RESEARCH ARTICLE

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Quality of Life after Laparoscopic Sphincter-Preserving Total Mesorectal Excision for Low Rectal Cancer: A Single-Center Prospective Cohort Study in Vietnam

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Abstract

Background: Quality of life (QoL) is a crucial indicator for comprehensively evaluating physical recovery, psychological well-being, and social reintegration among patients with low rectal cancer (LRC) undergoing sphincter-preserving surgery. Low anterior resection syndrome (LARS) is a common functional complication and a key factor affecting QoL. This study aimed to assess QoL scores before surgery and at 1, 3, 6, 9, and 12 months postoperatively, as well as to identify factors associated with QoL, including the impact of LARS. **Methods:** A prospective cohort study was conducted on 83 patients with LRC who underwent low anterior resection (LAR) with sphincter preservation at the Department of Gastrointestinal Surgery and the Department of Colorectal Surgery, University Medical Center Ho Chi Minh City, Vietnam. QoL was measured using the EORTC QLQ-C30 questionnaire at six time points, from preoperative assessment to 12 months postoperatively. A multivariable linear regression model was applied to identify independent factors associated with QoL at month 12. **Results:** The mean QoL score was 52.6 at one month and improved to 82.7 at twelve months. Some domains, such as social functioning, global QoL and financial difficulty, had not fully recovered. Severe LARS was the only independent factor associated with lower QoL, resulting in a reduction of 25.3 points on mean ($p < 0.001$). Adjuvant chemotherapy and alcohol use were indirectly associated with poorer QoL through worsening LARS symptoms. **Conclusion:** QoL significantly declined during the first three months after surgery but gradually improved and approached baseline levels by month twelve. Early screening for high-risk groups, including patients with severe LARS, habitual alcohol use, and those receiving adjuvant chemotherapy, is essential for timely intervention, symptom management, and improved QoL during the recovery period.

Keywords: low anterior resection (LAR)- sphincter-preserving- rectal cancer- quality of life (QoL)- risk factors

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Introduction

Rectal cancer (RC) is a leading cause of cancer-related mortality and often diagnosed at advanced stages [1]. Low rectal cancer (LRC), located near the anal sphincter, presents complex treatment challenges due to the need to preserve sphincter function and maintain bowel control while ensuring therapeutic success. Low anterior resection (LAR) with total mesorectal excision (TME) is the gold standard for its dual benefit of oncologic efficacy and anal preservation [2-5]. However, LAR frequently results in low anterior resection syndrome (LARS), with symptoms like frequent defecation, urgency, fecal incontinence, and incomplete evacuation, significantly affecting daily life and psychological well-being. In severe cases, LARS may impair quality of life (QoL) more than living with a permanent stoma [6-10]. International data show up to 60% of post-LAR patients develop LARS, with 40–80% experiencing the major type [7, 11, 12]. In Vietnam, prevalence ranges from 14.5% to 59.1%, with 22.5% having major LARS [13].Major LARS impairs not just bowel function but also mental health, causing anxiety, depression, reduced work capacity, and limited social integration [8, 9, 12, 7]. Some patients eventually require a permanent stoma [14, 15, 6, 16]. Despite this burden, no clinical guidelines exist for managing high-risk patients

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[17, 18].

QoL is now a key outcome alongside survival [19-21], reflecting a cancer patient's overall physical, mental, and social state. This is particularly relevant in Vietnam, facing a rising cancer burden and a rapidly aging population [22, 1]. Thus, optimizing postoperative care and identifying factors that influence QoL is essential. This study aimed to (1) evaluate QoL scores using the EORTC QLQ-C30 before surgery and at 1, 3, 6, 9, and 12 months post-LAR in rectal cancer patients; and (2) identify factors associated with QoL, including the impact of LARS. These results will support comprehensive, individualized care and guide timely interventions to improve patient QoL [23, 24].

Materials and Methods

Study design

A prospective cohort study without a control group was conducted on 83 rectal cancer patients (tumor located 3–9 cm from the anal verge) from March 2022 to March 2024 at the University Medical Center Ho Chi Minh City, Vietnam. All underwent low anterior resection (LAR) with total mesorectal excision (TME) using sphincter-preserving techniques, including low, ultra-low, and intersphincteric resections [17, 25, 9, 4, 5]. The sample size, based on a 95% LARS prevalence after LAR with TME, 5% margin of error, and 10% dropout rate, was calculated to require at least 80 patients [10, 7, 16].

Eligible patients were classified as ASA I–III, with or without neoadjuvant and/or adjuvant therapy, and had a temporary ileostomy or colostomy reversed within 6 months after surgery. All patients were required to: provide written informed consent, possess adequate cognitive capacity to complete the questionnaires, and attend at least one postoperative follow-up (1 month after surgery or 1 month after stoma closure). Patients were excluded if they experienced local cancer recurrence within 12 months, had neurological conditions affecting cognition or mobility (e.g., post-stroke cognitive impairment, dementia), had pre-existing chronic anorectal diseases (e.g., anal fistula, rectal prolapse, or prior anorectal surgery), or were lost to follow-up or unwilling to continue participation.

Data collection

Data were collected via 10–15 minute face-to-face interviews using a structured questionnaire and medical record review. Preoperative data included demographics (age, gender, BMI, smoking/alcohol use), clinical and paraclinical variables (pre/postoperative cancer stage, tumor invasion, LARS, neoadjuvant/adjuvant treatment), and QoL. Postoperative follow-up occurred at 1, 3, 6, 9, and 12 months; for patients with a stoma, timing was based on stoma closure. LARS severity was assessed using the LARS score (0–42), categorized as no (0–20), minor (20–29), or major (30–42) LARS. The validated Vietnamese version by Anh et al. and Quang et al. was used [26].

The primary outcome of the study was the quality of life score measured by the EORTC Core Quality of Life Questionnaire (QLQ-C30) at multiple postoperative time points.

The EORTC score quality of life (QLQ-C30) questionnaire

The QLQ-C30 (version 3.0), developed by the European Organisation for Research and Treatment of Cancer (EORTC), is a standardized tool for assessing QoL in cancer patients, widely used worldwide with good internal consistency (Cronbach's alpha ≥ 0.7) [27]. The Vietnamese version has also been officially translated and released by the EORTC group [27, 28, 13, 29]. The 30-item scale includes: (1) five functional domains (physical, role, emotional, cognitive, social); (2) symptom domains (fatigue, pain, nausea/vomiting) and six single symptoms (insomnia, digestive issues, financial difficulties); and (3) two global QoL items. Most items use a 4-point Likert scale, while the global items use a 7-point scale. Scores are standardized to a 0–100 scale per EORTC guidelines: functional scores < 80 and symptom scores > 20 suggest QoL impairment; higher global scores indicate better QoL [27, 23, 30]. Raw scores for each group are then transformed into a range 0-100 scale according to the EORTC guidelines [31]. Truc et al. [32] applied the QLQ-C30 in gastrointestinal cancer patients in Vietnam, confirming its reliability (Cronbach's alpha > 0.7). Overall, the scale is appropriate for comprehensive QoL assessment in clinical settings and research.

Study procedure

Among the 83 patients who underwent low anterior resection (LAR), 70 had a diverting ileostomy. Eleven patients were excluded from the study for the following reasons: three patients did not undergo ileostomy closure within six months after surgery; two patients had a permanent colostomy due to rectovaginal fistula; two patients were lost to follow-up; two patients died; one patient experienced cerebral infarction; and one had a permanent colostomy due to an anastomotic leak.

Statistical analysis

Data were entered and managed using EpiData version 4.6, and subsequently analyzed with SPSS Statistics version 20.0. Continuous variables were reported as mean ± SD (if normally distributed) or median (IQR) for skewed data; categorical variables were reported as frequency and percentage.

Independent sample t-tests were used to compare two groups, and one-way ANOVA for comparisons involving three or more groups, for normally distributed quantitative variables. Categorical variables were compared using the Chi-square test or Fisher's exact test when > 20% of the expected frequencies were < 5 or when any expected frequency was < 1. In cases where the dependent variable was binary, logistic regression analysis was performed, and odds ratios (OR) with 95% confidence intervals (CI) were calculated to assess the association between quality of life (QoL) and LARS severity. To control for potential confounders, Variables with $p < 0.2$ in univariate analysis were included in the multivariable linear regression. Statistical significance was set at $p < 0.05$.

Results

A total of 83 patients who met the inclusion criteria

were enrolled in the study, with a mean age of 61.5 ± 11.2 years. The youngest patient was 25 years old and the oldest was 84 years old. Of these, 54.2% (45 patients) were male and 45.8% (38 patients) were female. The patient recruitment process is illustrated in Figure 1.

Patients' quality of life (QoL) declined markedly during the first three months and improved significantly thereafter (Figure 2). The global QoL score decreased from 46.3 ± 10.4 before surgery to its lowest level at 21.7 ± 8.7 in the first month, reached 30.2 ± 10.7 by the third month, and then gradually increased over time, surpassing the preoperative level at 12 months (55.2 ± 12.7).

However, many functional scores declined significantly after surgery. Physical functioning decreased from 91.2 to 55.7 points at the first month, and remained at only 68.1 points after three months. Social role functioning was also reduced by half during the first three months compared to the preoperative level. From the sixth month onward, these functional scores showed marked improvement, nearly returning to baseline levels at 12 months (91.8 for physical functioning; 76.9 for social role functioning). Emotional functioning also improved steadily, from 52.9 before surgery to 87.2 at the twelfth month. In contrast, symptom scores such as fatigue, pain, and insomnia surged sharply at the first month after surgery but gradually declined, returning close to baseline levels by the twelfth month. Nonetheless, some symptoms such as digestive disorder (10.4 ± 6.8) and fatigue had not fully recovered compared to the preoperative state. From the third month onward, the overall QoL score, including both functional and symptom scales, gradually improved, approaching the preoperative QoL level.

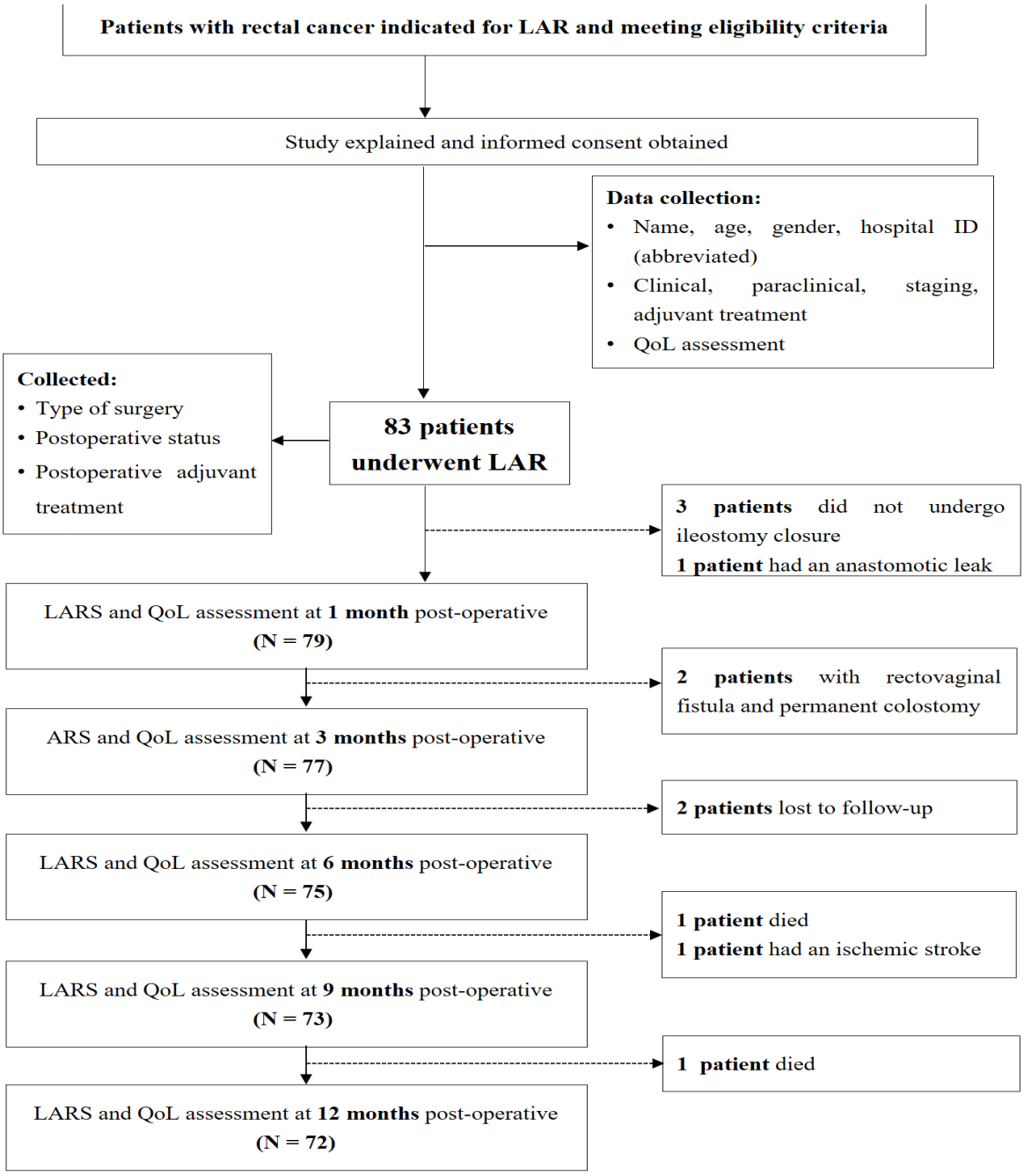

Figure 1. Flowchart of Patient Recruitment Process for the Study

Table 1. EORTC QLQ-C30 Scores at Preoperative and Postoperative Time Points

Characteristic	Pre-op (N=83)	1 month (N=79)	3 months (N=77)	6 months (N=75)	9 months (N=73)	12 months (N=72)
Functional scores						
Physical functioning	91.6 ± 15.3	55.7 ± 17.5	68.1 ± 16.1	77.9 ± 18.3	86.8 ± 13.3	91.8 ± 8.8
p-value		<0.001	<0.001	<0.001	0.002	0.18
Role functioning	80.4 ± 24.6	40.5 ± 16.8	50.4 ± 16.9	64.4 ± 20.4	70.8 ± 20.2	76.9 ± 19.7
p-value		<0.001	<0.001	<0.001	0.002	0.03
Social functioning	49.8 ± 21.8	37.6 ± 17.0	45.7 ± 17.0	56.2 ± 23.1	62.8 ± 19.9	70.4 ± 16.6
p-value		<0.001	0.26	0.08	0.001	<0.001
Emotional functioning	53.3 ± 21.0	41.8 ± 16.3	57.9 ± 20.8	73.1 ± 26.3	81.5 ± 19.3	87.2 ± 15.1
p-value		<0.001	0.07	<0.001	<0.001	<0.001
Cognitive functioning	90.9 ± 15.3	69.6 ± 18.2	85.3 ± 15.0	87.3 ± 19.5	93.8 ± 12.3	9..0 ± 9.4
p-value		<0.001	0.04	0.137	0.50	0.018
Global QoL	46.1 ± 10.1	21.7 ± 8.7	30.2 ± 10.7	40.0 ± 13.6	47.7 ± 13.0	55.2 ± 12.7
p-value		<0.001	<0.001	0.015	0.77	<0.001
Symptom scores						
Fatigue	17.4 ± 19.2	57.7 ± 14.9	46.0 ± 15.3	34.2 ± 21.0	24.7 ± 18.8	18.8 ± 16.8
p-value		<0.001	<0.001	<0.001	0.019	0.50
Pain	11.4 ± 17.4	40.7 ± 14.8	24.7 ± 17.9	15.3 ± 19.9	10.3 ± 14.9	6.0 ± 11.6
p-value		<0.001	<0.001	0.12	0.69	0.008
Insomnia	21.1 ± 22.8	48.9 ± 19.1	36.4 ± 15.5	29.8 ± 20.9	20.5 ± 19.7	14.8 ± 18.5
p-value		<0.001	<0.001	0.016	0.89	0.053
Dyspnoea	6.3 ± 15.2	20.3 ± 18.8	8.2 ± 14.5	7.6 ± 15.1	3.2 ± 9.9	2.3 ± 8.5
p-value		<0.001	0.19	0.40	0.26	0.09
Digestive disorder	11.1 ± 10.7	30.0 ± 10.9	23.6 ± 12.1	18.9 ± 14.3	13.2 ± 10.2	10.4 ± 6.8
p-value		<0.001	<0.001	<0.001	0.31	0.68
Financial difficulties	34.2 ± 30.2	37.6 ± 27.9	36.8 ± 26.8	37.8 ± 27.0	34.7 ± 26.3	33.8 ± 27.7
p-value		0.24	0.60	0.55	0.78	0.63
Overall QoL score	75.9 ± 11.1	52.6 ± 11.5	63.5 ± 10.7	71.3 ± 15.5	78.1 ± 11.3	82.7 ± 9.4
p-value		<0.001	<0.001	0.02	0.75	0.001

EORTC, European Organisation for Research and Treatment of Cancer; QoL, Quality of Life; Pre-op, Preoperative.

When comparing preoperative QoL scores to postoperative values (Table 1), functional domains progressively improved over time. Physical functioning rose from 55.7 at month 1 to 91.8 at month 12 ($p < 0.001$); role functioning from 40.5 to 76.9 ($p = 0.03$); social functioning from 37.6 to 70.4 ($p < 0.001$); emotional functioning from 41.8 to 87.2 ($p < 0.001$); and cognitive functioning stabilized early, reaching 93.8 by month 9 ($p = 0.018$ at month 12).

Symptom scores also improved. Fatigue decreased from 57.7 to 18.8 ($p = 0.50$), pain from 40.7 to 6.0 ($p = 0.008$), and insomnia from 48.9 to 14.8 ($p = 0.053$). Global QoL increased from 52.6 to 82.7 ($p = 0.001$). However, by month 12, scores related to social role, social integration, and overall QoL had not fully returned to baseline. QoL declined significantly in the first three months. From month 6 onward, patients showed substantial recovery in psychological and cognitive domains, reflecting adaptation and symptom relief from LARS.

Factors associated with quality of life

The multivariable linear regression model identified several factors associated with lower QoL at 12 months postoperatively (Table 2). Patients who received chemotherapy had significantly lower QoL scores than those who did not ($p = 0.02$). Alcohol consumption also negatively affected QoL ($p = 0.04$). Major LARS was the strongest independent factor, with patients scoring 25.17 points lower than those without LARS ($p < 0.001$).

Low anterior resection syndrome (LARS)

LARS progressively decreased in patients after surgery (Table 3). Initially, all patients (100%) experienced major LARS at 1 month, with a mean score of 40.3±2.3. This proportion significantly dropped over time: to 94.8% at 3 months (38.4±4.2), 81.3% at 6 months (35.1±7.1), 72.6% at 9 months (32.5±6.9), and 58.4% at 12 months (31.3±6.5). Concurrently, minor LARS increased from 3.9% at 3 months to 33.3% at 12 months, and patients with no LARS rose from 0% at 1 month to 8.3% at 12 months.

Major LARS was inversely associated with postoperative QoL (Figure 3). Specifically, patients with

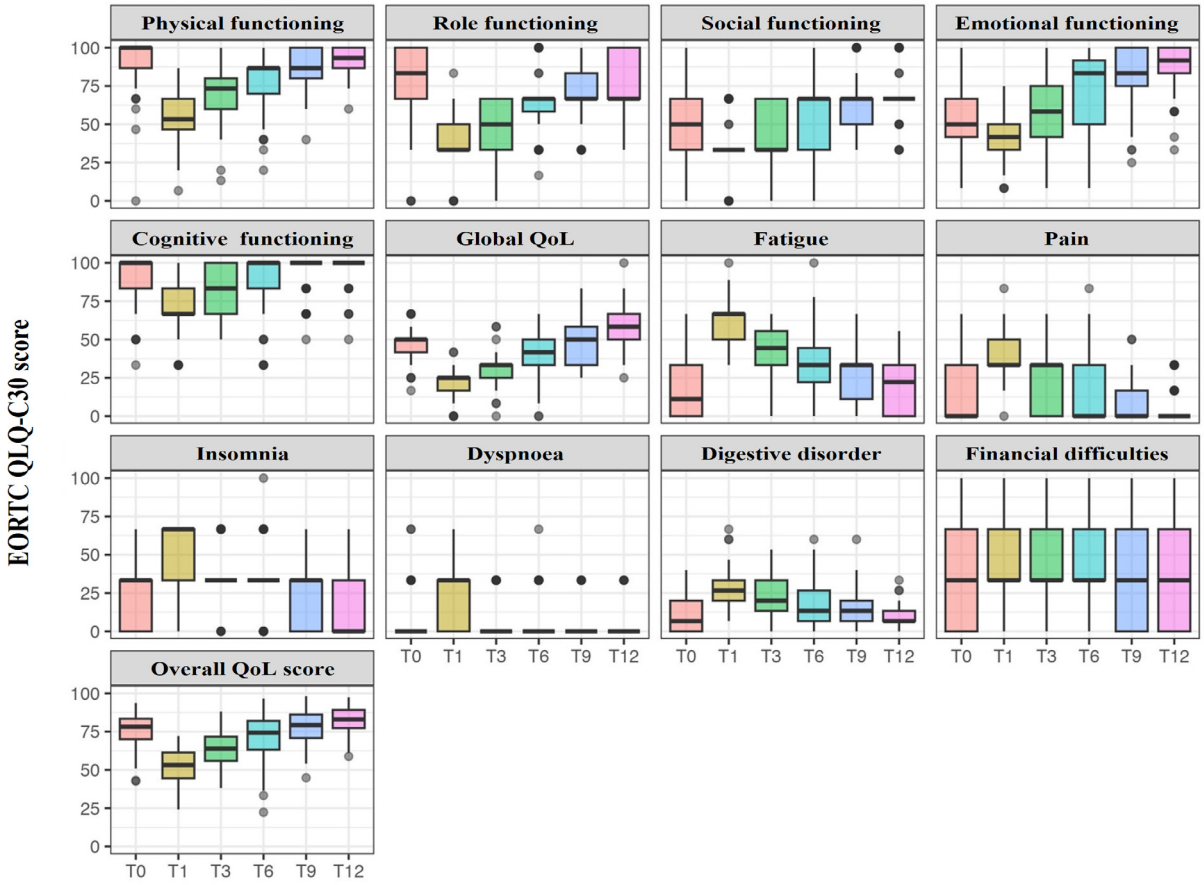

Figure 2. Preoperative and Postoperative Changes in Quality of Life. Legend: T0: preoperative assessment; T1: 1 month after surgery; T3: 3 months after surgery; T6: 6 months after surgery; T9: 9 months after surgery; T12: 12 months after surgery

major LARS had a 25.3-point lower global health status/QoL score compared to those without LARS ($p < 0.001$), along with substantial reductions in physical functioning (55.7 ± 12.3 vs. 91.8 ± 8.8), role functioning (40.5 ± 16.8 vs. 82.7 ± 15.4), and emotional functioning (41.8 ± 16.3 vs. 88.2 ± 10.5), with all $p < 0.001$. Moreover, the QoL scores in patients without or with minor LARS tended to remain stable over time and approached preoperative levels. In contrast, those with major LARS showed a prolonged and consistently low level of QoL across most follow-up points.

In addition, logistic regression analysis identified several factors associated with the risk of major LARS after surgery (Table 4). Patients aged 41–50 years had a significantly higher risk, with an OR = 23.28 (95% CI: 1.17 – 463.82; p = 0.04), compared to other age groups. Patients with T3 tumors were at significantly higher risk of developing major LARS than those with T1 or T2 tumors (p = 0.02). Furthermore, preoperative radiotherapy was associated with an increased risk of major LARS (OR = 2.88; 95% CI: 1.14 – 7.28; p = 0.03), and chemotherapy increased this risk by more than threefold (OR = 3.25; 95% CI: 1.28 – 8.22; p = 0.01).

Discussion

Along with overall survival and disease-free survival in patients with rectal cancer (RC) undergoing low anterior resection (LAR), QoL serves as a comprehensive indicator that reflects both physical recovery and the ability to reintegrate socially or achieve psychological stability following treatment [19-21]. In our study of 83 patients, QoL scores assessed by the QLQ-C30 scale improved over time. However, during the first three months postoperatively, scores dropped by half compared to baseline, and all patients experienced major LARS at one month.

Prior to surgery, we observed that patients maintained good physical functioning and cognitive functioning, consistent with the findings of Walming et al. [33], suggesting limited impact of the disease on general condition. However, low social and emotional functioning led to a reduced preoperative global QoL score (46.3). This may be due to concerns about disease progression, treatment effectiveness, and the psychological burden of adjusting to a stoma and bowel dysfunction after surgery [34, 35]. Moreover, QoL declines and postoperative mortality risks increase when patients with rectal cancer experience psychological issues such as anxiety and depression [36]. In this study, symptoms of insomnia, fatigue, and financial difficulties were reported at higher levels compared to previous studies by Kinoshita [37] and Walming [33]. Kimman et al. [34] noted that the high cost of treatment, particularly in countries with limited social

Table 2. Multivariate Analysis of Factors Associated with Postoperative Quality of Life in Patients with Low Rectal Cancer (N=72)

Characteristic		Crude			Adjusted		
		β	95% CI	p-value	β	95% CI	p-value
Smoking	No	ref			ref		
	Yes	5.31	0.47 – 10.14	0.03	0.19	0.08 – 0.30	0.99
Alcohol	No	ref			ref		
	Yes	6.57	1.47 – 11.67	0.01	7.63	0.53 – 14.73	0.04
Tumor invasion	T1	ref			ref		
	T2	-17.18	(-31.62) – (-)2.73	0.02	-7.11	(-17.97) – 3.75	0.204
	T3	-15.50	(-28.58) – (-2.42)	0.02	-2.48	(-12.60) – 7.63	0.632
	T4	-14.78	(-27.94) – (-1.62)	0.03	-3.95	(-14.35) – 6.46	0.460
Complications	No	ref			ref		
	Yes	-7.43	(-14.14) – (-18.36)	0.03	-2.98	-8.47 – 2.50	0.29
	No LARS	ref			ref		
Postoperative LARS	Minor LARS	-5.82	(-13.38) – 1.74	0.13	-6.91	(-14.50) – 0.68	0.075
	Major LARS	-25.30	(-32,23) –18.36	<0.001	-25.17	(-32.15) – (-18.18)	<0.001
Chemotherapy	No	ref			ref		
	Yes	-6.25	(-10.56) – (-1.94)	0.006	-4.32	(-8.03) – (-0.62)	0.02

β, Regression coefficient; CI, Confidence interval

support systems, contributes to QoL deterioration.

Physical functioning, social functioning, emotional functioning, and fatigue showed a marked decline during the first 3 months after surgery. This period corresponds to the time when patients experienced significant traumatic impacts such as pain, prolonged fatigue, and a second surgery to close the temporary stoma. Significantly, all patients developed major LARS within the first postoperative month. The severe negative Emotional functioning was largely attributed to symptoms of LARS, including fecal urgency, incontinence, and soiling [38, 39]. These findings emphasize that the first 3 months postoperatively represent a critical and challenging phase, requiring coordinated multimodal and multidisciplinary

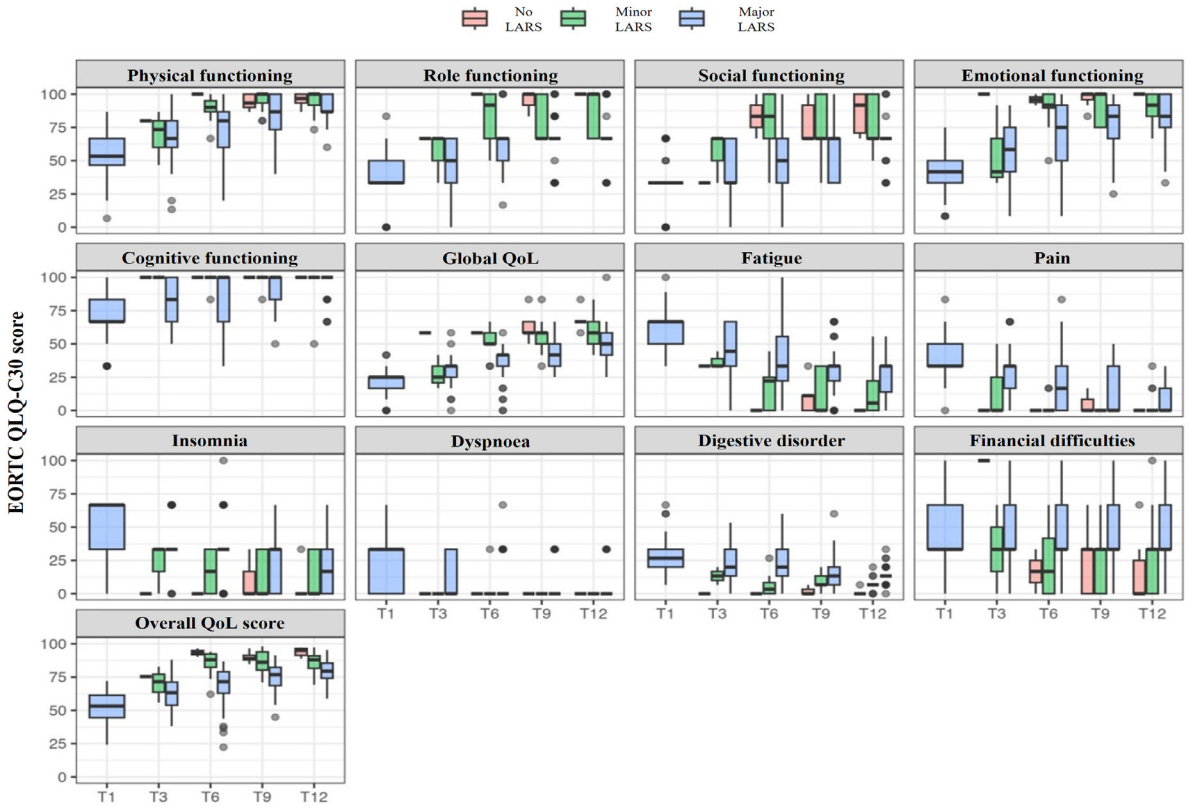

Figure 3. Impact of LARS on Postoperative Quality of Life. Legend: T1: 1 month after surgery; T3: 3 months after surgery; T6: 6 months after surgery; T9: 9 months after surgery; T12: 12 months after surgery

Table 3. Temporal Progression of LARS

	1 month (N=79)	3 months (N=77)	6 months (N=75)	9 months (N=73)	12 months (N=72)
LARS score*	40.3 ± 2.3	38.4 ± 4.2	35.1 ± 7.1	32.5 ± 6.9	31.3 ± 6.5
LARS severity					
No LARS	0 (0.0%)	1 (1.3%)	2 (2.7%)	7 (9.6%)	6 (8.3%)
Minor LARS	0 (0.0%)	3 (3.9%)	12 (16.0%)	13 (17.8%)	24 (33.3%)
Major LARS	79 (100.0%)	73 (94.8%)	61 (81.3%)	53 (72.6%)	42 (58.4%)

*Mean ± Standard deviation; Abbreviations: LARS, Low Anterior Resection Syndrome

Table 4. Risk Factors Associated with Major LARS at 12 Months after Surgery (N=72)

Characteristic		OR	95% CI	p-value
Age group	41 – 50	23.28	1.17 – 463.82	0.04
	51 – 60	2.46	0.39 – 15.46	0.34
	61 – 70	3.66	0.62 – 21.67	0.15
	>70	6.20	0.81 – 47.47	0.08
Gender	Male	1.00	ref	0.28
	Female	1.72	0.65 – 4.55	
Preoperative cTNM	Stage I	1.00	ref	
	Stage II	4.21	0.47 – 37.80	0.20
	Stage III	3.09	0.61 – 15.61	0.17
	Stage IV	1.76	0.07 – 43.52	0.73
Tumor invasion depth (T stage)	T1	1.00	ref	
	T2	13.27	0.71 – 248.37	0.08
	T3	18.77	1.44 – 244.05	0.02
	T4	12.34	0.96 – 159.20	0.054
Preoperative adjuvant therapy	No	1.00	ref	0.33
	Yes	1.83	0.55 – 6.13	
Complications	No	1.00	ref	0.35
	Yes	2.28	0.41 – 12.78	
Radiotherapy	No	1.00	ref	0.03
	Yes	2.88	1.14 – 7.28	
Chemotherapy	No	1.00	ref	0.01
	Yes	3.25	1.28 – 8.22	

CI, Confidence interval; OR, Odds ratio

support to help patients adapt and overcome initial difficulties.

From month 3 onward, especially after month 6, global QoL gradually improved over time. Physical functioning increased but remained below baseline due to persistent symptoms, such as fatigue and gastrointestinal issues, as noted by Juul [40] and Cheong [41]. Significant improvements in emotional functioning and physical functioning were observed after month 6, when patients began to manage LARS symptoms better and adjust their lifestyle. This helped restore daily confidence, reduce social isolation, and enhance global QoL [42, 43, 40, 41]. By month 12, most QoL domains nearly returned to baseline levels, consistent with Custers [44] though social functioning, bowel symptoms, and financial difficulty had not fully recovered, particularly in patients with major LARS [41, 40, 45, 46].

In addition to time-related factors, alcohol consumption negatively affected global QoL after surgery ($p = 0.04$). Quezada-Diaz et al. [47] also reported that drinking alcohol worsens postoperative symptoms, significantly impairing digestive function and bowel control, and reducing fatigue and physical functioning scores [44]. Moreover, a history of smoking was linked to higher risk of postoperative complications and about a 7-point decrease in global QoL, although this was only found in the univariate model [44]. Among 58 patients receiving adjuvant chemotherapy, all had significantly lower QoL due to side effects causing rehospitalization, prolonged treatment, financial burden, and psychological distress. Many patients had to delay treatment because of intolerance or exhaustion, and some refused further therapy after 2 to 3 cycles. Custers [44] and Chandra [48] also confirmed that chemotherapy-induced fatigue and gastrointestinal issues reduce global QoL.

Notably, major LARS was the strongest factor affecting global QoL, impacting all dimensions, especially physical, social, and emotional functioning. Multivariable regression showed major LARS reduced global QoL by 25.3 points at 12 months ($p < 0.001$), while minor LARS had no significant effect. These finding aligns with previous studies by Battersby [17], Juul [40], and Kooten [43], who reported that fecal incontinence and urgency significantly impair QoL. Although major LARS rates declined over time, it remained at 58.4% at 12 months, with only 8.3% reporting no distress. This rate was lower than Laursen (65.4%) [49], but higher than Pieniowski [50], Emmertsen (56,3%) [9] and Hughes (55,9%) [51]. In Vietnam, Thien [42] reported a reduction to 36% after 6 months, and Vu et al. [46] noted a sharp drop from 58.4% to 14.5% at 12 months. Overall, our 12-month prevalence exceeded the 30–50% range in several Asian countries [52, 48, 45].

Identifying both direct and indirect factors influencing global QoL after surgery is essential, especially those mediated through LARS. Prolonged LARS can lead to severe physical and mental decline [8, 53, 12, 35], often resulting from multimodal treatments that increase functional complications. Patients aged 41–50 had a significantly higher risk of major LARS ($P = 0.04$), similar to Homma's findings. Thus, screening should include all age groups. T3 tumors located ≤5 cm from the anal verge also increased LARS risk due to deep invasion [54, 17]. Moreover, radiotherapy remained the strongest risk factor for LARS [11, 7, 10, 55]. In our study, patients who received radiotherapy had lower global QoL scores, particularly those with complications such as anal ulceration or hemorrhagic colitis. Chemotherapy

was also associated with a higher risk of major LARS (P = 0.01). The adverse effects of chemotherapy are toxic to the gastrointestinal tract, increasing mucosal injury and worsening LARS severity [56, 57].

Our results showed that although physical function gradually improved over time after surgery, issues related to social reintegration and financial difficulties persisted. Previous findings have also suggested that gastrointestinal-bowel dysfunction after treatment, particularly in patients with LARS, may reduce the ability to return to work, increase economic burden, and negatively affect QoL [58]. Additionally, a study in Thailand reported that cultural-social factors, such as support from extended family and religious beliefs, play an important role in reducing anxiety, depression, and stigma among rectal cancer patients with a stoma [59]. These findings highlight the importance of strategically managing LARS-related symptoms, mobilizing family community support, and enhancing psychosocial support activities to help patients reintegrate into society, return to normal life sooner, and reduce the financial burden in the postoperative period.

The study closely monitored the recovery process and changes in patients' overall health through the QoL scale at five postoperative time points. This allowed physicians and nurses to more easily monitor and adjust care plans, which holds practical value in patient care strategies after surgery. In addition, the study identified an independent factor affecting QoL and clarified indirect impacts through LARS. These findings offer practical evidence for stage-specific postoperative care, early LARS screening, and symptom management to improve QoL and help patients adapt to functional changes following sphincter-preserving surgery for low rectal cancer. However, the single-center design and small sample size limit generalizability. QoL data were self-reported and may have been influenced by psychological factors or fatigue. Although the follow-up lasted 12 months, this may not have been sufficient to capture long-term complications. Moreover, the study did not include a control or comparison group, such as patients with permanent colostomy or those treated with alternative surgical techniques. This limitation may have implications for internal validity, particularly in interpreting functional outcomes. Future research should expand to multicenter designs, comprehensively assess other functions such as urogenital and sleep quality, and include longer follow-up periods (around 5 years) to better capture factors affecting QoL after surgery.

In conclusion, QoL in patients with LRC undergoing LAR declined sharply in the first 3 months and gradually improved over time, but did not fully recover after 12 months, especially in terms of social functioning and financial difficulty. Major LARS was the key factor associated with impaired QoL, with a high persistence rate after one year. Factors such as adjuvant chemoradiotherapy, alcohol consumption, and age group 41 to 50 were associated with an increased risk of major LARS. Therefore, multidisciplinary coordination is required for regular LARS screening, preoperative counseling for high-risk groups, and early management of bowel dysfunction. Developing stage-specific postoperative care strategies, particularly in the first 3 months, along with bowel rehabilitation programs and psychosocial support, is essential.

Author Contribution Statement

Conceptualization: Ly Huu Phu, Ung Van Viet; Methodology: Hoang Danh Tan, Ho Tat Bang; Formal analysis: Nguyen Trung Tin, Ly Huu Phu, Nguyen Viet Binh; Supervision: Ung Van Viet, Hoang Danh Tan; Writing-original draft: Ly Huu Phu, Ung Van Viet; Writing - review & editing: All Authors.

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Ethical Declaration

This study was approved by the Ethics Committee of the University of Medicine and Pharmacy at Ho Chi Minh City, with approval number 295/HĐĐĐ-ĐHYD, dated March 10, 2022.

Conflict of interest

The authors have no potential conflicts of interest to disclose.

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