05$ was considered statistically significant and $P < 0.05$ is two-sided. All statistical calculations were performed using SPSS software (version 19.0).

Results

Clinical characteristics of the patients

A total of 211 patients were recruited in this retrospective study and assigned as follows: 62 cases to the skeletonization group and 149 patients to the venation group. The participant flowchart is shown in *Figure 3*. The skeletonization group included 36 men and 26 women, with ages ranging from 39 to 80 years and a mean age of 61.6 years. Similarly, there were 92 men and 57 women in the venation group, with ages ranging from 23 to 80 years and a mean age of 64.2 years. The diagnoses of recruited patients were sigmoid cancer in 78 cases and rectal cancer in 133 cases. There were 21 cases with sigmoid cancer and 41 cases with rectal cancer in the skeletonization group. The remaining 57 cases with sigmoid cancer and 92 cases with rectal cancer were classified into the venation group. Of all these patients, 207 cases (98%) underwent laparoscopic surgery and the remaining 4 cases underwent open operation. All patients underwent radical resection with D3 lymph node dissection and preservation of the left colic artery. The patients' clinicopathological characteristics are shown in *Table 1* and there were no statistical differences between the 2 groups.

Comparison of primary endpoints between the 2 groups

The mean number of lymph nodes harvested from patients in the skeletonization group was 16.2 ± 6.2 (range from 5 to 31), which was higher than that in the venation group (14.7 ± 5.8 , range from 3 to 40), without a significant difference ($P = 0.082$). The mean number of positive lymph nodes in patients in the skeletonization group was 2.3 ± 4.3 (range from 0 to 25), which was also higher than that in the venation group (1.5 ± 2.9 , range from 0 to 22), without a significant difference ($P = 0.097$). Similar to this, the mean number of No. 253 lymph nodes harvested from

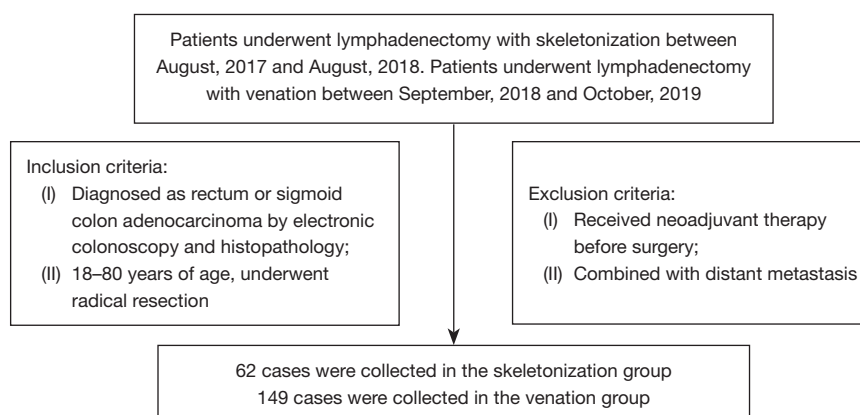


Figure 3 Flowchart describing patient enrollment and exclusion.

Table 1 The clinical characteristics of the patients stratified by groups

Characteristics	Skeletonization group	Venation group	t/χ^2 value	P value
Age (years), mean $\pm$ SD	61.6 $\pm$ 10.6	64.2 $\pm$ 11.9	−1.475	0.142
Gender, n			0.249	0.645
Male	36	92		
Female	26	57		
Diagnosis, n			0.361	0.639
Sigmoid cancer	21	57		
Rectal cancer	41	92		
Hypertension, n	6	17	0.135	0.713
Diabetes, n	4	11	0.057	0.811
Operation, n			0.560	0.323
Laparoscopy	62	145		
Laparotomy	0	4		
Tumor size (cm), mean $\pm$ SD	3.25 $\pm$ 1.12	3.55 $\pm$ 1.40	−1.497	0.136
TNM stage			0.552	0.907
I	8	20		
II	20	50		
III	28	69		
IV	6	10		

SD, standard deviation; TNM, tumor node metastasis.

patients in the skeletonization group was 1.7 ± 0.9 (range from 0 to 3), which was higher than that in the venation group (1.3 ± 1.1 , range from 0 to 3), without a significant difference ($P=0.096$). There was also no statistical difference in positive No. 253 lymph nodes between the 2

groups ($P=0.813$). However, the amount of bleeding in the skeletonization group was significantly higher than that in the venation group ($P\leq 0.001$), and the operation time in the skeletonization group was also significantly longer than that in the venation group ($P\leq 0.001$). There was no statistical

Table 2 Comparison of the primary endpoints between the 2 groups

Variables	Skeletonization group	Venation group	t value	P value
Total number of No. 253 lymph nodes, mean $\pm$ SD	1.7 $\pm$ 0.9	1.3 $\pm$ 1.1	0.294	0.096
Number of positive No. 253 lymph nodes, mean $\pm$ SD	0.0 $\pm$ 0.2	0.0 $\pm$ 0.17	0.635	0.813
Total number of lymph nodes, mean $\pm$ SD	16.2 $\pm$ 6.2	14.7 $\pm$ 5.8	-1.748	0.082
Number of positive lymph nodes, mean $\pm$ SD	2.3 $\pm$ 4.3	1.5 $\pm$ 2.9	-1.670	0.097
Amount of bleeding (mL), mean $\pm$ SD	179.8 $\pm$ 227.4	101.7 $\pm$ 56.4	-3.927	$\leq$ 0.001
Operation time (min), mean $\pm$ SD	251.8 $\pm$ 71.4	211.4 $\pm$ 55.3	-4.427	$\leq$ 0.001
Anastomotic leakage, n	3	5	0.264	0.695
Hospital stay (days), mean $\pm$ SD	7.9 $\pm$ 2.0	8.1 $\pm$ 2.5	-0.590	0.556

SD, standard deviation.

Table 3 Comparison of nodal staging between the 2 groups

Nodal staging	Skeletonization group	Venation group	χ^2 value	P value
N0	30	89	2.742	0.254
N1	22	45		
N2	10	15		

difference in anastomotic leakage and hospital stay. All these details are summarized in *Table 2*.

Comparison of nodal staging between the 2 groups

In the skeletonization group, 30 patients were found to be N0, 22 patients were N1, and 10 patients were N2. Correspondingly, 89 patients were N0, 45 patients were N1, and 15 patients were N2 in the venation group. The constituent ratio of N0, N1, and N2 in the 2 groups showed no significant difference ($P=0.254$). All these details are summarized in *Table 3*.

Discussion

Lymph node metastasis is an important factor affecting postoperative local recurrence and the 5-year survival rate of CRC, and is an important basis for determining the operation mode of CRC (6,7). Complete lymph node dissection is an effective method to improve the cure rate of CRC. For patients with CRC, the No. 253 lymph nodes should be removed completely to achieve D3 dissection (8,9). Previously, we severed the inferior mesenteric artery at the root to clean the No. 253 lymph nodes. Recently, to provide better blood supply at the anastomosis, we retained

the left colic artery and then severed the inferior mesenteric artery, which improved the difficulty of dissecting the No. 253 lymph nodes (10,11). In some cases, lymph nodes were left, owing to the difficulty of the operation, especially for overweight patients.

In actual clinical work, some surgeons prefer to dissect lymph nodes with skeletonization. They believe that the No. 253 lymph nodes can be cleaned completely by this method, especially lymph nodes behind the arteries. Besides, the visual effects of the surgery are very beautiful and appreciable. However, there are no published papers reporting this conclusion. Of course, there are disadvantages of this method, for example, stripping away the sheath of blood vessels may damage the vascular wall easily by thermal damage from the ultrasonic scalpel. In our study, there was 1 patient with rectal cancer who underwent laparoscopic radical resection and the No. 253 lymph nodes were removed with skeletonization. This patient presented with anastomotic leakage and intra-abdominal bleeding after the operation. Then, he underwent a second operation, during which a defect was found in the inferior mesenteric artery. The reason may be that there was vascular wall injury caused by the ultrasonic scalpel and intestinal fluid eroded the vascular wall following anastomotic leakage, resulting in vascular wall damaged and bleeding.

Some other surgeons prefer to dissect lymph nodes with venation, also named Choroidal dissection of lymph nodes. This method is relatively safe as it retains the vascular sheath. These surgeons argue that this method can also clean the No. 253 lymph nodes completely. Up to now, there has been no study to compare the results of these 2 methods.

To the best of our knowledge, our study is the first to compare the curative effect and safety of these 2 methods. Our study showed that there were no significant differences in the mean number of lymph nodes and positive lymph nodes harvested from the patients between the 2 groups. There were also no significant differences in the mean number of No. 253 lymph nodes and positive No. 253 lymph nodes between the 2 groups. Besides, there was also no significant difference in nodal staging between the 2 groups. Therefore, we could conclude that dissecting lymph nodes with venation had a similar curative effect compared to skeletonization. However, the amount of bleeding in the skeletonization group was significantly higher than that in the venation group, and the operation time in the skeletonization group was also significantly longer. As a result, it was more traumatic to dissect lymph nodes with skeletonization than venation. The benefits of venation are that it is safe and simple, and it does not affect the curative effect of cancer.

However, there were also some limitations to our study. First, the retrospective nature of our cohort study is its major limitation. Second, the cohort was comprised of a Chinese population, which may have led to racial bias. As a result, large multicenter randomized controlled clinical studies should be performed to further confirm the results.

Conclusions

For patients with rectal and sigmoid colon cancer, dissecting lymph nodes with skeletonization does not improve the curative effect compared to venation. However, the amount of bleeding and operation time in the skeletonization group were higher than those in the venation group. Therefore, lymphadenectomy with venation is preferred in the radical resection of patients with rectal and sigmoid colon cancer.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <https://jgo.amegroups.com/article/view/10.21037/jgo-22-545/rc>

Data Sharing Statement: Available at <https://jgo.amegroups.com/article/view/10.21037/jgo-22-545/dss>

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the IRB of Nanjing Drum Tower Hospital, the Affiliated Hospital of Nanjing University Medical School (No. 162-02). Written informed consent was obtained from all subjects.

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