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RESEARCH ARTICLE

Preoperative, Perioperative, and Pathological Characteristics of Sigmoid, Rectosigmoid, and Upper Rectal Adenocarcinomas: A Retrospective Cohort Study from the Turkish Colorectal Cancer Database

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ABSTRACT

Aim: This retrospective cohort study used the Turkish Society of Colon and Rectal Surgery Colorectal Cancer Database to compare the preoperative clinical characteristics and 30-day postoperative outcomes of patients undergoing curative surgery for adenocarcinomas of the sigmoid colon, rectosigmoid junction, and upper rectum.

Method: Patients who underwent curative resection for non-metastatic adenocarcinoma of the sigmoid colon, rectosigmoid junction, or upper rectum between January 2017 and January 2025 were identified. Tumors ≥10 cm from the anal verge were classified as upper rectal cancers. The three anatomical groups were compared regarding clinical parameters, 30-day outcomes, and histopathology. Statistical comparisons were performed using the chi-squared or Fisher's exact tests for categorical variables and the t-test or Mann-Whitney U test for continuous variables.

Results: A total of 634 patients were analyzed [sigmoid: 274 (43.3%), rectosigmoid: 174 (27.4%), upper rectum: 186 (29.3%)]. Patients with sigmoid cancer were older (mean 64±12 years) with a higher proportion of women (42%) than those with rectosigmoid and upper rectum cancer (p-value <0.001). Magnetic resonance imaging use was significantly higher in upper rectal tumors (73%) than in rectosigmoid (11%) and sigmoid (0%) tumors. Neoadjuvant therapy was administered to 62% of upper rectal and 11% of rectosigmoid tumors but only 4% of sigmoid tumors (p-value <0.001). Stage III disease occurred more frequently in rectosigmoid (40%) and upper rectum (55%) cancer than in sigmoid (32%) cancer (p-value <0.001). Lymph node positivity was highest in the upper rectum (57%).

Conclusion: Significant differences in diagnostic workup and treatment strategies exist across these segments. Rectosigmoid tumors share oncologic characteristics with rectal tumors but are often managed as colonic cancers, highlighting the need for clearer anatomical definitions and treatment guidelines.

Keywords: Rectosigmoid colon, colon cancer, upper rectum, outcomes

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Introduction

The rectosigmoid junction, representing the anatomical transition between the distal sigmoid colon and the upper rectum, is the origin of approximately 10% of all colorectal malignancies.[1] The management of tumors arising in this region remains a subject of ongoing controversy, owing to its ambiguous anatomical boundaries and overlap in therapeutic strategies.[2] Although certain clinical guidelines advocate for treating rectosigmoid tumors as colonic malignancies, others recommend adherence to rectal cancer protocols. More recently, there has been increasing support for a personalized, case-dependent approach. This distinction is particularly critical in locally advanced disease, where treatment paradigms differ substantially.[3]

Accurate anatomical localization of the tumor within the colorectum is essential for selecting the appropriate treatment pathway; however, this remains a considerable clinical challenge, particularly in the rectosigmoid region, where the boundaries between rectum and colon are poorly defined.[4] Therapeutic algorithms for colon and rectal cancers diverge considerably, with colon cancer favoring postoperative systemic therapy and rectal cancer necessitating preoperative chemoradiation.[5,6] Some studies, such as Venigalla et al.[5], support neoadjuvant chemoradiotherapy for stage II-III rectosigmoid tumors due to improved local control, whereas others, such as Käser et al.[6], report that oncologic outcomes for tumors in the upper rectum and rectosigmoid junction resemble those of colon cancer, suggesting that perioperative radiotherapy may be omitted in many cases without compromising long-term results.

Tumors arising at the rectosigmoid junction represent a diagnostically and therapeutically complex subgroup of colorectal cancers (CRCs), located at the anatomical transition between the distal sigmoid colon and the upper rectum.[3] Their management is often challenged by inconsistencies in anatomical definitions and the lack of standardized staging and treatment protocols. Clinical guidelines vary in their recommendations; the National Comprehensive Cancer Network Rectal Cancer Guidelines (v3.2024)[7] suggest treating tumors ≥15 cm from the anal verge according to colon cancer protocols, whereas the European Society for Medical Oncology Rectal Cancer Guidelines[8] emphasize anatomical definition but acknowledge that management may be individualized based on multidisciplinary discussion. The American Society of Colon and Rectal Surgeons Guidelines (2020) similarly note variability and encourage a patient-specific approach.[9] This lack of consensus is particularly critical in locally advanced disease, where neoadjuvant therapy is typically applied in rectal protocols but not in colon protocols. Accurate localization of the tumor is essential to ensure appropriate treatment selection.

Despite their frequency and clinical significance, rectosigmoid tumors remain largely underrepresented in the scientific literature. Most clinical trials and retrospective studies classify them under either sigmoid or rectal cancer cohorts, thereby overlooking their unique biological characteristics and clinical behavior.[10] This has resulted in a gap in high-quality evidence to guide optimal treatment strategies.

Currently, there is a lack of national data on the diagnostic and therapeutic preferences of colorectal surgeons for tumors located in the sigmoid colon, rectosigmoid junction, and upper rectum in Türkiye.

This study is comparative in design and aims to evaluate differences in diagnostic approaches, perioperative management, and short-term pathological outcomes for tumors of the sigmoid colon, rectosigmoid junction, and upper rectum using a national, multicenter database. We hypothesize that rectosigmoid tumors demonstrate clinical and pathological features more closely aligned with upper rectal cancers than sigmoid cancers, potentially supporting a reconsideration of current classification and treatment strategies.

Materials and Methods

Patient Selection

Between January 2017 and January 2025, patients who underwent curative resection for non-metastatic adenocarcinoma of the sigmoid colon, rectosigmoid junction, or upper rectum were identified from the multicenter Turkish Society of Colon and Rectal Surgery (TSCRS) CRC Database. Tumor location was determined intraoperatively by the attending surgeon and categorized into three groups: sigmoid colon, rectosigmoid colon, and upper rectum. Tumors located ≥10 cm from the anal verge were classified as upper rectal cancers. The anatomical subgroups were compared based on preoperative clinical features, 30-day postoperative outcomes, and histopathological characteristics. This retrospective cohort study analyzed data from the TSCRS CRC Database. The study was approved by the Ethics Committee of Acıbadem University (decision no: 2025-01/26, dated: 09.01.2025). Informed consent was obtained from all participants included in the study.

Study Setting and Participating Centers

This retrospective cohort study utilized data from the TSCRS CRC Database between 2018 and 2025. The database includes contributions from 24 centers across Türkiye, comprising 16 academic tertiary referral hospitals and 8 high-volume community hospitals. This diversity enhances the external validity of the findings by reflecting a broad spectrum of surgical practices. Preoperative, operative, and short-term (30-day) postoperative data of patients who underwent curative resection for CRC are prospectively recorded in the database. Data entry is performed by designated colorectal surgeons

at each contributing center, and all entries are subsequently validated by the TSCRS CRC Database study group.

Variables Examined

The study groups were compared in terms of age, body mass index (BMI), gender, American Society of Anesthesiologists (ASA) Score (I-II vs. III-IV), family history of CRC, preoperative tumor location (colon vs. rectum), preoperative imaging including magnetic resonance imaging (MRI), positron emission tomography-computed tomography (PET-CT), neoadjuvant therapy (administered or not), surgical approach (open, laparoscopic, and robotic), stoma creation, and 30-day morbidity. Pathological variables included T stage (T1/T2 vs. T3/T4), lymph node positivity (LN+), tumor/node/metastasis stage (I, II, III), lymphatic invasion, vascular (venous) invasion, perineural invasion, tumor budding, tumor differentiation grade, and histologic subtypes.

Classification of Tumor Location

Tumor location was determined intraoperatively by the primary surgeon, based on anatomical landmarks. To minimize inter-observer variability, participating surgeons received standardized TSCRS guidelines defining anatomical boundaries (including the "sigmoid take-off" and distance from the anal verge).

Patient Selection and Flow Diagram

Patients who underwent curative resection for non-metastatic adenocarcinoma of the sigmoid colon, rectosigmoid junction, or upper rectum were identified. Of 721 patients initially screened, 87 were excluded for the following reasons: conversion to open surgery without curative intent (n=21), missing key perioperative or pathological data (n=38), metastatic disease at presentation (n=18), and loss to follow-up before 30 days (n=10).

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation, and categorical variables were expressed as percentages. The significance between categorical variables was analyzed using the Fisher exact test or the chi-squared test, whereas the significance between continuous variables was assessed using the t-test or the Mann-Whitney U test. Statistical analyses were conducted using SPSS version 21.0. A p-value of <0.05 was considered statistically significant.

Sample Size and Power Considerations

The final sample included 634 patients (sigmoid: n=274, rectosigmoid: n=174, upper rectum: n=186). Post-hoc power analysis indicated that with this sample size, the study had >80% power ($\alpha=0.05$) to detect differences of 10%-12% in the primary outcomes (MRI usage, neoadjuvant therapy rates, and stage III disease prevalence) across groups.

Results

A total of 634 patients who underwent curative resection for non-metastatic adenocarcinoma of the sigmoid colon (274, 43.3%), rectosigmoid junction (174, 27.4%), or upper rectum (186, 29.3%) were included in the analysis. Clinical, surgical, and pathological characteristics were compared across these three anatomical subgroups.

Preoperative and Intraoperative Characteristics

There were no significant differences among the groups in terms of age, BMI, gender distribution, ASA classification, or family history of CRC. However, significant variation was observed in preoperative tumor classification; although nearly all sigmoid tumors were identified as colonic (98.9%), only 74.6% of rectosigmoid and 2.7% of upper rectal tumors were similarly labeled. In contrast, 97.3% of upper rectal tumors were classified preoperatively as rectal ($p<0.001$) (Table 1).

Use of diagnostic imaging differed substantially. MRI was performed in 73.1% of upper rectal cancers but in only 10.9% and 0% of rectosigmoid and sigmoid cases, respectively ($p<0.001$). Similarly, PET-CT usage was more frequent in upper rectal tumors (48.4%) than in rectosigmoid (28.2%) or sigmoid tumors (29.6%) ($p<0.001$). Neoadjuvant therapy was also significantly more common in upper rectal cancers (61.8%) than in rectosigmoid (10.9%) and sigmoid tumors (3.6%) ($p<0.001$).

Surgical approach varied by tumor location ($p=0.002$). Laparoscopic surgery was most frequently employed in upper rectal tumors (55.4%), whereas robotic surgery was used predominantly in sigmoid cases (13.1%). Stoma creation rates differed markedly, being highest in upper rectal cancers (68.4%) and lowest in sigmoid cancers (9.5%) ($p<0.001$). The 30-day morbidity rate was also highest in the upper rectum group (32.3%), followed by the rectosigmoid (24.1%) and sigmoid groups (21.2%) ($p=0.025$).

Pathological Outcomes

Advanced tumor stage (T3/T4) was most common in sigmoid cancers (79.9%) and least common in upper rectal cancers (65.6%) ($p=0.003$). However, LN+ and stage III disease were most frequently observed in upper rectal cancers (57.0% and 55.0%, respectively; $p<0.001$). Lymphatic and perineural invasion rates did not differ significantly among groups, whereas vascular invasion showed a trend toward higher frequency in rectosigmoid tumors (36.2%; $p=0.065$). Tumor budding was significantly more prevalent in sigmoid (38.0%) and rectosigmoid (40.6%) tumors than in upper rectal cancers (21.8%) ($p<0.001$). Poorly differentiated tumors were most frequent in the sigmoid group (15.7%) and least frequent in upper rectal cancers (8.6%) ($p=0.032$). Across all groups, moderately differentiated adenocarcinoma was the

Table 1. Comparison of preoperative, intraoperative, and 30-day postoperative outcomes in sigmoid, rectosigmoid, and upper rectal cancers

Variable	Sigmoid colon	Rectosigmoid colon	Upper rectum	p-value
Age, years (mean ± SD)	64.4±12.0	63.5±11.1	62.0±12.1	0.087
BMI, kg/m² (mean ± SD)	26.7±4.3	26.0±4.0	25.8±4.2	0.099
Sex, n (%)				0.186
Male	159 (58.0%)	116 (66.7%)	113 (60.8%)	
Female	115 (42.0%)	58 (33.3%)	73 (39.2%)	
ASA score, n (%)				0.086
ASA I-II	216 (78.8%)	138 (79.3%)	161 (86.6%)	
ASA III-IV	58 (21.2%)	36 (20.7%)	25 (13.4%)	
Family history of colorectal cancer	29 (10.6%)	19 (10.9%)	22 (11.9%)	0.906
Preoperative tumor location, n (%)				<0.001
Colon	271 (98.9%)	129 (74.6%)	5 (2.7%)	
Rectum	3 (1.1%)	44 (25.4%)	181 (97.3%)	
Preoperative MRI performed	0 (0.0%)	19 (10.9%)	136 (73.1%)	<0.001
Preoperative PET-CT performed	81 (29.6%)	49 (28.2%)	90 (48.4%)	<0.001
Neoadjuvant therapy administered	10 (3.6%)	19 (10.9%)	115 (61.8%)	<0.001
Surgical approach, n (%)				0.002
Open	119 (43.4%)	74 (42.5%)	78 (41.9%)	
Laparoscopic	119 (43.4%)	82 (47.1%)	103 (55.4%)	
Robotic	36 (13.1%)	18 (10.3%)	5 (2.7%)	
Stoma creation, n (%)	26 (9.5%)	36 (20.8%)	119 (68.4%)	<0.001
30-day morbidity	58 (21.2%)	42 (24.1%)	60 (32.3%)	0.025

BMI: Body mass index, ASA: American Society of Anesthesiologists, MRI: Magnetic resonance imaging, PET-CT: Positron emission tomography-computed tomography

predominant histological type. No significant differences were noted in histologic subtype, with adenocarcinoma being the most common in all groups (≥93%; p=0.496) (Table 2).

Distribution and Patterns of Neoadjuvant Therapy

Neoadjuvant treatment was most applied in rectal cancers (61.8%), less so in rectosigmoid (10.9%), and rarely in sigmoid tumors (3.6%) (Figure 1). Chemoradiotherapy was predominantly used for rectal tumors (88.3%), with limited use in rectosigmoid (10.8%) and sigmoid (0.9%) cancers. In contrast, chemotherapy alone was more frequent in sigmoid (56.2%) and rectosigmoid (37.5%) tumors. Radiotherapy alone was almost exclusively used in rectal cancers (94.1%) (Figure 2).

Discussion

This nationwide, multicenter study represents the first population-level analysis in Türkiye utilizing the TSCRS CRC Database to evaluate preoperative, intraoperative, and

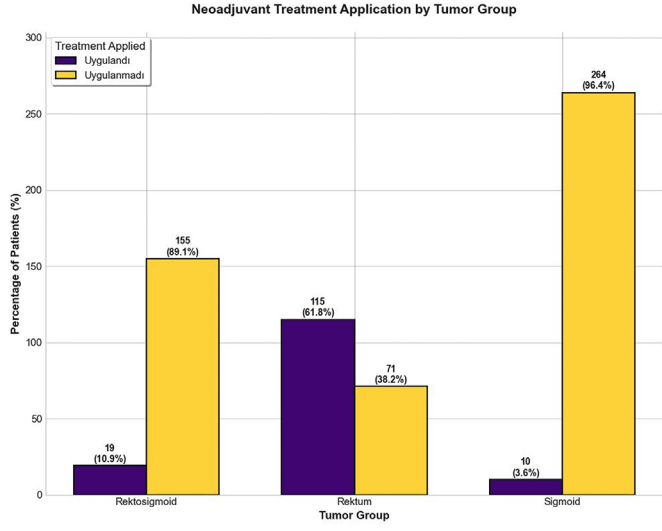

Figure 1. Neoadjuvant treatment application among the study groups

Table 2. Comparison of pathological outcomes in sigmoid, rectosigmoid, and upper rectal cancers

Variable	Sigmoid colon	Rectosigmoid colon	Upper rectum	p-value
T stage, n (%)				
T1/T2	55 (20.1%)	44 (25.3%)	64 (34.4%)	0.003
T3/T4	219 (79.9%)	130 (74.7%)	122 (65.6%)	0.003
Lymph node positivity (LN+), n (%)	97 (35.4%)	67 (38.5%)	106 (57.0%)	<0.001
TNM stage, n (%)				<0.001
Stage I	57 (25.3%)	36 (25.0%)	29 (18.1%)	
Stage II	91 (40.4%)	56 (38.9%)	43 (26.9%)	
Stage III	77 (34.2%)	52 (36.1%)	88 (55.0%)	
Lymphatic invasion, n (%)	108 (39.4%)	74 (42.5%)	59 (31.7%)	0.088
Vascular (venous) invasion, n (%)	73 (26.6%)	63 (36.2%)	50 (26.9%)	0.065
Perineural invasion, n (%)	52 (19.0%)	38 (21.8%)	34 (18.3%)	0.661
Tumor budding, n (%)	101 (38.0%)	67 (40.6%)	38 (21.8%)	<0.001
Tumor differentiation grade, n (%)				0.032
Poorly differentiated	43 (15.7%)	22 (12.7%)	16 (8.6%)	
Undetermined	22 (8.0%)	13 (7.5%)	29 (15.6%)	
Moderately differentiated	143 (52.2%)	91 (52.6%)	88 (47.3%)	
Well differentiated	66 (24.1%)	47 (27.2%)	53 (28.5%)	
Histologic subtype, n (%)				0.496
Adenocarcinoma	255 (93.1%)	168 (96.6%)	176 (94.6%)	
Mucinous adenocarcinoma	18 (6.6%)	6 (3.4%)	10 (5.4%)	
Signet ring cell carcinoma	1 (0.4%)	0 (0.0%)	0 (0.0%)	

TNM: Tumor depth-nodal status-metastasis

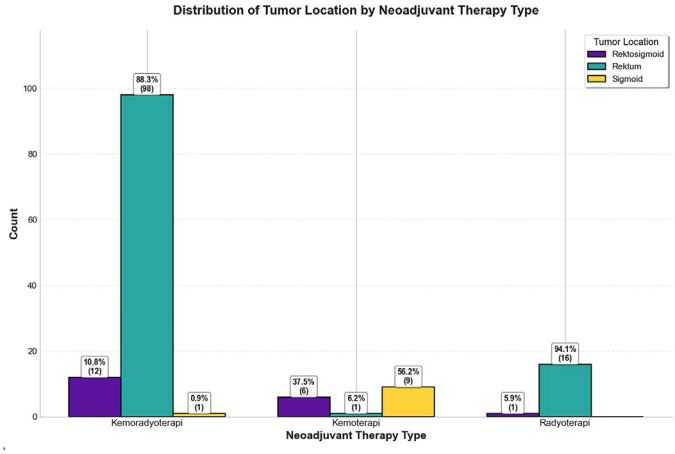

Figure 2. Distribution of tumor location by neoadjuvant therapy types

pathological characteristics of sigmoid, rectosigmoid, and upper rectal cancers. Our findings highlight significant variability in the diagnostic classification, management strategies, and oncologic features among these three anatomically contiguous yet clinically distinct colorectal segments. Patients with upper rectal tumors were more likely to undergo preoperative MRI (73.1%) and receive neoadjuvant chemoradiotherapy (61.8%) a pattern consistent with standard rectal cancer management. In contrast, rectosigmoid tumors appeared to occupy a gray zone between colon and rectal cancer paradigms, as reflected in intermediate rates of MRI use, neoadjuvant therapy, and stoma creation. Robotic surgery was more frequently applied in sigmoid cancers in our cohort, primarily due to institutional resource allocation and surgeon preference. In several participating centers, robotic platforms were prioritized for upper abdominal and selected colon cases, whereas rectal cancer cases were predominantly managed laparoscopically due to case volume and operating room scheduling.

Among the most important observations is the considerable heterogeneity in the classification and management of tumors located at the rectosigmoid junction.[11] This anatomical region, which marks the transition between the mobile sigmoid colon and the fixed rectum, has long been a source of clinical and academic ambiguity.[1,12] The "sigmoid take-off" is a valuable

anatomical landmark for differentiating the rectosigmoid junction. However, during the study period (2018-2025), this definition was not consistently implemented across participating centers. Most cases were classified intraoperatively by the attending surgeon according to traditional anatomical descriptions, without routine MRI-based localization for sigmoid or rectosigmoid tumors. Although rectosigmoid tumors account for a large proportion of CRC cases, they remain underrepresented in clinical trials and large-scale studies.[13] As a result, they are frequently subsumed into either the colon or rectal cancer categories, thereby obscuring their distinct biological behavior and therapeutic implications. This lack of uniformity in clinical practice is further compounded by the absence of standardized definitions for the rectosigmoid junction. Unlike the sigmoid colon and rectum, which have relatively well-accepted anatomical boundaries, the rectosigmoid region lacks clear radiological or surgical landmarks.[14,15] Consequently, its classification varies across institutions, registries, and even among clinicians within the same center.

In our cohort, 74.6% of rectosigmoid tumors were classified preoperatively as colonic, whereas 25.4% were labeled as rectal, reflecting inconsistency in anatomical interpretation even among experienced surgical teams. This misclassification was associated with considerable variability in the use of staging tools and treatment approaches. Specifically, preoperative MRI -widely accepted as the imaging modality of choice for rectal cancer staging- was utilized in only 10.9% of rectosigmoid tumors, compared with 73.1% of upper rectal cancers. Similarly, the administration of neoadjuvant chemoradiotherapy, a cornerstone of rectal cancer treatment, was significantly less common in rectosigmoid tumors (10.9%) than in upper rectal tumors (61.8%). These findings suggest a potential underutilization of rectal cancer treatment protocols in patients with rectosigmoid tumors, despite evidence of comparable oncologic burden.[3,16] Notably, stoma formation was significantly more frequent in upper rectal tumors, likely due to the need for low pelvic anastomoses and protective diversion following neoadjuvant treatment.[17] PET-CT was used in selected stage II-III cases as part of preoperative staging to rule out occult metastatic disease or for equivocal findings on conventional imaging. This reflects institutional practice variation across centers.

Indeed, our pathological analysis revealed that rectosigmoid tumors had a high incidence of stage III disease (36.1%) and LN+ (38.5%), closely mirroring the upper rectal group and surpassing the sigmoid colon group. Additionally, tumor budding -a histologic marker associated with poor prognosis- was more frequent in rectosigmoid (40.6%) and sigmoid tumors (38.0%) than in upper rectal tumors (21.8%). These findings underscore the biologic aggressiveness of rectosigmoid cancers and raise concerns about the adequacy of current treatment paradigms that may overlook their risk profile. Carcinomas of the rectosigmoid junction exhibit distinct biological behavior compared with neighboring bowel segments.[18] This region remains difficult to classify, as it cannot be clearly attributed to either the sigmoid colon or the upper rectum. As part of our recent Delphi consensus on the anatomical definition of colon cancer segments, experts have suggested eliminating the term "rectosigmoid," stating that it creates ambiguity rather than clarity, and that the region should no longer be classified as part of the colon.[19] However, our current study demonstrates that rectosigmoid cancers display distinct biological and clinical behavior compared with adjacent segments. These differences underscore the importance of recognizing rectosigmoid cancer as a separate entity. Rather than discarding the term entirely, we advocate for a re-evaluation of its classification. This could involve redefining its anatomical boundaries and clinical categorization by considering the specific features and outcomes identified in our analysis, ensuring these unique characteristics are appropriately addressed in both research and clinical settings.[20]

Our results highlight significant variation in neoadjuvant treatment patterns based on tumor location, particularly at the rectosigmoid junction. Although chemoradiotherapy was consistently applied in rectal cancers, its use in rectosigmoid tumors was limited, and chemotherapy alone was more common. This reflects the ongoing ambiguity in classifying rectosigmoid tumors, which often share features with both rectal and colonic cancers. The infrequent use of neoadjuvant therapy in this group may lead to inconsistent treatment and potentially suboptimal outcomes. In contrast, the near absence of neoadjuvant therapy in sigmoid cancers aligns with standard practice. These findings underscore the need for clearer anatomical definitions and evidence-based guidelines to standardize treatment, particularly for tumors at the rectosigmoid junction.[1,21,22]

Study Limitations

This study has several limitations that warrant consideration. First, the dataset does not include all surgical centers in Türkiye; it only includes those actively involved in CRC management during the study period that contributed data, which may limit the generalizability of the results. Second, the absence of long-term follow-up data prevented evaluation of oncologic outcomes, such as disease-free and overall survival. Third, the lack of molecular profiling data limited our ability to investigate the underlying biological mechanisms driving survival differences across subgroups. Tumor location was determined intraoperatively by the primary surgeon, which

may introduce selection bias and limit the comparability of treatment strategies across groups. Despite these limitations, the study offers several notable strengths. Importantly, it represents the first nationwide study in Türkiye to leverage data from the TSCRS CRC Database, laying a strong foundation for future research and quality improvement initiatives in CRC care.

Future Directions

Future studies should incorporate standardized imaging criteria, central reviews for tumor localization, molecular characterization, and survival follow-up. A prospective registry capturing uniform definitions and treatment protocols could better assess the true impact of anatomical location on outcomes.

Conclusion

In summary, rectosigmoid tumors exhibit a distinct set of clinical and pathological characteristics that differentiate them from both sigmoid and upper rectal cancers. Although they share oncologic aggressiveness with rectal tumors, they are often managed as colonic cancers-raising concerns about potential under-staging and suboptimal treatment. These findings highlight the need to re-examine current classification systems and advocate for the development of segment-specific diagnostic and therapeutic guidelines. Rather than eliminating the term "rectosigmoid," we propose its redefinition using standardized anatomical landmarks and its recognition as a separate, clinically meaningful entity. Such refinement is essential to ensure that patients with rectosigmoid cancers receive appropriately individualized, evidence-based care.

Ethics

Ethics Committee Approval: The study was approved by the Ethics Committee of Acıbadem University (decision no: 2025-01/26, dated: 09.01.2025).

Informed Consent: Informed consent was obtained from all participants included in the study.

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Footnotes

Authorship Contributions

Surgical and Medical Practices: Ç.B., A. M., N.R., M.A.B., B.B., Concept: Ç.B., A. M., N.R., M.A.B., B.B., Design: Ç.B., A. M., N.R., M.A.B., B.B., Data Collection or Processing: Ç.B., A. M., N.R., M.A.B., B.B., Analysis or Interpretation: Ç.B., A. M., N.R., M.A.B., B.B., Literature Search: Ç.B., A. M., N.R., M.A.B., B.B., Writing: Ç.B., A. M., N.R., M.A.B., B.B.

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