

Laparoscopic Mesorectal Excision for Rectal Cancer: Pathological Outcome and Short-term Survival Analysis

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ABSTRACT

Background: Total mesorectal excision (TME) by conventional laparotomy has been considered the standard of care for patients with rectal cancer. Over the past two decades, numerous prospective randomized studies have reported the feasibility, safety, and advantages of laparoscopic colorectal surgery. The benefits of laparoscopic surgery are advantageous only when the quality of the TME, as demonstrated by standardized pathological measures, is at least similar, if not superior, to that of open TME. However, in most of the studies, the impact of laparoscopic TME on pathological outcomes has been inconsistently reported. Therefore, we aimed to assess the quality of TME in laparoscopic resection of rectal cancer.

Materials and methods: We reviewed retrospectively the medical records of patients who underwent laparoscopic resection for rectal cancer post-chemoradiation during the period from 2017 to 2021 at our institute. Patient data were collected from the cancer registry. The quality of pathological outcomes was analyzed by the completeness of TME, circumferential margins, lymph node harvest, and distal resection margins. Data analysis was done using MS Excel, and SPSS 28.0 (Trail version). Using this software, frequencies, percentage, range, mean, and standard deviation. Chi-square test, *t*-test, and *p*-values were calculated.

Results: A total of 64 patients were included in the study. And 35 patients underwent low anterior resection (55%), 22 patients underwent abdominal perineal resection (34%), and 7 patients underwent anterior resection (11%). The mesorectum excision was complete in 58 patients (90.48%) and near complete in 6 patients (9.52%). The average number of lymph nodes harvested was 10. The multivariable analysis between patients with lymph nodes retrieved less than 12 and greater than 12 shows that the lymph node retrieved is less than 12 if the interval between radiotherapy and surgery is less than 6 weeks which is statistically significant (*p*-value = 0.04). And there was no statistically significant association between the number of nodes retrieved and survival rate. Positive circumferential margins were seen in 2 patients (4%) and the rest 62 patients (96%) showed negative margins. In all the patients, distal resected margins were free of tumors. In a follow-up of 2 years, distant metastasis was seen in 5 patients. No one had local recurrence.

Conclusions: Our study has shown that optimal pathological outcomes can be achieved with laparoscopic mesorectal excision in rectal cancer patients. Among patients who received preoperative chemoradiation, the number of lymph nodes retrieved was not associated with overall survival.

Keywords: Laparoscopy, Rectal cancer, Total mesorectal excision.

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INTRODUCTION

Colorectal cancer ranks as the third most prevalent form of malignancy worldwide; out of these, one-third were rectal cancers.^{1,2} Rectal cancer management has historically depended on ontogenetic principles. The existence of “planes” has facilitated optical local control using total mesorectal excision (TME). The basis of this embryological theory lies in the hypothesis that local dissemination of tumor cells initially occurs within the compartment of origin. During the early stages of cancer, further spread of tumor cells is restricted at these borders. The TME concept, designed by Heald, has been popularized with the ever-growing knowledge of the mesorectal fascia.³ Appropriate traction on this fascia opens up an avascular plane between the mesorectal fascia and pre-sacral pelvic fascia. Meticulous, sharp dissection in this plane improves the quality of surgical resection.

Since its introduction in 1982, TME has been widely regarded as the standard treatment protocol for patients diagnosed with rectal cancer.⁴ In the last two decades, several studies have documented the benefits and safety associated with laparoscopic rectal surgery. Laparoscopic TME has the added advantage of better vision with

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magnification, thus combining origin and evolution to attain excellent oncological outcomes.

The advantages of laparoscopic surgery are significant only if the quality of TME, as indicated by pathological outcomes, is on par

Table 1: Grading of quality and completeness of the mesorectum in a total mesorectal excision specimen⁵

	Mesorectum	Defects	Coning	CRM
Complete	Intact, smooth	Not deeper than 5 mm	None	Smooth regular
Near complete	Moderate bulk, irregular	No visible muscularis propria	Moderate	Irregular
Incomplete	Little bulk	Down to muscularis propria	Moderate–marked	Irregular

with or superior to that achieved through open TME. However, most studies have inconsistently reported the pathological outcomes achieved through laparoscopic TME. In our current study, we assessed various domains to evaluate the standard of TME in our patients who underwent laparoscopic surgery for rectal cancer.

MATERIALS AND METHODS

This is a retrospective study including all patients with rectal cancer who underwent laparoscopic resection after neoadjuvant therapy at our institute from January 2017 to June 2021. Data were collected from our cancer registry, encompassing basic demographic data, presentation history, examination findings, and diagnosis. We analyzed the quality of pathological outcomes, including the completeness of TME, circumferential resection margins (CRMs), number of nodes harvested, and distal margins.

All patients were monitored for a minimum of 2 years, with a follow-up protocol that included clinical examinations every 3–6 months, including per rectal examination. Investigations included CEA levels every 6 months, endoscopic evaluation every 6 months, and a yearly CT scan. If clinically indicated, MRI and PET CT scans were also performed.

Data analysis was conducted using MS Excel and SPSS 28.0 (Trial version), where various statistical measures such as frequencies, percentages, ranges, mean, median, mode, standard deviation, variance, *t*-tests, Chi-square tests, and *p*-values were calculated. A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

This study included 64 patients, of which 37 (58%) were male and 27 (42%) were female. The mean age was 50.39 ± 11.3 years, with a median of 51 years. Among the patients, 26 were classified as stage II (41%) and 38 as stage III (59%). Surgical procedures involved low anterior resection (LAR) in 35 patients (55%), abdominoperineal resection (APR) in 22 patients (34%), and anterior resection (AR) in 7 patients (11%), with preservation of the sphincter achieved in 66% of the cases.

The completeness of TME was assessed as given in Table 1.

In our study, the mesorectum was complete in 90.48% of cases and nearly complete in 9.52% of the study population. Positive circumferential resected margins (CRM) were observed in 4% of the study population, while the remaining 96% showed negative margins. Distal resection margins were negative in all cases.

Among the two patients with CRM-positive margins, one patient treated with adjuvant chemotherapy achieved disease-free survival of more than 4 years during follow-up. Unfortunately, the other patient, who had multiple comorbidities, passed away in the early postoperative period due to a medical complication.

During the 2-year follow-up, distant metastases were observed in 5 patients among the study population of 64. These metastases included 2 cases of skeletal metastases, and 1 each of peritoneal, liver, and port site metastasis. No cases of local recurrence were recorded.

Table 2: Survival: 1 year and 2 years

	1-Year survival		2-Year survival	
	Frequency	Percentage	Frequency	Percentage
Yes	60	93.7	55	85.9
No	4	6.3	9	14.1

The survival rates were 93.7% at the end of the first year and 85.9% at the end of the second year. These rates are summarized in Table 2.

In our study, the mean number of nodes retrieved was 9.19 ± 6.24 nodes ranging from a minimum of 0 nodes to a maximum of 23 nodes. Node positivity was observed in 19 patients, with a positivity rate of 0.83 ± 1.90 nodes.

The multivariable analysis was made between patients with the lymph node retrieved less than 12 and greater than 12, and the results are summarized in Table 3.

In our study, it was found that if the surgery was done within 6 weeks of completion of chemoradiation, lymph node yield was less than 12 nodes. This association is statistically significant (*p*-value = 0.04).

The 1-year survival rate among patients with fewer than 12 nodes retrieved was 93.4% and the same for the patients with ≥12 nodes was 89.4%. Similarly, the 2-year survival rate in the patients with less than 12 nodes retrieved was 86.6%, and the same for the patients with ≥12 nodes was 84.2%.

However, this difference in the survival rate at 1 year and 2 years was not statistically significant. Thus, no association was observed between node retrieval and the survival rate. The findings are summarized in Table 4.

DISCUSSION

Oncologic safety plays a crucial role in assessing the benefits of laparoscopic surgery in rectal cancer. The multicentric COREAN trial is noteworthy for presenting a comprehensive set of pathological parameters after both open and laparoscopic TME, highlighting the comparability of these approaches.⁶

In rectal cancer surgery, the circumferential resected margin (CRM) is an important prognostic factor. Patients with a positive CRM have a higher risk of recurrence and reduced overall survival. In this study, the incidence of positive CRM was 4%. This rate of CRM positivity is significantly lower than what other researchers have reported. The completeness of the TME specimen is also an important prognostic factor. The study by Nagtegaal et al. demonstrated that patients with incomplete mesorectal excision had higher recurrence rates compared with those with complete mesorectal excision.⁷ Numerous studies have indicated that laparoscopic surgery does not influence the distal resected margin. In our study, distal margins were negative in all patients.

The COREAN trial reported lower rates of positive CRM, with rates of 2.9% for laparoscopic surgery and 4.1% for open surgery, compared with our study. However, it is crucial to note that in this

Table 3: Multivariable analysis of lymph node retrieval

Variables	Lymph nodes retrieved		p-value
	<12 (N = 45)	≥12 (N = 19)	
Age in years (mean ± SD)	50.73 ± 12.03	49.57 ± 9.59	0.71
Gender			
Male	24 (64.9)	13 (35.1)	0.26
Female	21 (77.8)	6 (22.2)	
Procedure			
APR	17 (77.3)	5 (22.7)	0.64
AR	5 (71.4)	2 (28.6)	
LAR	23 (65.7)	12 (34.3)	
TME			
Complete	39 (67.2)	19 (32.8)	0.16
Incomplete	6 (100.0)	0 (0.0)	
Pre-op clinical staging			
T2	12 (85.7)	2 (14.3)	0.27
T3	20 (62.5)	12 (37.5)	
T4	13 (72.2)	5 (27.8)	
Node imaging			
Yes	38 (73.1)	14 (26.9)	0.31
No	7 (58.3)	5 (41.7)	
Time interval between CRT and surgery			
≤6 weeks	13 (92.9)	1 (7.1)	0.04
≥6 weeks	32 (64.0)	18 (36.0)	
Post-op pathological staging			
T0 (PCR)	11 (57.9)	8 (42.1)	0.44
T1	3 (60.0)	2 (40.0)	
T2	22 (78.6)	6 (21.4)	
T3	9 (75.0)	3 (25.0)	
Recurrence/metastasis			
Yes	2 (40.0)	3 (60.0)	0.15
No	43 (72.9)	16 (27.1)	
No. of nodes positive (mean ± SD)	0.57 ± 1.17	1.42 ± 2.94	0.24

Bold value is statistically significant p-value. PCR, pathological complete response

Table 4: Nodes retrieved and survival rate

Nodes retrieved	Survival	1-Year survival	2-Year survival
<12 nodes (n = 45)	Yes	42	39
	No	3	6
≥12 nodes (n = 19)	Yes	17	16
	No	2	3
p-value		0.29	0.63

study,⁸ we considered CRM as positive when tumor cells were present within 2 mm from the lateral surface of the mesorectum, whereas the COREAN study used a 1-mm margin. This difference in margin criteria resulted in a higher rate of positive CRM in our study.

The lymph node harvest is influenced by several factors, including patients' anatomical and physiological characteristics, preoperative treatments, the extent and technique of surgical dissection, and the pathologist's examination methods. Guidelines

stipulate that a minimum number of nodes to be retrieved in rectal cancer specimens to achieve accurate pN staging and prevent under-staging is 12. In our study, the average number of nodes harvested was 10. Importantly, none of the patients experienced local recurrence.

In 2008, Rullier et al. demonstrated no significant association between lymph node yield and survival among 198 patients with rectal cancer post-chemoradiation.⁹ Similarly, Kim et al. showed no significant association between lymph node yield and recurrence or survival in 150 patients with rectal cancer post-chemoradiation.¹⁰

The ACOSOG and ALaCaRT trials established pathological criteria for evaluating TME, including complete or near-complete TME, clear (>1 mm) CRM, and clear (>1 mm) distal margin.^{11,12} In our study, we found that 90% (n = 64) of consecutive patients who underwent laparoscopic TME for rectal cancer achieved pathologically optimal TME.

This study's main constraint lies in its retrospective design; it lacks the rigor of a prospective randomized controlled trial. The second limitation is the small sample size of patients. The third limitation is the short duration of follow-up, which spans only 2 years. However, it is worth noting that most local site recurrences tend to occur within 2 years, as demonstrated by studies like the COLOR II and the Dutch TME study.¹³ The fourth limitation is the potential for selection bias. It is noteworthy to mention that consecutive inclusion of patients with rectal tumors was ensured, and all cases of rectal cancer at our institution underwent exclusive treatment with laparoscopic TME of the rectum. The fifth limitation is we did not compare laparoscopic surgery with open surgery, but the results of this study are compared with the results of the literature.

CONCLUSIONS

The significance of pathological outcome in patient survival is indisputable. Laparoscopic TME has to meet determinants of quality of care before making it a standard procedure in any institution.

The relevance of negative CRM and low lymph node ratio in understanding the prognosis is reinstated in our study. This extends to patients operated on after neoadjuvant therapy. With the advent of personalized medicine, a complete and quality resection remains the only surgeon-modifiable risk factor in rectal cancer management.

Ethical Statement

Institutional ethical committee approved.

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