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ORIGINAL ARTICLE

Pelvic index/mesorectal length ratio: a new predictive factor for rectal cancer prognosis and low anterior resection syndrome

Relación índice pélvico/longitud mesorrectal: un nuevo factor predictivo para el pronóstico del cáncer de recto y el síndrome de resección anterior baja

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Abstract

Objective: *This study aimed to evaluate whether the pelvic index/mesorectal length (PI/ML) ratio is an effective factor in recurrence, anastomotic leakage, mesorectal excision status, and low anterior resection syndrome (LARS) development in rectal cancer patients undergoing total mesorectal excision.* **Methods:** *A total of 47 patients who underwent surgery for rectal cancer between January 2016 and December 2021 were included. Demographics, clinical data, and pre-operative PI measurements were recorded. Post-operative LARS was assessed using the LARS questionnaire in patients followed for at least 12 months.* **Results:** *A significant association was found between PI/ML ratio and tumor recurrence ($p < 0.0001$). Receiver operating characteristic analysis identified a cutoff value of PI/ML < 1.6 for predicting tumor recurrence, with 100% sensitivity and 84.6% specificity. After applying Bonferroni correction for multiple comparisons (n = 4, adjusted significance threshold $p < 0.0125$), this association remained statistically significant. The association between PI/ML ratio and anastomotic leakage (cutoff < 2.15; sensitivity 100%, specificity 53.7%) showed marginal significance ($p = 0.009$). No significant association was found between PI/ML ratio and LARS or mesorectal excision status after correction.* **Conclusions:** *PI/ML ratio appears to be a useful predictor for tumor recurrence and may help identify patients at risk for anastomotic leakage in rectal cancer surgery. However, this ratio was not significantly associated with the development of LARS. Further research with larger cohorts is needed to validate these findings and clarify the potential prognostic value of the ratio.*

Keywords: *Rectal cancer. Pelvic index. Low anterior resection syndrome. Total mesorectal excision.*

Resumen

Objetivo: *Evaluar si la relación índice pélvico/longitud mesorrectal (IP/LM) es un factor predictivo eficaz en la recurrencia, la fuga anastomótica, el estado de la escisión mesorrectal y el desarrollo de síndrome de resección anterior baja (SRAB) en pacientes con cáncer de recto sometidos a escisión mesorrectal total.* **Métodos:** *Se incluyeron 47 pacientes sometidos a cirugía por cáncer rectal entre enero de 2016 y diciembre de 2021. Se registraron características demográficas, datos clínicos y mediciones preoperatorias del índice pélvico. El SRAB posoperatorio se evaluó mediante un cuestionario en pacientes con un seguimiento mínimo de 12 meses.* **Resultados:** *Se encontró una asociación significativa entre la relación IP/LM y la recurrencia tumoral ($p < 0.0001$). El análisis de la curva ROC identificó un valor de corte de IP/LM < 1.6 para predecir la recurrencia*

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tumoral, con una sensibilidad del 100% y una especificidad del 84.6%. Tras aplicar la corrección de Bonferroni para comparaciones múltiples (n = 4, umbral de significación ajustado p < 0.0125), esta asociación siguió siendo estadísticamente significativa. La asociación entre la relación IP/LM y la fuga anastomótica (valor de corte < 2.15; sensibilidad 100%, especificidad 53.7%) mostró una significación marginal (p = 0.009). No se encontró ninguna asociación significativa entre la relación IP/LM y el SRAB, ni con el estado de la escisión mesorrectal tras la corrección. **Conclusiones:** *La relación IP/LM parece ser un predictor útil para la recurrencia tumoral y podría ayudar a identificar a los pacientes con riesgo de fuga anastomótica en la cirugía de cáncer de recto. Sin embargo, esta relación no se asoció significativamente con el desarrollo de SRAB. Se necesitan más estudios con cohortes más grandes para validar estos hallazgos y aclarar el potencial valor pronóstico de esta relación.*

Palabras clave: *Cáncer rectal. Índice pélvico. Síndrome de resección anterior baja (SRAB). Escisión mesorrectal total.*

Introduction

Colorectal cancer (CRC) remains a major health problem worldwide and is the third leading cause of cancer-related death. Recent data indicate that rectal cancer accounts for nearly 39% of all CRC cases and contributes substantially to morbidity and mortality[1-3]. A narrow pelvis and difficult pelvic anatomy are considered to be important risk factors for rectal cancer surgery[2]. Different angles and strictures in the pelvis can lead to the possibility of difficult and incomplete resection. Although the length of the mesorectum may appear relatively short or long on the pathology slides, depending on an individual's pelvic anatomy, pathological evaluation can provide significant insights[1,2].

Appropriate oncologic resection is critical in the surgical treatment of rectal cancer, with total mesorectal excision (TME) becoming the gold standard[2]. However, even with modern techniques, post-operative functional disorders such as low anterior resection syndrome (LARS) remain significant complications, occurring in up to 50-80% of patients[3,4]. LARS encompasses symptoms such as fecal urgency, incontinence, and frequent bowel movements, significantly impacting quality of life[4,5].

Recent meta-analyses and multicenter trials have identified important risk factors for LARS, including low tumor height, low anastomotic height, neoadjuvant therapy, anastomotic leakage, and protective stomas[4,5]. Furthermore, new surgical approaches such as transanal TME have shown promise in reducing conversion rates and potentially improving functional outcomes, although concerns about specific complications and local recurrence remain[6].

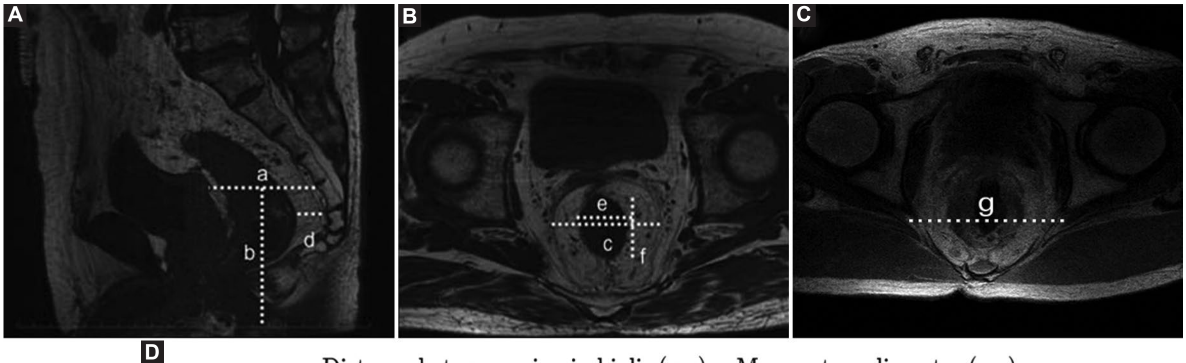
The basic pathophysiology of LARS involves a combination of colonic motility disorder, neo-rectal reservoir dysfunction, and impaired anal sphincter function. Dysfunction after rectal resection leads to LARS symptoms due to denervation, decreased functional capacity, and hypogastric plexus injury. Therefore, the pelvic angle and the size of the resected pathologic lesion are among the determining factors for the development of LARS[7,8].

In rectal cancer surgery, new markers are needed to predict the patient's prognosis, and studies on this topic are ongoing. In this context, pelvimetric measurements have increasingly been explored as potential predictors of surgical outcomes. Therefore, in our study, we calculated the pelvic index (PI) value based on the pre-operative tomography images of the patients. In addition, we recorded the mesorectal length (ML) and complete/incomplete mesorectal excision data from the pathological reports of rectal cancer. By calculating the "Pelvic Index/Mesorectal Length (PI/ML) Ratio" using pelvimetric measurements, we aimed to contribute to the literature by investigating the relationship between this ratio and factors that influence the prognosis of rectal cancer surgery and the development of LARS. We hypothesize that a lower PI/ML ratio is an independent predictor of an increased risk of anastomotic leakage, tumor recurrence, and the development of LARS in patients undergoing TME for rectal cancer.

Methods

Study design and participants

In this retrospective observational study, patients who underwent surgery for rectal cancer in the General Surgery Clinic of Istanbul Training and Research. Hospital between January 2016 and December 2021 were analyzed. Patients who could not undergo curative surgery, whose clinical data could not be reached in the post-operative period, or who could not participate in the LARS questionnaire (or who had not completed 1 year postoperatively) were excluded from the study.



$$PI = 100 \times \frac{\text{Distance between spina ischialis (cm)} - \text{Mesorectum diameter (cm)}}{\text{Depth of small pelvis (cm)}}$$

Figure 1. *Magnetic resonance imaging measurements and schematic diagram for calculation of the pelvic index (PI) in rectal cancer patients.* **A:** *sagittal plane image showing the pelvic inlet width (a) measured as the transverse diameter of the pelvic brim, the depth of cavity of the lesser pelvis (b) the length measured between the middle point of line "a," and the mesorectal thickness (d).* **B:** *axial plane image showing the mesorectal diameter (c) measured at the point of maximum width, transverse rectal diameter (e), and longitudinal rectal diameter (f).* **C:** *axial plane image illustrating the interspinous distance defined as the narrowest distance between the ischial spines (g).* **D:** *schematic diagram demonstrating the formula used for calculating the pelvic index using the distance between the spina ischialis, the diameter of the mesorectum in the axial plane, and the depth of the small pelvis.*

A priori power analysis was performed using G*Power (Heinrich Heine University Düsseldorf, Germany). For detecting differences between two independent means (two-tailed *t*-test), an effect size (Cohen's d) of 1.64 was assumed, with an alpha level of 0.05 and statistical power set at 95%. The effect size was estimated based on preliminary analyses of institutional data, which demonstrated substantial differences in pelvic measurements between patient groups. Similar large effect sizes have also been reported in previous studies investigating pelvic anatomy and surgical outcomes in rectal cancer. The analysis indicated that a total sample size of 22 patients (11/group) would be sufficient. As our study included 47 patients, the sample size was deemed adequately powered for the analyses conducted.

Data collection

Demographic and clinical data

Demographic data, operative data, pathology reports, and radiologic imaging were analyzed. Clinical files of the patients were scanned, and demographic data, as well as recurrence and anastomotic leakage status, were recorded.

Pre-operative imaging and PI measurement

All PI measurements were performed by a single experienced radiologist to ensure consistency (Fig. 1). Interobserver variability was not assessed in this study, which represents a limitation. In the pre-operative period, tomography images taken within 1 week before surgery were evaluated by a radiologist, and the PI was calculated using the following formula presented in figure 1[9].

Pathologic evaluation

We obtained the mesorectal length (ML) data from the pathologic slide reports.

LARS score

The LARS questionnaire was administered via telephone to patients with at least 12 months of postoperative follow-up. According to the results of the questionnaire, patients were classified as follows:

- No LARS: 0-20 points
- Minor LARS: 21-29 points
- Major LARS: 30-49 points
- We evaluated patients in two groups: those with LARS (minor + major) and patients without LARS[10].

Ethical approval

The study was initiated with the approval of decision number 391 from the Ethics Committee of Istanbul

Training and Research Hospital on December 23, 2022. This was a retrospective observational study and was not registered in a public trials registry, as registration is not required for retrospective studies under current regulations.

Results

The study was conducted with a total of 47 patients, 21 (44.7%) females and 26 (55.3%) males. The mean age was 62.1 ± 9.8 years (range: 37-86), and body mass index (BMI) was 26.6 ± 4.9 kg/m^2 (Table 1). The number of patients who received neoadjuvant chemoradiotherapy in our case series was 33 (70.2%), whereas the number of patients who did not receive neoadjuvant chemoradiotherapy was 14 (29.8%).

We observed an anastomotic leakage in 12.8% of patients (six cases) and detected recurrent tumoral lesions in 17% (eight cases). In the evaluation of mesorectal excision in pathologic slides, we found incomplete mesorectal excision in 36.2% (17 cases) and complete mesorectal excision in 63.8% (30 cases) (Table 1).

In terms of tumor localization, 29 (61.7%) patients had tumor localization in the proximal rectum, 13 (27.7%) in the middle rectum, and 5 (10.6%) in the distal rectum. In terms of surgical method, laparoscopic surgery was performed in 33 cases, and loop ileostomy was performed in 21 of them. Conventional surgery was performed in 13 cases, and loop ileostomy was performed in addition to resection in nine of them. When the stage distribution was analyzed in our study, the most common stage was E3b with 26 cases (54.6%), and at least 1 case (2.1%) was the E3c stage (Table 1).

Twenty patients (42.6%) showed LARS findings, and the mean LARS score was 17.1 ± 13.1. The mean interspinous distance was 11.3 ± 1.2 cm, the radiologic diameter of the mesorectum was 7.83 ± 1.05 cm, and the depth of the small pelvic cavity was 9.64 ± 1.2 cm. The mean PI value was calculated as 36.7 ± 12.5 cm. The average pathologic mesorectal length was 16.8 ± 4.2 cm, and the ratio of PI to mesorectal length was 2.4 ± 1.3 (Table 1).

The mean BMI of the female group was 28.5 ± 5.2 and 25.0 ± 4.0 in the male group (Table 2). The mean BMI of the female group was higher than that of the male group, and this difference was statistically significant and was found to have a large effect size (Cohen's d = 0.758, 95% confidence interval [CI] = −1.350-−0.158, p = 0.013).

The mean PI/ML was 2.6 ± 1.3 in the female group and 2.2 ± 1.3 in the male group. There was no statistically significant difference between the sexes in terms of PI/ML (p > 0.05) (Table 2).

To correct for multiple comparisons (n = 4), we applied a Bonferroni correction, setting the

Table 1. Demographic, clinical, pathological, and treatment characteristics of patients undergoing total mesorectal excision for rectal cancer

Parameters	Mean ± SD or n (%)
Age (years)	62.1 ± 9.8
Sex, n (%)	Male: 26 (55.3) Female: 21 (44.7)
BMI (kg/m^2)	26.6 ± 4.9
Tumor location, n (%)	Proximal: 29 (61.7) Middle rectum: 13 (27.7) Distal: 5 (10.6)
Pathological stage (pTNM), n (%)	Stage I: 6 (12.8) Stage II: 3 (6.4) Stage III: 36 (76.6) Stage IV: 2 (4.3)
Neoadjuvant radiotherapy, n (%)	33 (70.2)
Complete mesorectal excision, n (%)	30 (63.8)
Anastomotic leakage, n (%)	6 (12.8)
Tumor recurrence, n (%)	8 (17.0)
LARS	
n (%)	20 (42.6)
Mean score	17.1 ± 13.1
Interspinous distance (cm)	11.3 ± 1.2
Mesorectum radiologic diameter (cm)	7.83 ± 1.05
Depth of small pelvic cavity (cm)	9.64 ± 1.2
PI (cm)	36.7 ± 12.5
Pathologic mesorectal length (cm)	16.8 ± 4.2
PI/ML (cm)	2.4 ± 1.3

LARS: low anterior resection syndrome; PI/ML: pelvic index/mesorectal length; BMI: body/mass index, SD: standard deviation.

Table 2. Comparison of age, BMI, PI/ML ratio, and tumor localization between male and female patients

Parameters	Mean ± SD		Effect size (95% CI)	p
	Female	Male		
Age	61.4 ± 10.7	62.6 ± 9.1	0.12 (–0.46-0.70)	0.683
BMI	28.5 ± 5.2	25.0 ± 4.0	–0.76 (–1.35 –0.16)	0.013
PI/ML (cm)	2.6 ± 1.3	2.2 ± 1.3	–0.28 (–0.86-0.30)	0.339

PI/ML: pelvic index/mesorectal length; BMI: body/mass index, SD: standard deviation, 95% CI: confidence interval.

Table 3. ROC analysis results for predicting anastomotic leakage, tumor recurrence, complete mesorectal excision, and LARS based on the PI/ML ratio

Parameters	AUC ± SD	Cutoff	Sensitivity	Specificity	95% CI	p
Anastomotic leakage	0.833 ± 0.079	< 2.15	100	53.7	0.679-0.988	0.009
Recurrence	0.929 ± 0.037	< 1.6	100	84.6	0.858-1.000	0.00001
Complete mesorectal excision	0.520 ± 0.093	> 1.64	73.3	41.2	0.338-0.701	0.825
LARS	0.589 ± 0.088	< 1.90	55	66.6	0.436-0.730	0.315

PI/ML: pelvic index/mesorectal length; LARS: low anterior resection syndrome; AUC: area under the curve; SD: standard deviation; CI: confidence interval; ROC: receiver operating characteristic.

Table 4. Comparison of demographic and clinical characteristics between patients with and without LARS

Parameters	No. LARS (n = 27)	LARS present (n = 20)	Odd ratio/effect size (95% CI)	p
Gender, n (%)			0.40 (0.12-1.35)*	0.394
Male	13 (48.1)	13 (65.0)		
Female	14 (51.9)	7 (35.0)		
Age, X ± SD	61.67 ± 10.1	62.65 ± 9.5	0.01 (−0.57-0.60)**	0.957
BMI, X ± SD	24.77 ± 3.4	28.02 ± 5.3	0.46 (−0.13-1.05)**	0.035
Mesorectal excision, n (%)			0.20 (0.06-0.72)*	0.045
Complete	21 (77.8)	9 (45.0)		
Incomplete	6 (22.2)	11 (55.0)		
PI, X ± SD	38 ± 13	35 ± 12	−0.27 (−0.85-0.32)	0.241
Mesorectal length (ML), X ± SD	16.50 ± 3.79	18.41 ± 4.15	0.44 (−0.16-1.02)**	0.140
PI/ML, X ± SD	2.4 ± 1	1.8 ± 1	0.34 (0.02-0.25)**	0.040

*Odd ratio.
**Effect size (Cohen's d).
BMI: body mass index; X ± SD: mean ± standard deviation; PI/ML: pelvic index/mesorectal length ratio; LARS: low anterior resection syndrome.

significance threshold at $p < 0.0125$. Under this correction, the relationship between recurrence and PI/ML remained statistically significant ($p = 0.00001 < 0.0125$), and the association between anastomotic leakage and PI/ML was marginally retained ($p = 0.009 < 0.0125$). Associations with complete mesorectal excision and LARS did not reach the adjusted significance level (Table 3).

When the PI/ML cutoff value ≤ 2.1 for anastomotic leakage, sensitivity and specificity were 100% and 53.7%, respectively. There was a statistically significant correlation between PI/ML and anastomotic leakage ($p < 0.05$) (Fig. 2A). We found the sensitivity and specificity to be 100% and 84.6%, respectively, when the PI/ML cutoff value was ≤ 1.6 for recurrence. PIML was found to be significantly associated with the recurrence ($p < 0.05$) (Fig. 2B). Sensitivity and specificity were 73.3% and 41.2%, respectively, when the PI/ML cutoff value was > 1.64. PI/ML was not statistically significantly associated with complete mesorectal excision ($p > 0.05$) (Fig. 2C). Sensitivity and specificity were found to be 55% and 66.6%, respectively, when the cutoff value for PI/ML was < 1.90. We did not find a statistically significant correlation between PI/ML and LARS ($p > 0.05$) (Fig. 2D and Table 3).

Patients in our study were divided into two groups: no LARS (0-20) and LARS (21-42 minor + major). Demographic and clinical data are analyzed in table 4. Twenty-seven patients had no LARS, and 20 patients had LARS findings (minor + major). There was no statistical significance between these groups in terms of age and gender ($p > 0.05$). BMI was 28.02 ± 5.3 in the group with LARS findings and 24.77 ± 3.4 in the group without LARS, which has a moderate effect size ($p = 0.035$; Cohen's d = 0.462; 95% CI: −0.131-1.050).

While there was no statistical difference between the LARS groups in terms of T, N, and Stage, no statistical difference was observed in terms of tumor localization ($p > 0.05$). There was no statistical significance between

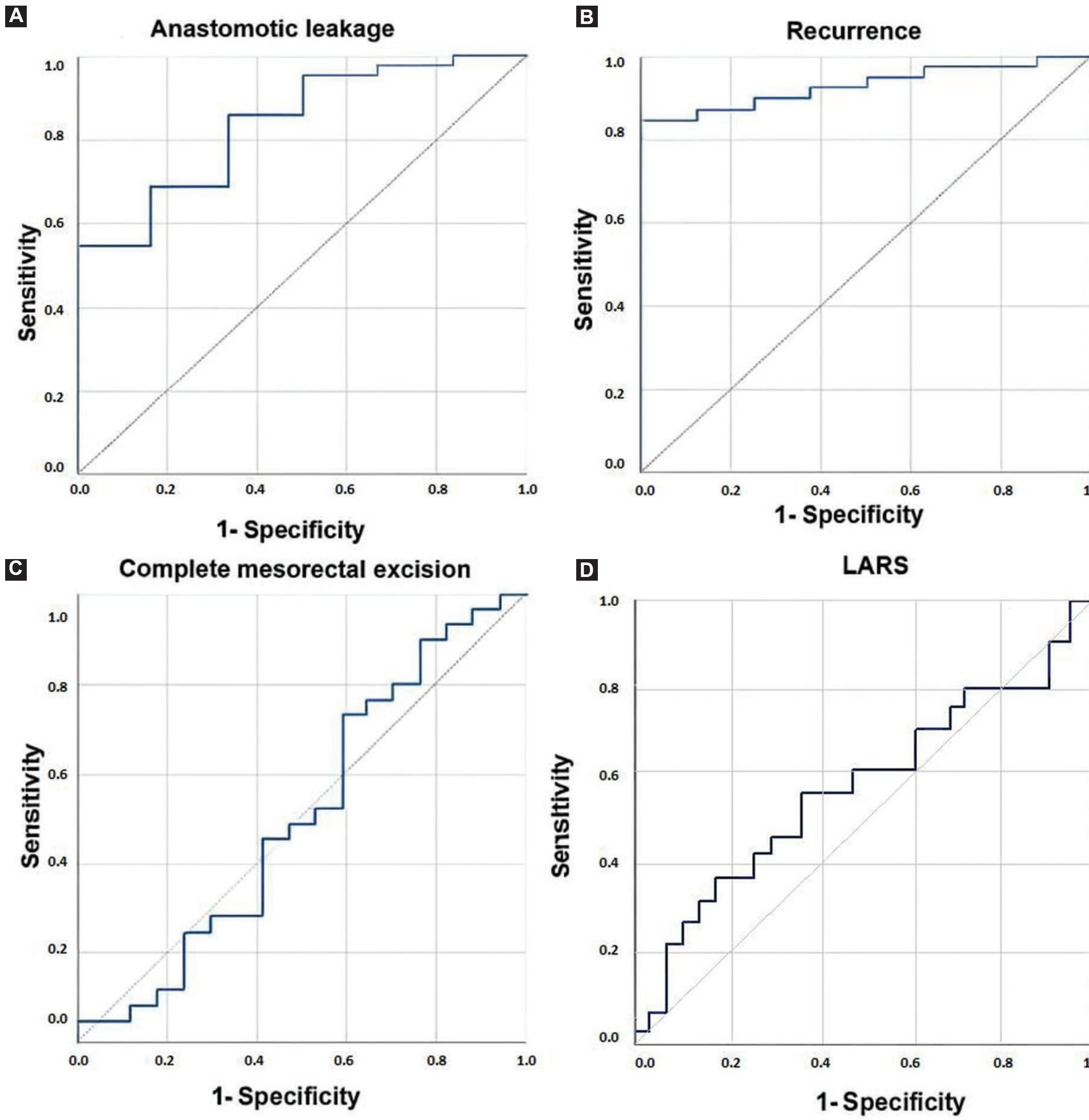


Figure 2. *Receiver operating characteristic analyses of anastomotic leakage* **(A)**, *recurrence* **(B)**, *complete mesorectal excision* **(C)**, *and low anterior resection syndrome* **(D)** *according to the pelvic index/mesorectal lenght ratio.*

the PI and ML between the groups according to the presence of LARS. The PI/ML ratio was found to be higher in individuals without LARS than in individuals with LARS. This difference had a small effect size (p = 0.040; Cohen's d = 0.336; 95% CI: 0.020-0.253) (Table 4).

Incomplete mesorectal excision was reported in 11 cases (55%) with LARS, whereas complete mesorectal excision was reported in 21 cases (77.8%) without LARS (Table 4). Cases with complete excision were 5.05 times less likely to develop LARS than individuals without complete excision (p = 0.045; OR = 0.198; 95% CI: 0.055-0.715).

In the correlation analysis between LARS score and demographic and clinical data, no statistical significance was observed in the correlation between age, BMI, PI, ML, and PI/ML (Table 5).

Discussion

In our study, we investigated whether the PI/ML ratio, derived from pre-operative pelvic measurements,

Table 5. Correlation analysis between LARS scores and continuous demographic and clinical variables

Parameters	r	p	95% CI	
			Lower	Upper
Age	–0.156	0.295	–0.431	0.146
BMI	0.198	0.182	–0.103	0.466
PI	–0.167	0.262	–0.441	0.135
ML	0.140	0.349	–0.162	0.418
PI/ML	–0.160	0.284	–0.434	0.142

LARS: low anterior resection syndrome; BMI: body mass index; CI: confidence intervals; PI/ML: pelvic index/mesorectal length ratio.

could predict surgical and oncological outcomes in rectal cancer patients undergoing TME, which is critical for patient prognosis. After correcting for multiple comparisons using the Bonferroni method, we found that the PI/ML ratio remained significantly associated with tumor recurrence and showed a marginally significant association with anastomotic leakage. However, the PI/ML ratio was not significantly associated with the development of LARS.

The relationship between pelvic anatomy and surgical outcomes has been discussed in the literature[11,12]. Several studies have shown that a narrow pelvis and difficult pelvic anatomy can lead to more challenging resections, higher rates of incomplete excision, and potentially higher recurrence rates[7,8,11,12]. High-resolution magnetic resonance imaging studies have recently provided more detailed insights, demonstrating that pelvic dimensions and mesorectal involvement are crucial factors for rectal cancer staging and surgical planning. Narrow pelvic dimensions may complicate surgical access and influence resection margins and oncological outcomes[7,8]. Our study's findings regarding PI/ML ratio align with these anatomical considerations, suggesting that the PI/ML ratio might serve as a quantitative reflection of pelvic complexity in rectal cancer surgery.

In our series, we found a significant correlation between PI/ML ratio and tumor recurrence. This supports the hypothesis that pelvic anatomy, as reflected in pelvimetric measurements, may influence oncological outcomes. For tumor recurrence, a PI/ML cutoff value of < 1.6 was identified, with high sensitivity and specificity. Our findings suggest that pre-operative pelvic measurements could assist in risk stratification for tumor recurrence in rectal cancer patients. This finding is consistent with recent imaging literature emphasizing how mesorectal involvement and pelvic constraints may influence local recurrence risk[11]. However, Huang et al. found no significant difference between radiologically measured pelvic parameters and recurrence and mortality[13].

A significant association was also observed between the PI/ML ratio and anastomotic leakage. In patients with a PI/ML ratio < 2.15, the sensitivity and specificity for predicting anastomotic leakage were 100% and 53.7%, respectively. While pelvic anatomy has long been recognized as an important factor in surgical difficulty[11,12], our study contributes quantitative data supporting its association with post-operative complications. Accordingly, the PI/ML ratio can be used in determining the surgical strategy and may be of clinical benefit in applications such as controlling anastomotic tension and monitoring anastomotic viability.

Our findings regarding LARS differ from earlier assumptions that pelvic anatomy directly predicts functional outcomes. Although we observed a trend toward lower PI/ML ratios in patients with LARS, this did not reach statistical significance. This is in line with a recent systematic review and meta-analysis, which reported a pooled incidence of major LARS of approximately 44%[8]. Sun et al. highlighted that the major risk factors for LARS include neoadjuvant radiotherapy, low tumor height, low anastomotic level, anastomotic leakage, and diverting stomas, rather than purely anatomical parameters such as pelvic dimensions. Thus, while pelvic anatomy may play a role in surgical difficulty, its direct correlation with post-operative functional disorders remains uncertain[8].

Recent evidence suggests that BMI may influence oncological outcomes in rectal cancer patients. Although BMI was not independently associated with the PI/ML ratio in our cohort, the post-operative LARS rate in patients with high BMI was statistically significant in our study. High BMI values cause an increase in mesorectal adipose tissue thickness and increase the technical difficulty of TME. This finding supports the results of the study by Meng et al.[14]. Liu et al. demonstrated that lower BMI, particularly BMI < 18.5 kg/m^2, was significantly associated with poorer overall and cancer-specific survival in patients undergoing neoadjuvant chemoradiotherapy followed by TME[15]. This highlights that not only anatomical factors but also patient-related biological characteristics may contribute to prognosis in rectal cancer[16].

In the literature, Boyle et al. found that pelvic dimensions vary by sex in healthy individuals. The anteroposterior diameter of the mesorectum and the volume of the fat area were evaluated radiologically, and it was found that the mesorectal area was wider in men and the anterior mesorectal fat was thinner in women[16]. In our study, there was no significant difference in PI/ML between male and female patients, but BMI values were higher in female patients compared to male patients. These BMI differences could be relevant when planning treatment, as higher BMI may influence technical difficulty during surgery and post-operative outcomes. However, our study did not find a direct link between BMI and PI/ML ratio or post-operative complications, possibly due to the limited sample size.

Our findings align with recent research highlighting the role of pelvic anatomy in rectal cancer surgery. A study by Aparicio-López et al. found that specific pelvimetric measurements correlated significantly with surgical difficulty and post-operative complications, including anastomotic leakage and conversion rates during rectal cancer surgery[17]. Similarly, another review emphasized that variations in pelvic anatomy may influence not only technical aspects of TME but also functional outcomes such as LARS[18]. These reports support the potential clinical utility of anatomical indices such as the PI/ML ratio as prognostic tools for surgical planning and risk stratification in rectal cancer.

Our study has several limitations that should be acknowledged. First, it was a retrospective study conducted at a single center, which may introduce selection bias and limit the generalizability of the findings. Second, the sample size was relatively small, potentially reducing the statistical power to detect associations, especially regarding LARS outcomes. This sample size, though reflective of all eligible patients during the study period, may be underpowered to detect smaller effect sizes, particularly for outcomes such as LARS. Third, the assessment of LARS was performed via telephone interviews rather than in-person evaluations, which could introduce recall bias or variability in patient responses. Additionally, we did not assess interobserver variability for PI measurements, which may affect the reproducibility of our findings. Despite these limitations, our study provides valuable preliminary evidence on the potential role of PI/ML ratio in predicting oncological and surgical outcomes in rectal cancer patients. Future prospective multicenter studies with larger patient cohorts are needed to validate and expand upon these findings.

Conclusions

In our study, we found that the PI/ML ratio was significantly associated with anastomotic leakage and tumor recurrence in patients undergoing TME for rectal cancer. Specifically, lower PI/ML ratios were predictive of higher risk for both anastomotic leakage and tumor recurrence, with high sensitivity and moderate to high specificity. However, we did not observe a statistically significant association between the PI/ML ratio and complete mesorectal excision status or the development of LARS. Although patients with LARS had lower mean PI/ML ratios, this difference did not reach statistical significance in our analysis.

These findings suggest that pre-operative pelvic measurements and the PI/ML ratio could be useful for predicting certain oncological and surgical outcomes, such as anastomotic leakage and recurrence risk. Further research with larger cohorts is warranted to validate these findings and explore the potential of PI/ML as a prognostic tool in rectal cancer surgery.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that the procedures followed complied with the ethical standards of the responsible human experimentation committee and adhered to the World Medical Association and the Declaration of Helsinki. The procedures were approved by the institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely obtained and anonymized clinical data, so informed consent was not necessary. Relevant guidelines were followed.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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