e-ISSN 2536-4898
Volume 36
Issue 1
March 2026

Turkish Journal of COLORECTAL DISEASE

Official Journal of the Turkish Society of Colon and Rectal Surgery

galenos yayınevi
www.turkishjcrd.com

Turkish Journal of
COLORECTAL DISEASE

All inquiries should be addressed to
TURKISH JOURNAL OF COLORECTAL DISEASE
Address: Mecidiyeköy, Latilokum Sk. Alphan İşhanı No: 3 Kat: 2, Şişli, İstanbul, Türkiye
Phone: +90 212 356 01 75-76-77 Gsm: +90 532 300 72 36 Fax: +90 212 356 01 78
Online Manuscript: www.journalagent.com/krhd Web page: www.turkishjcrd.com E-mail: info@turkishjcrd.com

Publisher Contact
Galenos Publishing House
Address: Molla Gürani Mah. Kaçamak Sk. No: 21/1 34093 İstanbul, Türkiye **Phone:** +90 530 177 30 97 **Fax: E-mail:** info@galenos.com.tr/gamze@galenos.com.tr
Web: www.galenos.com.tr **Publisher Certificate Number:** 14521

Printing at: Son Sürat Daktilo
Gayrettepe Mahallesi Yıldızposta Caddesi Evren Sitesi A Blok No: 3D:1-, 34394 Beşiktaş/İstanbul **Phone:** 021288 45 75 / 76 **Mail:** print@sonsuratdaktilo.com

Printing Date: March 2026 **ISSN:** 2536-4898 **E-ISSN:** 2536-4901

Turkish Journal of
COLORECTAL DISEASE

ADVISORY BOARD

Turkish Journal of
COLORECTAL DISEASE

Please refer to the journal's webpage (**https://www.turkishjcrd.com/home**) for "Ethical Policy" and "Instructions to Authors".

The editorial and publication processes of the journal are shaped in accordance with the guidelines of the ICMJE, WAME, CSE, COPE, EASE, and NISO. Turkish Journal of Colorectal Disease is currently indexed in **DOAJ, TÜBİTAK/ULAKBİM, British Library, ProQuest, Ebsco Host: CINAHL, IdealOnline, Embase, Gale/Cengage Learning, Turkish Citation Index, Hinari, GOALI, ARDI, OARE, AGORA J-GATE, CNKI** and **TürkMedline**.

The journal is published online.

Owner: Feza Yarbuğ Karakayalı on behalf of the Turkish Society of Colon and Rectal Surgery

Responsible Manager: Fatma Ayça Gültekin

Turkish Journal of
COLORECTAL DISEASE

CONTENTS

DOI: 10.4274/tjcd.galenos.2025.2025-6-8
Turk J Colorectal Dis 2026;36(1):1-8

RESEARCH ARTICLE

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

Çiğdem Benlice[1], Ariorad Moniri[2], Nur Ramoğlu[3], Makbule Ayşegül Bağda[1], Bilgi Baca[3], Turkish Colorectal Cancer Database Study Group[4]

[1]Acıbadem Altunizade Hospital, Clinic of General Surgery, İstanbul, Türkiye
[2]Acıbadem Mehmet Ali Aydınlar University School of Medicine, İstanbul, Türkiye
[3]Acıbadem Mehmet Ali Aydınlar University School of Medicine, Department of General Surgery, İstanbul, Türkiye
[4]Turkish Colorectal Cancer Database Study Group: Özgen Işık, (Department of General Surgery, Acıbadem Mehmet Ali Aydınlar University Faculty of Medicine; Acıbadem Atakent Hospital, İstanbul, Türkiye); Tayfun Bişgin, (Department of General Surgery, Dokuz Eylül University Faculty of Medicine, İzmir, Türkiye); Osman Bozbıyık, (Department of General Surgery, Ege University Faculty of Medicine, İzmir, Türkiye); Mehmet Ali Koç, (Department of General Surgery, Ankara University Faculty of Medicine, Ankara, Türkiye); Nuri Okkabaz, (Department of General Surgery, Atlas University, Faculty of Medicine, İstanbul, Türkiye); Volkan Ozben, (Department of General Surgery, Acıbadem Mehmet Ali Aydınlar University Faculty of Medicine, İstanbul, Türkiye); Ahmet Rencüzoğulları, (Department of General Surgery, Koç University Faculty of Medicine, İstanbul, Türkiye); Cemil Burak Kulle, (Department of General Surgery, İstanbul University, İstanbul Faculty of Medicine, İstanbul, Türkiye); İsmail Tirnova, (Department of General Surgery, Başkent University School of Medicine, İstanbul, Türkiye); Uğur Topal, (Department of General Surgery, Çukurova University Faculty of Medicine, Adana, Türkiye)

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

Address for Correspondence: Çiğdem Benlice MD, Acıbadem Altunizade Hospital, Department of General Surgery, İstanbul, Türkiye
E-mail: cigdembenlice@gmail.com **ORCID ID:** orcid.org/0000-0002-5211-1779
Received: 03.07.2025 **Accepted:** 20.09.2025 **Publication Date:** 31.03.2026

Cite this article as: Benlice Ç, Moniri A, Ramoğlu N, Bağda MA, Baca B; Turkish Colorectal Cancer Database Study Group. Preoperative, perioperative, and pathological characteristics of sigmoid, rectosigmoid, and upper rectal adenocarcinomas: a retrospective cohort study from the Turkish Colorectal Cancer Database. Turk J Colorectal Dis. 2026;36(1):1-8

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 (α=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

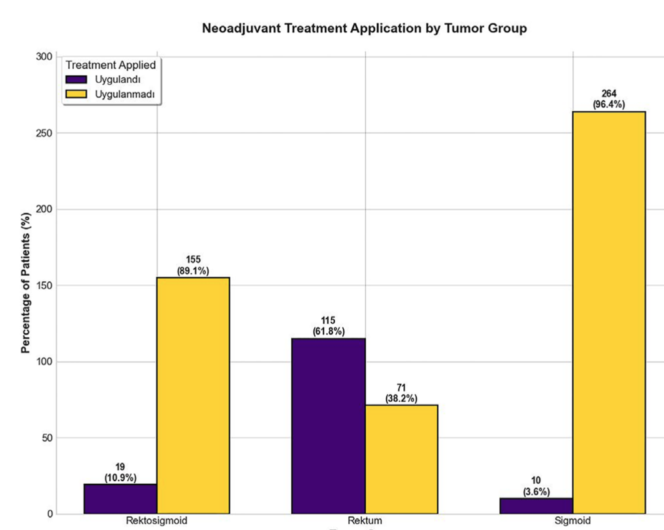

Figure 1. Neoadjuvant treatment application among the study groups

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

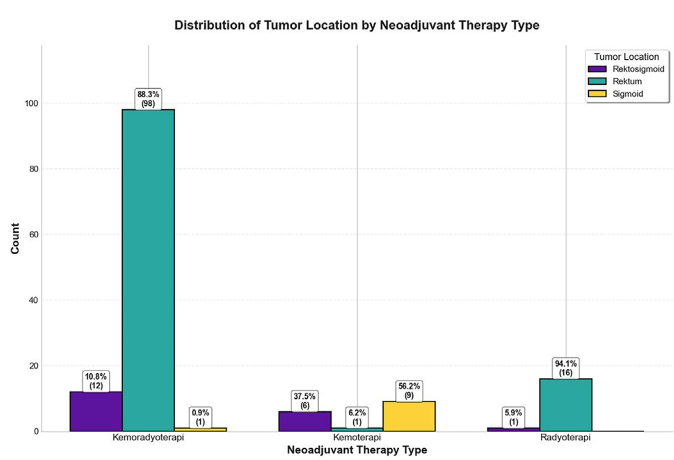

Figure 2. Distribution of tumor location by neoadjuvant therapy types

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.

Acknowledgment

Presented as an oral presentation at the 20th National and 3rd International Turkish Colon and Rectal Surgery Congress, May 16-20, 2025.

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.

Conflict of Interest: The authors declare that they have no conflicts of interest relevant to the content of this article.

Financial Disclosure: The authors have no conflicts of interest including relevant financial interests, activities, relationships, and affiliations.

REFERENCES

1. Falch C, Mueller S, Braun M, Gani C, Fend F, Koenigsrainer A, Kirschniak A. Oncological outcome of carcinomas in the rectosigmoid junction compared to the upper rectum or sigmoid colon - a retrospective cohort study. Eur J Surg Oncol. 2019;45:2037-2044.
2. Rosenberg R, Maak M, Schuster T, Becker K, Friess H, Gertler R. Does a rectal cancer of the upper third behave more like a colon or a rectal cancer? Dis Colon Rectum. 2010;53:761-770.
3. Benlice C, Elhan AH, Gorgun E, Kuzu MA. Long-term outcomes of sigmoid, rectosigmoid, and rectal cancers: a matched analysis. World J Surg. 2025;49:819-829.
4. Kutlu B, Benlice C, Seker ME, Kocaay AF, Kuzu MA. The emperor has no clothes-the need for standardized anatomical segment definitions in the management of colon cancer. Int J Colorectal Dis. 2025;40:219.
5. Venigalla S, Chowdhry AK, Wojcieszynski AP, Lukens JN, Plastaras JP, Metz JM, Ben-Josef E, Mahmoud NN, Reiss KA, Shabason JE. Comparative effectiveness of neoadjuvant chemoradiation versus upfront surgery in the management of recto-sigmoid junction cancer. Clin Colorectal Cancer. 2018;17:e557-e568.
6. Käser SA, Froelicher J, Li Q, Müller S, Metzger U, Castiglione M, Laffer UT, Maurer CA. Adenocarcinomas of the upper third of the rectum and the rectosigmoid junction seem to have similar prognosis as colon cancers even without radiotherapy, SAKK 40/87. Langenbecks Arch Surg. 2015;400:675-682.
7. Benson AB, Venook AP, Adam M, Chang G, Chen YJ, Ciombor KK, Cohen SA, Cooper HS, Deming D, Garrido-Laguna I, Grem JL, Haste P, Hecht JR, Hoffe S, Hunt S, Hussan H, Johung KL, Joseph N, Kirilcuk N, Krishnamurthi S, Malla M, Maratt JK, Messersmith WA, Meyerhardt J, Miller ED, Mulcahy MF, Nurkin S, Parikh A, Patel H, Pedersen K, Saltz L, Schneider C, Shibata D, Shogan B, Skibber JM, Sofocleous CT, Tavakkoli A, Willett CG, Wu C, Jones F, Gurski L. NCCN Guidelines® Insights: Rectal Cancer, Version 3.2024. J Natl Compr Canc Netw. 2024;22:366-375.
8. Hofheinz RD, Fokas E, Benhaim L, Price TJ, Arnold D, Beets-Tan R, Guren MG, Hospers GAP, Lonardi S, Nagtegaal ID, Perez RO, Cervantes A, Martinelli E; ESMO Guidelines Committee. Electronic address: clinicalguidelines@esmo.org. Localised rectal cancer: ESMO Clinical Practice Guideline for diagnosis, treatment and follow-up. Ann Oncol. 2025;36:1007-1024.
9. You YN, Hardiman KM, Bafford A, Poylin V, Francone TD, Davis K, Paquette IM, Steele SR, Feingold DL; On Behalf of the Clinical Practice Guidelines Committee of the American Society of Colon and Rectal Surgeons. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Management of Rectal Cancer. Dis Colon Rectum. 2020;63:1191-1222.
10. Sebag-Montefiore D, Stephens RJ, Steele R, Monson J, Grieve R, Khanna S, Quirke P, Couture J, de Metz C, Myint AS, Bessell E, Griffiths G, Thompson LC, Parmar M. Preoperative radiotherapy versus selective postoperative chemoradiotherapy in patients with rectal cancer (MRC CR07 and NCIC-CTG C016): a multicentre, randomised trial. Lancet. 2009;373:811-820.
11. Massalou D, Moszkowicz D, Mariage D, Baqué P, Camuzard O, Bronsard N. Is it possible to give a single definition of the rectosigmoid junction? Surg Radiol Anat. 2018;40:431-438.

12. D'Souza N, de Neree Tot Babberich MPM, Lord A, Shaw A, Abulafi M, Tekkis P, Wiggers T, Brown G. The rectosigmoid problem. Surg Oncol. 2018;27:521-525.

13. Morarasu S, O'Brien L, Clancy C, Dietrich D, Maurer CA, Frasson M, Garcia-Granero E, Martin ST. A systematic review and meta-analysis comparing surgical and oncological outcomes of upper rectal, rectosigmoid and sigmoid tumours. Eur J Surg Oncol. 2021;47:2421-2428.

14. Augustine A, Cecil GH, Lakhani A, Kanamathareddy HV, John R, Simon B, Eapen A, Mittal R, Chandramohan A. "Sigmoid take-off" to define recto-sigmoid junction and its impact on rectal cancer classification, staging, and management. Clin Radiol. 2025;84:106858.

15. Burton S, Brown G, Daniels I, Norman A, Swift I, Abulafi M, Wotherspoon A, Tait D. MRI identified prognostic features of tumors in distal sigmoid, rectosigmoid, and upper rectum: treatment with radiotherapy and chemotherapy. Int J Radiat Oncol Biol Phys. 2006;65:445-451.

16. Salami AC, Obaid T, Nweze NJ, Deleon M, Force L, Gorgun E, Wexner S, Joshi ART. Neoadjuvant chemoradiation versus adjuvant chemotherapy for locally advanced adenocarcinoma of the rectosigmoid junction. Colorectal Dis. 2020;22:513-520.

17. Gastinger I, Marusch F, Steinert R, Wolff S, Koeckerling F, Lippert H; Working Group 'Colon/Rectum Carcinoma'. Protective defunctioning stoma in low anterior resection for rectal carcinoma. Br J Surg. 2005;92:1137-1142.

18. Sanford NN, Aguilera TA, Beg MS, Sanjeevaiah A, Hong TS, Wo JY, Folkert MR. Patterns of care for stage II-III rectosigmoid cancers in the United States, 2004-2015. Am J Clin Oncol. 2020;43:311-318.

19. Kuzu MA, Benlice C, Parvaiz A, Gorgun E, Bertelsen CA, Wexner S, Dozois EJ, Hohenberger W, Miskovic D, Sugihara K, Spinelli A, Wiggers T, Lee WY, Möslein G, Tsarkov P, Basany EE, Patron Uriburu JC, Perez RO, Lynch C, Liu Z, Hahnloser D, Nilsson PJ, Chowdri NA, Brown G, Rouanet P, Madoff RD, West NP, Sahin T, Elhan AH, Bordeianou LG; Colon Cancer Delphi Consensus Study Group. Standardizing the definition of each colon cancer segment: Delphi consensus on clinical decision-making for oncologic outcomes. Dis Colon Rectum. 2025;68:835-844.

20. Hui C, Baclay R, Liu K, Sandhu N, Loo P, von Eyben R, Chen C, Sheth V, Vitzthum L, Chang D, Pollom E. Rectosigmoid cancer-rectal cancer or sigmoid cancer? Am J Clin Oncol. 2022;45:333-337.

21. Li F, Wang B, Lu S, Wang Y, Sun T, Wang H, Zhou X, Fu W. Comparison of the sigmoid take-off with other definitions of the rectosigmoid junction: a retrospective comparative cohort analysis. Int J Surg. 2020;80:168-174.

22. Sauer R, Becker H, Hohenberger W, Rödel C, Wittekind C, Fietkau R, Martus P, Tschmelitsch J, Hager E, Hess CF, Karstens JH, Liersch T, Schmidberger H, Raab R; German Rectal Cancer Study Group. Preoperative versus postoperative chemoradiotherapy for rectal cancer. N Engl J Med. 2004;351:1731-1740.

DOI: 10.4274/tjcd.galenos.2025.2025-9-5
Turk J Colorectal Dis 2026;36(1):9-18

RESEARCH ARTICLE

Effectiveness of Laboratory Parameters in Predicting Complicated Acute Appendicitis in Pregnant Patients: A Retrospective Analysis

Hikmet Pehlevan Özel, Hüseyin Fahri Martlı, Abidin Göktaş, Şükrü Melih Bayazıtlı, Mehmet Ali Pak, Özgür Akgül

Ankara Bilkent City Hospital, Clinic of General Surgery, Ankara, Türkiye

ABSTRACT

Aim: Acute appendicitis during pregnancy presents a diagnostic challenge due to physiological and anatomical changes that can obscure classical symptoms. This study aimed to evaluate the predictive value of inflammatory markers—particularly C-reactive protein (CRP) and the CRP/albumin ratio (CAR)—for detecting complicated acute appendicitis in pregnant women.

Method: This retrospective study included 67 pregnant patients who underwent appendectomy for acute appendicitis between October 2019 and December 2024. Patients were categorized into complicated and non-complicated appendicitis groups based on histopathological findings. Laboratory parameters comprising the platelet-to-lymphocyte ratio, lymphocyte-to-monocyte ratio, neutrophil-to-lymphocyte ratio, systemic immune inflammation index, systemic inflammatory response index, receiver operating characteristic (ROC) curve, and decision curve analysis (DCA) were used to assess diagnostic and clinical performance.

Results: Complicated appendicitis was identified in 25.4% (n=17) of patients. Multivariate regression demonstrated that CRP [odds ratio (OR)=1.095; 95% confidence interval (CI)=1.042-1.151; p<0.001] and CAR (OR=23.863; 95% CI=4.223-134.830; p<0.001) were independent predictors. The ROC analysis demonstrated high diagnostic accuracy for CRP [area under the curve (AUC)=0.954] and CAR (AUC=0.946). The DeLong test revealed no significant difference between CRP and CAR (p=0.878), and DCA confirmed that both markers provided higher net clinical benefit than "treat-all" or "treat-none" strategies.

Conclusion: The results show that CRP and CAR may be promising, cost-effective biomarkers for early identification of complicated appendicitis in pregnancy, particularly where imaging is limited, but these single-center data require cautious interpretation and external validation before routine clinical use.

Keywords: Acute appendicitis, pregnancy, C-reactive protein, C-reactive protein/albumin ratio, inflammation markers

Introduction

Acute appendicitis is the most common non-obstetric surgical emergency during pregnancy, with an incidence reported in approximately 0.01-0.2% of all pregnancies.[1] Anatomical and physiological changes that occur during pregnancy make diagnosis difficult. The displacement of abdominal organs due to uterine enlargement, changes in pain localization, and pregnancy-related physiological leukocytosis are the main causes of these difficulties. In addition, symptoms such as nausea, abdominal pain, or mild fever seen in pregnancy can mask the symptoms of appendicitis. Therefore, delays in diagnosis are common, increasing the risk of both maternal and fetal complications. Early diagnosis and surgical intervention are critical in preventing perforated appendicitis and associated fetal loss.[1,2]

Clinical evaluation and imaging methods may have limited diagnostic value during pregnancy. Ultrasonography may be inadequate in the later stages of pregnancy due to uterine enlargement, but magnetic resonance imaging (MRI) is not

Address for Correspondence: Ass. Prof. Özgür Akgül MD, Ankara Bilkent City Hospital, Clinic of General Surgery, Ankara, Türkiye
E-mail: drozgurakgul@gmail.com **ORCID ID:** orcid.org/0000-0002-3762-3987
Received: 25.09.2025 **Accepted:** 07.12.2025 **Publication Date:** 31.03.2026

Cite this article as: Özel HP, Martlı HF, Göktaş A, Bayazıtlı ŞM, Pak MA, Akgül Ö. Effectiveness of laboratory parameters in predicting complicated acute appendicitis in pregnant patients: a retrospective analysis. Turk J Colorectal Dis. 2026;36(1):9-18

available at every center. This situation leads clinicians to use laboratory markers as a diagnostic support tool. Inflammatory markers such as the platelet-to-lymphocyte ratio (PLR), lymphocyte-to-monocyte ratio (LMR), neutrophil-to-lymphocyte ratio (NLR), and systemic immune inflammatory index (SII) have been proposed as potential diagnostic and prognostic tools in the literature, including for appendicitis and predicting complications.[3,4]. C-reactive protein (CRP) is an inflammatory acute-phase reactant produced by the liver in response to inflammation or infection.[4] However, a slight increase in CRP levels may be observed physiologically during pregnancy, which may reduce the specificity of the test.

The CRP/albumin ratio (CAR) is a parameter obtained by dividing the CRP level by the level of albumin, a protein in the blood, and has shown promise as a prognostic marker in several inflammatory conditions, where it helps predict the severity of the disease.[4]

Nevertheless, despite their potential, there is a notable absence of studies that validate the diagnostic and prognostic relevance of these clinical evaluation and imaging methods in forecasting complications associated with acute appendicitis during pregnancy.[5]

This study evaluated clinical characteristics, inflammatory markers, and outcomes in patients who underwent surgery for acute appendicitis during pregnancy. The study hypothesis was that CRP and CAR could be independent predictors of complicated acute appendicitis during pregnancy. Furthermore, the relationship between these parameters and other hematologic indices (NLR, PLR, SII, etc.) and the development of complications was investigated. Evaluating the diagnostic performance of these parameters may contribute to improving clinical outcomes for both the mother and fetus by supporting early diagnosis and appropriate treatment decisions.

Materials and Methods

This study is a single-center, retrospective observational study conducted in the general surgery clinic of a tertiary care hospital between October 2019 and December 2024. To reduce bias, standardized diagnostic and pathological criteria were applied across all cases. The research was conducted in accordance with the Declaration of Helsinki, and ethical principles were observed. This study was approved by the local ethics committee of Ankara Bilkent City Hospital (decision number: 1-25-1008, date: 12.02.2025). Due to the retrospective nature of the study, individual informed consent was not obtained from patients; data were evaluated with identity information concealed.

Inclusion criteria for the study were cases of acute appendicitis during pregnancy that underwent surgery with a diagnosis of acute appendicitis and histopathological confirmation. Exclusion criteria were active infection, autoimmune disease, malignancy, liver or kidney failure, hematologic diseases, and systemic steroid use. The study confirmed that there were no missing data. If missing observations were detected in the dataset, these cases were excluded from the analysis. Accordingly, 67 patients were included in the analysis (Figure 1).

Age, gestational age, pregnancy trimester, and laboratory results were evaluated in all patients. Laboratory samples were collected from all patients within the first 2 hours after presentation to the emergency department prior to surgery.

Specifically, albumin was included as a well-established negative, acute-phase reactant that decreases in the presence of major intra-abdominal inflammation and has been identified in previous studies as a marker of complicated appendicitis.[6] Total bilirubin was evaluated because hyperbilirubinemia has been consistently associated with perforated or gangrenous appendicitis, largely through mechanisms involving hepatocellular dysfunction and endotoxin-mediated cholestasis.[7] Electrolytes—particularly sodium—were assessed given evidence that hyponatremia frequently accompanies severe systemic inflammation and has been reported in patients with complicated appendicitis.[8] Hemogram-derived inflammatory indices [NLR, PLR, LMR, SII, and the systemic immune response index (SIRI)] were incorporated based on robust studies demonstrating their predictive value for perforation, disease severity, and adverse clinical outcomes.[3,4] Amylase was included because mild elevations have been reported in advanced intra-abdominal inflammation, particularly in cases of peritoneal irritation or localized enzymatic activation accompanying complicated appendicitis. Clinical series evaluating atypical biochemical

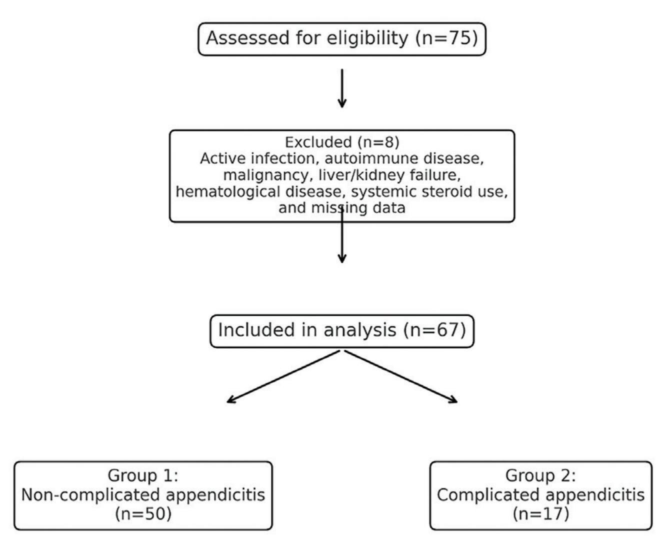

Figure 1. Flowchart of patient selection and grouping

profiles in perforated appendicitis have described transient increases in amylase, suggesting a secondary inflammatory or enzymatic response. Although not a standard marker of appendicitis, its assessment has been considered relevant in studies investigating broader biochemical changes in severe intra-abdominal infection. Accordingly, all biochemical and hematologic variables included in this study were selected a priori based on their literature-supported mechanistic relevance to inflammatory severity rather than simply being routinely collected laboratory measurements.

Laboratory markers included white blood cell count, neutrophil count, lymphocyte count, monocyte count, platelet count, CRP, albumin, sodium, and bilirubin.

Pregnancy periods were evaluated in three groups: first trimester (≤13^{+6} weeks), second trimester (14^{+0}-27^{+6}weeks), and third trimester (28^{+0}-40^{+6} weeks). The relationship between the trimester and complications was evaluated in exploratory subgroup analyses. Inflammatory markers were also compared among trimesters (Supplementary Table 1).

Inflammatory markers were calculated as follows:

PLR: platelet/lymphocyte

LMR: lymphocyte/monocyte

NLR: neutrophil/lymphocyte

SII: neutrophil × platelet/lymphocyte

SIRI: neutrophil × monocyte /lymphocyte

CRP-to-albumin ratio: CRP/albumin.

All patients underwent ultrasonography in the preoperative period. MRI was performed in patients whose appendix could not be visualized on ultrasound (US).

All patients underwent surgery for appendicitis. The specimens were examined pathologically and divided into two groups according to the histopathologic results.

Group 1: Non-complicated acute appendicitis. Phlegmonous and acute nonperforated appendicitis cases were included in the uncomplicated group.

Group 2: Complicated acute appendicitis. Complicated appendicitis was defined as cases in which intra-abdominal fecalitis, abscess, gangrene-necrotizing perforated appendicitis, or peritonitis were detected intraoperatively or histopathologically.

Due to the retrospective nature of the study, no prior sample size or power analysis was performed. All eligible patients accessible during the study period were included in the analysis.

Statistical Analyses

Statistical analyses were performed using SPSS version 21.0 software (IBM Corp., Armonk, NY, USA). Additionally, decision curve analysis (DCA) was conducted using the R software environment (R Foundation for Statistical Computing, Vienna, Austria). The distribution of continuous variables was assessed using the Shapiro-Wilk test. Variables showing a normal distribution were presented as mean ± standard deviation, and non-normally distributed variables were presented as median (minimum-maximum) values. Categorical variables were expressed as frequency (percentage). To evaluate differences between groups, the Student's t-test or Mann-Whitney U test was used for continuous variables, and the chi-square test or Fisher's exact test was used for categorical variables. The possibility of collinearity was assessed among the CRP, albumin, and CAR variables using Spearman correlation analysis and the variance inflation factor (VIF). Variables showing high correlation were not used together in the same model, and VIF analysis was performed to evaluate multicollinearity among independent variables.

To identify independent variables associated with the development of complicated appendicitis, univariate logistic regression analysis was first performed, followed by multivariate logistic regression analysis of variables with a p-value <0.2. The backward likelihood ratio method was used in multiple regression analysis. The VIF values for CRP and CAR were both above 100, indicating severe multicollinearity; therefore, CRP and CAR were not included together in the same regression model and were analyzed separately in two independent multivariate models to prevent collinearity bias. All other variables had VIF values below 2.0, indicating no significant collinearity.

Due to the limited number of events, only statistically significant variables were included in the model. Results were reported as odds ratios (ORs), 95% confidence intervals (CIs), and p-values. Receiver operating characteristic (ROC) curves were generated to evaluate diagnostic performance. For each marker, the area under the curve (AUC), 95% CIs, sensitivity, specificity, and positive and negative predictive values (PPV/NPV) were calculated. The optimal cut-off points in the ROC analyses were determined using the Youden index. Decision curve analysis was conducted to assess the net clinical benefit of the CRP and CAR models. Statistical significance was set at p<0.05.

Results

A total of 67 out of 73 patients met the inclusion criteria and were included in the analysis. The mean age was 28.41±5.48 years (19-41 years). Seventeen of the patients (25.4%) had complicated acute appendicitis. The mean gestational age was 18.13±8.15 weeks, with a minimum of 4 weeks and a maximum of 36 weeks. MRI was performed in 20 patients (29.9%). Patient data are presented in Table 1.

According to univariate regression analysis, three parameters were associated with complicated acute appendicitis: CRP, LMR, and CAR (p<0.001, p=0.028, and p<0.001, respectively)

Table 1. Data of complicated appendicitis and non-complicated appendicitis groups

	Total (n=67)	Non-complicated (n=50)	Complicated (n=17)	p-value
Age, years, (mean ± SD)	28.41±5.48	28.22±5.83	29.0±4.35	0.564
Gestational age, weeks, (mean ± SD)	18.13±8.15	17.54±7.92	19.88±8.80	0.341
Trimester, (%)				
Trimester	22 (32.8%)	17 (77.3%)	5 (22.7%)	
Trimester	36 (53.7%)	28 (77.8%)	8 (22.2%)	0.416*
Trimester	9 (13.4%)	5 (55.6%)	4 (44.4%)	
Albumin, g/L, (mean ± SD)	39.871±3.58	39.74±3.70	39.64±3.31	0.923
Total bilirubin, mg/dL, median (min-max)	0.5 (0.10-1.10)	0.4 (0.1-1.10)	0.5 (0.30-0.99)	0.026
Amylase, U/L, (mean ± SD)	60.11±16.73	61.64±15.88	55.60±18.79	0.246
Sodium, mEq/L, median (min-max)	137 (132-141)	137 (133-141)	137 (132-141)	0.489
Calcium, mg/dL, (mean ± SD)	8.74±0.48	8.75±0.49	8.72±0.53	0.764
WBC, ×10^9/L, (mean ± SD)	13.54±4.47	13.33±4.39	14.18±4.77	0.521
Neutrophil, ×10^9/L, median (min-max)	10.56 (2.41-27.18)	10.54 (2.41-27.18)	12.50 (4.80-21.09)	0.280
Neutrophil, %, median (min-max)	83.0 (54.3-94.1)	81.35 (54.3-94.1)	85.70 (68.3-92.1)	0.053
Lymphocyte, ×10^9/L, median (min-max)	1.37 (0.33-3.81)	1.50 (0.33-3.81)	1.34 (0.55-2.80)	0.089
Monocyte, ×10^9/L, median (min–max)	0.54 (0.20-2.55)	0.53 (0.220-1.23)	0.54 (0.26-2.55)	0.943
MPV, fL, median (min-max)	8.2 (6.5-16.2)	8.2 (6.5-16.2)	8.3 (6.8-10.4)	0.624
Platelet, ×10^9/L, median (min-max)	257. (159.0-455.0)	253 (165-447)	261 (159-455)	0.729
RDW, %, median (min-max)	14.2 (12.7-58.1)	14.2 (12.7-21.4)	14.2 (12.8-58.1)	0.846
LUC, %, (mean ± SD)	0.13±0.05	0.13±0.04	0.12±0.06	0.751
DNI, %, median (min-max)	0.01 (0.00-12.70)	0.10 (0-7.80)	0.01 (0-12.7)	0.652
CRP, mg/L, median (min-max)	14.0 (0.1-230)	10.0 (0.1-70)	57.0 (13.0-230.0)	<0.001
PLR, median (min-max)	170.64 (67.03-875.76)	169.75 (67.03-875.76)	187.32 (113.57-659.42)	0.116
LMR, median (min-max)	2.89 (0.88-6.17)	3.13 (0.97-6.17)	2.25 (0.88-4.67)	0.026
NLR, median (min-max)	6.71 (1.54-27.45)	6.41 (1.54-27.45)	8.92 (3.43-23.58)	0.032
SII, median (min-max)	3.57 (0.39-17.50)	3.49 (0.39-17.02)	4.33 (1.03-17.50)	0.048
SIRI, median (min-max)	1,724.58 (449.43-10,728.77)	1,591.47 (449.43-10,515.09)	2,341.54 (545.14-10,728.77)	0.059
CAR, median (min-max)	0.34 (0.00-5.90)	0.26 (0-2.0)	1.39 (0.34-5.90)	<0.001
Imaging				
USG	47 (70.1%)	37 (78.7%)	10 (21.3 %)	0.237
USG + MRI	20 (29.9%)	13 (65.0%)	7 (35.0%)	

*Fisher's exact test

WBC: White blood cell count, MPV: Mean platelet volume, RDW: Red blood cell distribution width, LUC: Large unstained cells, DNI: Delta neutrophil index, CRP: C-reactive protein, PLR: Platelet-to-lymphocyte ratio, LMR: Lymphocyte-to-monocyte ratio, NLR: Neutrophil-to-lymphocyte ratio, SII: Systemic immune inflammatory index, SIRI: Systemic immune response index, CAR: CRP/albumin ratio

(Table 2). CRP and CAR were evaluated in two separate multivariate models due to significant collinearity (VIF>100). Multivariate analysis revealed that CRP (OR: 1.095, 95% CI: 1.042-1.151; p<0.001) and CAR (OR=23.863; 95% CI: 4.223-134.830; p<0.001) were independent predictors (Table 2, Figure 2). Total bilirubin initially appeared significant in univariate group comparison (p=0.026); however, it was not independently associated with complicated appendicitis in univariate logistic regression (p=0.139). As a result, bilirubin did not meet the criteria for multivariate inclusion and was removed during the backward elimination steps. Therefore, bilirubin was considered a negative finding in the adjusted analysis and was not retained as a clinically meaningful predictor.

The ROC curve was performed for CRP and CAR. For CRP, the cut-off value was found to be 23 mg/L (AUC=0.954, 95% CI=0.903-1.000, p<0.001, sensitivity=94.1%, specificity 86.0%). For CAR, the cut-off value was found to be 0.55 (AUC=0.946, 95% CI=0.893-0,999, p<0.001, sensitivity=94.1%, specificity 86.0%) (Figure 3). When the CRP cut-off value was 23 mg/L and the CAR cut-off value was 0.55, the PPV was 69.9% and the NPV was 97.7% (Table 3). Comparison of the ROC curves using the DeLong method revealed no statistically significant difference between CRP and CAR (AUC 0.954 vs. 0.946, p=0.878), indicating comparable discriminatory performance. Decision curve analysis demonstrated that both the CRP and CAR models provided a higher net clinical benefit across most threshold probabilities (0.10-0.45) than the "treat-all" and "treat-none" strategies, indicating good clinical usefulness (Figure 4).

In exploratory subgroup analyses, no statistically significant differences were observed in CRP, CAR, or other inflammatory indices among the first, second, and third trimesters (p>0.05). However, a numerically higher rate of complicated appendicitis was observed in the third trimester (44.4%) than in the first and second trimesters (22.7% and 22.2%, respectively) (Supplementary Table 1).

Table 2. Univariate and multivariate logistic regression analyses

Variables	OR (95% CI)	p-value
Univariate logistic regression analyses		
Age, years	1.027 (0.928-1.136)	0.610
Gestational age, weeks	1.037 (0.967-1.111)	0.306
Trimester		0.388
1.Trimester	Reference	
2.Trimester	0.971 (0.273-3.451)	0.964
3.Trimester	2.720 (0.522-14.16)	0.235
Albumin, g/L	0.993 (0.851-1.159)	0.926
Total bilirubin, mg/dL	6.637 (0.541-81.375)	0.139
Amylase, U/L	0.977 (0.942-1.013)	0.201
Sodium, mEq/L	1.118 (0.800-1.562)	0.513
Calcium, mg/dL	0.828 (0.266-2.575)	0.745
WBC, $\times 10^9$/L	1.043 (0.923-1.179)	0.495
Neutrophil, $\times 10^9$/L	1.062 (0.936-1.205)	0.349
Neutrophil, %	1.071 (0.984-1.166)	0.111
Lymphocyte, $\times 10^9$/L	0.401 (0.146-1.103)	0.077
Monocyte, $\times 10^9$/L	2.524 (0.483-13.201)	0.273
MPV, fL	1.012 (0.692-1.480)	0.952
Platelet, $\times 10^9$/L	0.999 (0.991-1.008)	0.896
RDW, %	1.077 (0.944-1.229)	0.271
LUC, %	0.174 (0-7,195.203)	0.747

Table 2. Continued

Variables	OR (95% CI)	p-value
DNI, %	1.060 (0.845-1.330)	0.613
CRP, mg/L	1.095 (1.042-1.151)	<0.001
PLR	1.003 (0.998-1.007)	0.232
LMR	0.553 (0.327-0.98)	0.028
NLR	1.110 (0.997-1.235)	0.057
SII	1.154 (0.999-1.334)	0.052
SIRI	1.000 (1.000-1.000)	0.151
CAR	23.863 (4.223-134.830)	<0.001
Multivariate logistic regression analyses for CRP*		
CRP, mg/L	1.095 (1.042-1.151)	<0.001
Multivariate logistic regression analyses for CAR*		
CAR	23.863 (4.223-134.830)	<0.001

OR: Odds ratio, CI: Confidence interval, WBC: White blood cell count, MPV: Mean platelet volume, RDW: Red blood cell distribution width, LUC: Large unstained cells, DNI: Delta neutrophil index, CRP: C-reactive protein, PLR: Platelet-to-lymphocyte ratio, LMR: Lymphocyte-to-monocyte ratio, NLR: Neutrophil-to-lymphocyte ratio, SII: Systemic immune inflammatory index, SIRI: Systemic immune response index, CAR: CRP/albumin ratio

*VIF analysis showed high collinearity between CRP and CAR (VIF>100); therefore, they were analyzed in separate multivariate models

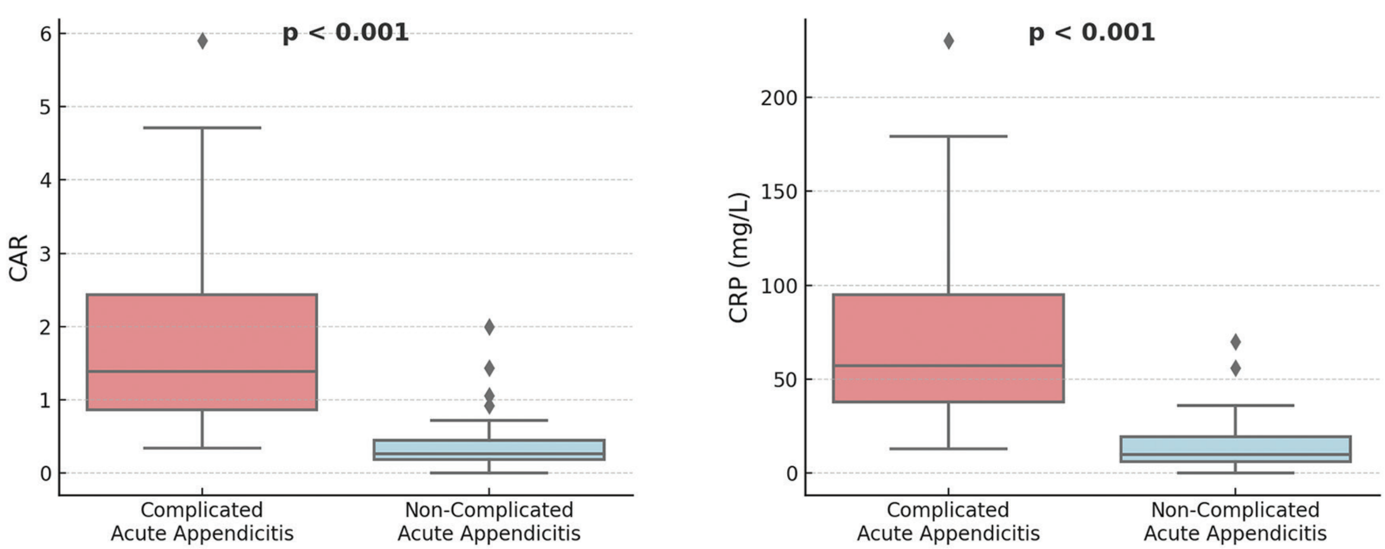

Figure 2. Comparison of CRP and CAR levels between complicated and non-complicated acute appendicitis in pregnant women
(CRP: C-reactive protein, CAR: CRP/albumin ratio)

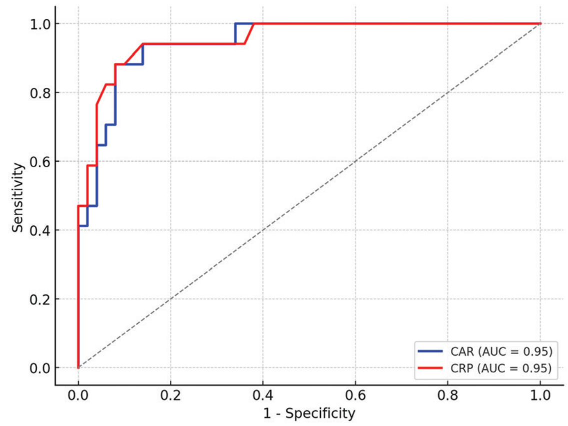

Figure 3. Receiver operating characteristic curve analysis for CRP and CAR
**No significant difference was observed between the areas under the curve of CRP and CAR (DeLong test, p=0.878)*
(CRP: C-reactive protein, CAR: CRP/albumin ratio)

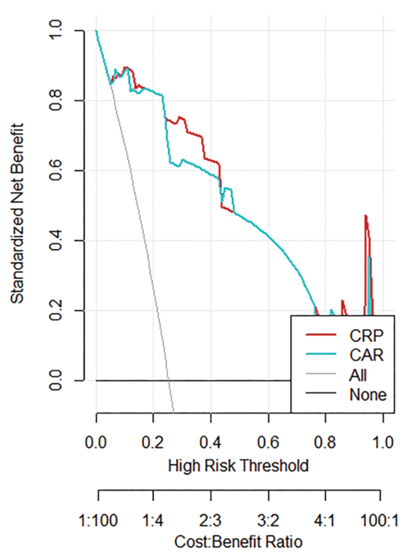

Figure 4. Decision curve analysis comparing the clinical net benefit of the CRP and CAR models
**Decision curve analysis showing that both the CRP and CAR models provided higher standardized net benefit than the "treat-all" and "treat-none" strategies between threshold probabilities of 0.10 and 0.45; CAR demonstrated slightly greater net benefit than CRP within this range.*
CRP: C-reactive protein, CAR: CRP/albumin ratio

Discussion

In this study, the cases of 67 patients undergoing surgery for acute appendicitis during pregnancy were retrospectively reviewed. The rate of complicated appendicitis was found to be 25.4%. The main finding of the study was that CRP and CAR levels appeared to be significant independent predictors of complicated appendicitis, although these results should be interpreted cautiously due to the limited sample size. In the ROC analysis, both CRP and CAR showed high diagnostic accuracy (AUC 0.954 and 0.946, respectively) in this dataset; however, these values may be subject to optimism given the limited number of events. The DeLong test revealed no significant difference between the two markers (p=0.878). Decision curve analysis confirmed the clinical usefulness of both models, showing greater net benefit compared to the "treat-all" and "treat-none" strategies.

These findings suggest that CRP and CAR may serve as promising laboratory markers for predicting complicated appendicitis in pregnant women. In particular, CAR may provide diagnostic balance despite the physiological increase in CRP during pregnancy, as it reflects both the inflammatory response (CRP) and changes in albumin levels. Nevertheless, the small sample size and low number of events require these findings to be interpreted cautiously, as the high AUC values may reflect optimism or overfitting.

In the literature, the number of studies focusing on the prognostic evaluation of acute appendicitis during pregnancy is limited. There are few studies investigating the prognostic value of CRP and CAR in this specific patient group, and the present study contributes to this limited body of evidence. Similarly, Bozbıyık et al.[9] reported that negative appendectomy rates were higher due to the limited use of imaging methods in the diagnosis of acute appendicitis in pregnant women but that the clinical course and postoperative outcomes were similar to those in non-pregnant patients. This finding supports the diagnostic difficulties highlighted in our study. Assessing the prognosis of acute appendicitis during pregnancy is a complex issue; due to the potential risks for both the mother and the fetus, the development of accurate prediction systems in this area is of great importance. Surgical intervention remains

Table 3. Diagnosis of complicated appendicitis with a CRP cut-off of 23 mg/L and a CAR cut-off of 0.55

		Non-complicated appendicitis	Complicated appendicitis	p-value
CRP	<23 mg/L	43 (97.7%)	1 (2.3%)	<0.001*
	≥23 mg/L	7 (30.4%)	16 (69.6%)	
CAR	<0.55	43 (97.7%)	1 (2.3%)	<0.001*
	≥0.55	7 (30.4%)	16 (69.6%)	

*Fisher's exact test
CRP: C-reactive protein, CAR: CRP/albumin ratio

the gold standard, but conservative management may be considered in selected cases.[10] In this context, the use of simple and accessible laboratory parameters that predict the risk of complications can provide important support in determining the optimal timing of surgery.

The potential use of CRP and CAR in predicting complicated acute appendicitis in pregnant women represents a promising area of research. CRP is a well-established marker of inflammation, and high levels have been shown to be associated with complicated acute appendicitis,[11] and CAR is a parameter that reflects both inflammation and nutritional status, allowing for a more comprehensive assessment of the inflammatory response.[12] A CRP level ≥34.82 mg/L significantly increases the risk of complications (OR=6.24) and provides high diagnostic accuracy (AUC=0.95, sensitivity 85.7%, specificity 90.9%).[13] CRP levels are significantly higher in patients with complicated acute appendicitis. For example, mean CRP levels have been reported as high as 154.17 mg/L in patients with perforated appendicitis compared with 2.95 mg/L in uncomplicated cases.[14] This strong relationship can be explained by CRP's direct correlation with the severity of inflammation in the appendix wall.[15,16]

Similarly, elevated CAR values have been linked to the systemic inflammatory response accompanied by increased CRP and decreased albumin.[17-19] Although some studies in the general population have reported that CAR is not an independent predictor of complicated appendicitis,[20] its potential role in pregnant women has not yet been investigated. In pediatric populations, CAR has been found to be a significant predictor of complicated appendicitis; when CAR ≥1.39, the likelihood of complications increases markedly, with a sensitivity of 86.61% and specificity of 84.62%.[21] Zhao et al.[22] found the CAR ≥1.04 threshold to be diagnostically significant in adults (AUC=0.871), whereas Zengin et al.[20] reported that CAR was not an independent predictor in multivariate analysis. This discrepancy may stem from physiological hemodilution and altered protein synthesis during pregnancy, which may modify CAR behavior. From this perspective, the present study is one of the first to directly compare CRP and CAR in a pregnant population.

The World Society of Emergency Surgery recommends MRI when available, given its lack of radiation and high diagnostic accuracy.[23] However, in our study, the MRI utilization rate was 29.9%, which may reflect limited resources, access difficulties, or a preference for US as the first-line imaging modality. Considering the limited contribution of imaging in predicting complications, laboratory markers such as CRP and CAR may play an important complementary role in clinical decision-making.

The lack of significance of hematological indices such as PLR, LMR, NLR, SII, and SIRI in predicting complications can be explained by pregnancy-specific hematological and hormonal changes. Physiological increases in neutrophil counts, altered LMRs, and expanded plasma volume during pregnancy can affect baseline values, reducing the diagnostic reliability of these indices.[24-27] Furthermore, trimester-specific variations in immune and hormonal activity may contribute to the instability of these ratios as consistent predictive markers. This finding was consistent across our exploratory trimester subgroup analyses.

Although total bilirubin showed a significant difference between groups at baseline in the univariate comparison, it did not show independent predictive value in the univariate logistic regression and was excluded in the backward elimination process. This indicates that bilirubin did not contribute meaningfully to the adjusted model and should be considered a negative finding rather than an omitted or selectively reported result. The absence of an independent association is consistent with previous reports showing that bilirubin may be elevated in inflammatory abdominal conditions due to non-specific hepatocellular or cholestatic responses but rarely remains significant after multivariate adjustment.[7] This suggests that bilirubin may reflect nonspecific physiological variation in pregnancy rather than functioning as a clinically meaningful predictor of complication severity.

Study Limitations

This study has certain limitations. The single-center, retrospective design increases the risk of selection bias and limits external validity. The number of patients was determined by including all eligible cases without performing a specific power analysis. Limited access to MRI (29.9%) may have restricted the radiological confirmation of complicated cases. Furthermore, physiological changes during pregnancy complicate the interpretation of biomarkers such as CRP and CAR. Nevertheless, this study is one of the first analyses to demonstrate the high diagnostic performance of CRP and CAR for predicting complicated appendicitis in pregnant women. Larger multicenter, prospective studies are warranted to validate and expand these findings.

Conclusion

This study suggests that CRP and CAR may be promising and easily accessible biomarkers for the early identification of complicated appendicitis in pregnancy; however, these findings should be interpreted cautiously given the small, single-center nature of the study. External validation in larger, multicenter cohorts is required before these markers can be integrated into routine clinical practice. Physiological and biochemical changes during pregnancy may influence inflammatory biomarkers; therefore, CRP and CAR should be used as complementary—rather than standalone—diagnostic tools within a combined clinical, laboratory, and imaging-based assessment strategy.

Ethics

Ethics Committee Approval: This study was approved by the local ethics committee of Ankara Bilkent City Hospital (decision number: 1-25-1008, date: 12.02.2025).

Informed Consent: Due to the retrospective nature of the study, individual informed consent was not obtained from patients; data were evaluated with identity information concealed.

Acknowledgments

The authors wish to thank all the staff of the surgery, radiology, and pathology departments in Ankara City Hospital.

Footnotes

Authorship Contributions

Surgical and Medical Practices: H.P.Ö., H.F.M., A.G., Ş.M.B., M.A.P., Ö.A., Concept: H.P.Ö., Ö.A., Design: H.P.Ö., H.F.M., A.G., Ş.M.B., M.A.P., Ö.A., Data Collection or Processing: H.F.M., A.G., Ş.M.B., M.A.P., Ö.A., Analysis or Interpretation: H.P.Ö., H.F.M., Ö.A., Literature Search: H.P.Ö., H.F.M., Ö.A., Writing: H.P.Ö., H.F.M., A.G., Ş.M.B., M.A.P., Ö.A.

Conflict of Interest: The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding Disclosure: The authors received no financial support for the research, authorship, and/or publication of this article.

Suplementary Table Link: https://d2v96fxpocvxx.cloudfront.net/beb8919b-f013-4ea1-b1c8-40332e840fe1/content-images/1bef559d-4ba6-480c-989b-7d9f281205de.pdf

REFERENCES

1. Zainur ZR, Sulaiha SA, Azmi MN. Acute appendicitis in pregnancy: a diagnostic and management challenge. IIUM Med J Malaysia. 2014;13:77-80.
2. Steegers E, Eggink AJ. Severe maternal morbidity requires regionalistion of obstetric critical care. BJOG. 2017;124:1254.
3. Shindoh J, Niwa H, Kawai K, Ohata K, Ishihara Y, Takabayashi N, Kobayashi R, Hiramatsu T. Diagnostic power of inflammatory markers in predicting severity of appendicitis. Hepatogastroenterology. 2011;58:2003-6.
4. Haider Kazmi SJ, Zafar MT, Zia BF, Khalid SR, Kumar V, Tabassum S, Ali A, Aziz N, Khan NA, Kumari K, Saleem K, Asghar MS. Role of serum C-reactive protein (CRP)/albumin ratio in predicting the severity of acute pancreatitis: a retrospective cohort. Ann Med Surg (Lond). 2022;82:104715.
5. Franca Neto AH, Amorim MM, Nóbrega BM. Acute appendicitis in pregnancy: literature review. Rev Assoc Med Bras (1992). 2015;61:170-7.
6. Sheinenzon A, Shehadeh M, Michelis R, Shaoul E, Ronen O. Serum albumin levels and inflammation. Int J Biol Macromol. 2021;184:857-862.
7. Sand M, Bechara FG, Holland-Letz T, Sand D, Mehnert G, Mann B. Diagnostic value of hyperbilirubinemia as a predictive factor for appendiceal perforation in acute appendicitis. Am J Surg. 2009;198:193-8.
8. Anand S, Krishnan N, Birley JR, Tintor G, Bajpai M, Pogorelić Z. Hyponatremia-a new diagnostic marker for complicated acute appendicitis in children: a systematic review and meta-analysis. Children (Basel). 2022;9:1070.
9. Bozbıyık O, Uç C, Yoldaş T, Çalışkan C, Akgün E, Korkut MA. The clinical course of acute appendicitis during pregnancy: comparison of reproductive age patients and pregnant patients. Turk J Colorectal Dis. 2022;32:33-6.
10. Ashbrook M, Cheng V, Sandhu K, Matsuo K, Schellenberg M, Inaba K, Matsushima K. Management of complicated appendicitis during pregnancy in the US. JAMA Netw Open. 2022;5:e227555.
11. García González LA, Merayo M, Michi Campos JL, Carrasco B, Rodicio Miravalles JL, Granero Trancón JE. Preoperative analytical predictors of complicated acute appendicitis: myth or reality of predictive scores? Br J Surg. 2023;110(Suppl 1):znac443.057.
12. Oh TK, Song IA, Lee JH. Clinical usefulness of C-reactive protein to albumin ratio in predicting 30-day mortality in critically ill patients: a retrospective analysis. Sci Rep. 2018;8:14977.
13. Zheng X, He X. Development of a nomogram for the prediction of complicated appendicitis during pregnancy. BMC Surg. 2023;23:188.
14. Fennell J, Territo HM, Telt N, Wrotniak BH, Kozielski R, Pape E, Penque M. The association between c-reactive protein levels and pediatric appendicitis score and the severity of appendicitis in children. J Emerg Med. 2024;66:e508-e515.
15. Ribeiro AM, Romero I, Pereira CC, Soares F, Gonçalves Á, Costa S, da Silva JB. Inflammatory parameters as predictive factors for complicated appendicitis: a retrospective cohort study. Ann Med Surg (Lond). 2022;74:103266.
16. Moon HM, Park BS, Moon DJ. Diagnostic value of C-reactive protein in complicated appendicitis. J Korean Soc Coloproctol. 2011;27:122-6.
17. Sproston NR, Ashworth JJ. Role of C-reactive protein at sites of inflammation and infection. Front Immunol. 2018;9:754.
18. De Rop L, De Burghgraeve T, De Sutter A, Buntinx F, Verbakel JY. Point-of-care C-reactive protein test results in acute infections in children in primary care: an observational study. BMC Pediatr. 2022;22:633.
19. Sheinenzon A, Shehadeh M, Michelis R, Shaoul E, Ronen O. Serum albumin levels and inflammation. Int J Biol Macromol. 2021;184:857-62.
20. Zengin A, Bağ YM, Öğüt MZ, Sağlam K. The role of C-reactive protein/albumin ratio and prognostic nutritional index in the diagnosis of complicated acute appendicitis. Turk J Surg. 2024;40:54-8.
21. Hou J, Feng W, Liu W, Hou J, Die X, Sun J, Zhang M, Wang Y. The use of the ratio of C-reactive protein to albumin for the diagnosis of complicated appendicitis in children. Am J Emerg Med. 2022;52:148-54.
22. Zhao X, Yang J, Li J. The predictive value of the C-reactive protein/albumin ratio in adult patients with complicated appendicitis. J Lab Med. 2023;47:211-5.
23. Di Saverio S, Birindelli A, Kelly MD, Catena F, Weber DG, Sartelli M, Sugrue M, De Moya M, Gomes CA, Bhangu A, Agresta F, Moore EE, Soreide K, Griffiths E, De Castro S, Kashuk J, Kluger Y, Leppaniemi A, Ansaloni L, Andersson M, Coccolini F, Coimbra R, Gurusamy KS, Campanile FC, Biffl W, Chiara O, Moore F, Peitzman AB, Fraga GP, Costa D, Maier RV, Rizoli S, Balogh ZJ, Bendinelli C, Cirocchi R, Tonini V, Piccinini A, Tugnoli G, Jovine E, Persiani R, Biondi A, Scalea T, Stahel P, Ivatury R, Velmahos G, Andersson R. WSES Jerusalem guidelines for diagnosis and treatment of acute appendicitis. World J Emerg Surg. 2016;11:34.
24. Mawlood SA, Mahmoud BM. Hematological changes, serum interferon gamma and interleukin-4 alterations in normal pregnancy and preeclampsia. Int Electron J Med. 2020;9:44-51.

25. Kalaycı T, İliklerden ÜH. Methods for the diagnosis of acute appendicitis in pregnant women. East J Med. 2019;24:310-3.
26. Brunton PJ, Russell JA. Endocrine induced changes in brain function during pregnancy. Brain Res. 2010;1364:198-215.
27. Robinson DP, Klein SL. Pregnancy and pregnancy-associated hormones alter immune responses and disease pathogenesis. Horm Behav. 2012;62:263-71.

DOI: 10.4274/tjcd.galenos.2026.2025-9-11
Turk J Colorectal Dis 2026;36(1):19-26

RESEARCH ARTICLE

Endoscopic Stenting Followed by Laparoscopic Resection in Malignant Colonic Obstruction: Oncological Safety of the Bridge-to-Surgery Approach

Deniz Öçal, Mehmet Torun

Erzurum State Hospital, Clinic of Gastrointestinal Surgery, Erzurum, Türkiye

ABSTRACT

Aim: The aim of this retrospective cohort study was to evaluate the perioperative and long-term oncological outcomes of patients with malignant colonic obstruction who underwent self-expandable metallic stent (SEMS) implantation as a bridge to surgery (BTS), followed by elective laparoscopic colectomy.

Method: One-hundred two consecutive patients initially managed with a SEMS implantation as a BTS constituted a modified intention-to-treat cohort and were retrospectively analyzed. Ninety-five of these patients (the per-protocol cohort) went on to undergo a resection with curative intent between 2013 and 2023 at a tertiary referral center. Clinical demographics, operative findings, pathological results, postoperative complications, and survival outcomes for all participants were systematically recorded. The primary endpoints were overall survival, laparoscopic completion rate, and R0 resection rate. Secondary endpoints included postoperative morbidity, anastomotic leakage, recurrence, distant metastasis, disease-free survival, metastasis-free survival, and stent-to-surgery interval. Median follow-up values were calculated using the reverse Kaplan-Meier method.

Results: Stent placement was technically successful in all (95/95) patients in the operative (per-protocol) cohort. The mean interval between SEMS placement and surgery was 10±3 days. Laparoscopic resection was completed in 84.2% of these patients, whereas 15.8% required a conversion to open surgery. The mean operative time was 148±32 minutes, and intraoperative complications occurred in 4.2% of cases. An adequate lymphadenectomy count (≥12 nodes) was achieved in over 90% of patients, with a median lymph node yield of 21. The R0 resection rate was 93.7%. Postoperative complications, including anastomotic leakage, occurred in approximately 40% of patients, including both laparoscopic and open surgery cases. No 30-day mortality was observed. During the reverse Kaplan-Meier median follow-up period of 31.8 months, recurrence occurred in 28.4% of cases, and distant metastasis in 21.0%. The 3-year OS rate was 76%, with no significant difference between laparoscopic and open surgery procedures ($p>0.05$). Kaplan-Meier curves with number-at-risk tables support these findings.

Conclusion: Endoscopic stenting, followed by elective laparoscopic colectomy, represents a feasible and clinically sound BTS strategy for malignant colonic obstruction. This approach provides acceptable perioperative outcomes, enables high rates of minimally invasive resection, and does not appear to negatively influence medium-term oncological outcomes in appropriately selected patients. Further prospective studies are needed to refine the patient selection process and validate the long-term oncologic safety of this approach.

Keywords: Malignant colonic obstruction, self-expandable metallic stent, bridge to surgery, laparoscopic colectomy, oncological outcomes, minimally invasive colon surgery

Address for Correspondence: Mehmet Torun, MD, Erzurum State Hospital, Clinic of Gastrointestinal Surgery, Erzurum, Türkiye
E-mail: mehmettorun@hotmail.com **ORCID ID:** orcid.org/0000-0002-8742-6359
Received: 05.10.2025 **Accepted:** 02.02.2026 **Publication Date:** 31.03.2026

Cite this article as: Öçal D, Torun M. Endoscopic stenting followed by laparoscopic resection in malignant colonic obstruction: oncological safety of the bridge-to-surgery approach. Turk J Colorectal Dis. 2026;36(1):19-26

Introduction

Malignant colonic obstruction is a life-threatening condition occuring in 7%-15% of patients with colorectal cancer that frequently necessitates urgent decompression to restore bowel function and stabilize the patient.[1,2] Endoscopic self-expandable metallic stent (SEMS) implantation as a bridge to surgery (BTS) has been proposed as an alternative to emergency colectomy, allowing for short-term physiological optimization, the completion of oncologic staging, and planned minimally invasive resection.[3-5] Despite these advantages, the long-term oncologic consequences of SEMS placement remain debated. Concerns include tumor manipulation, microperforation, and subclinical dissemination, all of which may influence recurrence patterns and survival but are incompletely characterized in current evidence.[6,7]

Although several meta-analyses and multicenter studies have assessed SEMS implantation as a BTS strategy, the existing literature is limited by substantial methodological heterogeneity. Prior studies frequently differ in their definitions of technical and clinical success, apply inconsistent criteria for stent failure, and vary widely in follow-up duration and endpoint reporting.[8-10] In addition, most available cohorts combine open and laparoscopic resections, lack a standardized operative technique, or do not employ Enhanced Recovery After Surgery (ERAS) pathways, limiting their comparability and generalizability. Importantly, few real-world consecutive series examine long-term survival outcomes after BTS followed by uniform laparoscopic oncologic colectomy within an intention-to-treat framework in a high-volume center. This leaves a persistent knowledge gap about the true long-term oncologic impact of SEMS implantation as a BTS when applied in modern minimally invasive colorectal surgery.

To address this gap, we designed a study centered on a single, testable primary hypothesis: SEMS placement as a BTS does not adversely affect long-term oncologic outcomes in patients undergoing standardized laparoscopic colectomy for malignant colonic obstruction. Secondary hypotheses were prespecified to evaluate whether SEMS placement as a BTS promotes high laparoscopic completion rates, maintains acceptable R0 resection rates and lymph node yields, and is associated with perioperative outcomes comparable to contemporary minimally invasive colorectal surgery benchmarks.

Accordingly, the aim of this retrospective consecutive cohort study was to evaluate the technical success, perioperative outcomes, and long-term oncologic results of SEMS placement as a BTS followed by standardized laparoscopic colectomy in patients with malignant colonic obstruction treated at a high-volume tertiary referral center. This endpoint-driven approach allows a focused assessment of both short- and long-term outcomes within a modern surgical framework.

Materials and Methods

Study Design and Setting

This retrospective cohort study was conducted at a high-volume tertiary referral center between January 2013 and December 2023. The study was designed to evaluate perioperative and long-term oncologic outcomes in patients with malignant colonic obstruction initially managed with SEMS placement as a BTS.

Although this study is retrospective in design, clinical and procedural data were derived from routinely maintained institutional databases and electronic medical records.

This study was approved by the Scientific Research Ethics Committee of Erzurum Faculty of Medicine, Health Sciences University (decision no: BAEK 2025/03-159, meeting no: 03, decision no: 159, date: 11.03.2025), and was conducted in accordance with the principles of the Declaration of Helsinki.

Study Population and Intention-to-Treat Framework

During the study period, 102 consecutive patients with acute malignant colonic obstruction were evaluated for SEMS placement with curative intent. Primary analysis was performed using a modified intention-to-treat (mITT) approach. All 102 patients (designated the mITT cohort) were initially managed with SEMS placement as a BTS and were included in the primary analytical framework, including those who experienced SEMS failure and required urgent surgery. These patients were considered outcomes of the BTS strategy rather than exclusions. SEMS failure was defined as technical failure, clinical failure, or the need for emergency surgery following stent placement.

Seven patients were deemed unsuitable for curative intent surgery due to metastatic progression detected after initial staging, a deterioration in performance status, or an inability to proceed with oncologic resection. These patients were retained in the mITT cohort but excluded from per-protocol analysis. Ninety-five patients for whom SEMS placement was successful and who subsequently underwent elective minimally invasive colectomy with curative intent were designated the per-protocol cohort and included in the per-protocol analysis. A consolidated flow diagram illustrating screening, SEMS placement outcomes, and analytic cohorts is provided.

Eligibility Criteria

All patients presented with histologically confirmed adenocarcinoma of the colon, with radiologic or endoscopic evidence of a malignant large-bowel obstruction and no overt perforation at presentation. Exclusion criteria for the per-protocol cohort included benign obstruction, synchronous obstructing lesions, perforation at presentation, primary emergency resection without a prior SEMS implantation attempt, and an inability to undergo elective surgery. Distant metastasis was excluded by contrast-enhanced thoracoabdominal computed tomography (CT), supplemented by magnetic resonance imaging or positron emission tomography-CT when indicated.

Preprocedural Evaluation

Before SEMS placement, all patients underwent standardized staging with a contrast-enhanced thoracoabdominal CT. Cases with radiologic uncertainty regarding resectability were discussed by a multidisciplinary tumor board. Only patients confirmed to have a potentially curable disease proceeded along the BTS pathway.

SEMS Placement Technique

The placement of the SEMS was performed by experienced interventional endoscopists using a standardized protocol. Procedures were conducted under combined endoscopic and fluoroscopic guidance using either a through-the-scope or over-the-wire technique with hydrophilic guidewires. Nitinol colonic stents from approved commercial manufacturers were selected according to stricture length and colonic anatomy. Balloon dilation was not performed in any case.

All procedures were conducted under intravenous midazolam-fentanyl sedation, with a single preprocedural intravenous dose of cefazolin (1 g). Technical success was defined as accurate stent deployment fully covering the stricture with immediate expansion, whereas clinical success required a resolution of obstructive symptoms and restoration of bowel function within 48 hours of placement. All stent-related adverse events, including perforation, migration, re-obstruction, and procedure-related pain, were recorded.

Surgical Procedure

Following clinical stabilization, patients underwent restaging and optimization before elective surgery. Colectomy was scheduled after a median interval of approximately 10 days, depending on clinical response. Laparoscopic resections followed a standardized oncologic protocol, which included the high ligation of relevant vascular pedicles, complete mesocolic excision, and routine splenic flexure mobilization for left-sided tumors. Anastomosis was performed using intracorporeal or extracorporeal techniques at the attending surgeon's discretion.

Indocyanine green fluorescence angiography was selectively used to assess anastomotic perfusion. Conversion to open surgery was recorded whenever laparotomy was required due to a technical difficulty or intraoperative instability. Diverting stoma creation was based on predefined institutional criteria, including high-risk anastomosis, questionable perfusion, and substantial local inflammation.

Perioperative and Postoperative Care

Perioperative management followed a standardized ERAS protocol. Preoperative measures included carbohydrate loading, venous thromboembolism prophylaxis, and antibiotic prophylaxis. Intraoperative care emphasized goal-directed fluid therapy, normothermia, and opioid-sparing analgesia. Postoperatively, early mobilization, early oral intake, and multimodal pain control were encouraged. Institutional ERAS adherence during the study period was approximately 80%.

Postoperative complications were graded according to the Clavien-Dindo classification system, and anastomotic leakage was defined based on International Study Group of Rectal Cancer criteria. Thirty-day morbidity, readmission, and mortality were systematically recorded.

Pathological Assessment

Resected specimens were examined according to standardized colorectal cancer pathology protocols. Evaluation included an assessment of mesocolic plane quality, lymphovascular and perineural invasion, and tumor budding; the inking of resection margins; and lymph node harvest, with a target of at least 12 nodes. Pathologic staging was performed according to American Joint Committee on Cancer Tumor, Node, Metastasis, 8th edition, classification.

Follow-Up and Outcome Definitions

Patients were followed every 3 months for the first 2 years, every 6 months until the 5-year timepoint, and annually thereafter. Surveillance included clinical examination, serum carcinoembryonic antigen measurement, and a contrast-enhanced thoracoabdominal CT in accordance with National Comprehensive Cancer Network and Japanese Society for Cancer of the Colon and Rectum guidelines. Recurrence was defined as a radiologically confirmed local or distant relapse validated by a multidisciplinary review.

Although the study period began in 2013, the implementation only after 2018 of a fully standardized electronic documentation protocol for long-term oncologic follow-up accounts for the maximum observed follow-up duration of 44 months seen in the current dataset.

Statistical Analysis

Statistical analyses were performed using SPSS for Windows, version 28.0 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality using the Shapiro-Wilk test and reported as mean ± standard deviation or median [interquartile range (IQR)], as appropriate. Categorical variables were expressed as frequencies and percentages.

The primary endpoint analyzed was overall survival (OS). For time-to-event analyses, OS was calculated from the date of SEMS placement in the mITT cohort and from the date of colectomy in the per-protocol cohort. Secondary endpoints included disease-free survival (DFS), metastasis-free survival (MFS), perioperative outcomes, and pathological results.

Survival curves were generated using the Kaplan-Meier method with log-rank testing, and numbers at risk were displayed. Variables with p<0.10 in univariate analyses were entered into multivariable Cox proportional hazards models after a verification of proportional hazards assumptions using Martingale residuals. Sensitivity analyses comparing the two cohorts were performed to assess robustness. A competing risks framework was considered but deemed unnecessary owing to the low incidence of death without recurrence.

Results

Study Population and Flow

Of the 102 consecutive patients initially managed with SEMS placement as a BTS strategy, 95 experienced successful SEMS placement and subsequently underwent elective surgery with curative intent. Seven patients experienced SEMS failure or required urgent surgery but were retained in the primary (mITT) analysis as outcomes of the BTS strategy. The distribution of postoperative complications and oncologic events is illustrated in Figures 1-3. Patient inclusion, SEMS placement outcomes, and analytic cohorts are summarized in the study flow diagram.

Patients who experienced SEMS failure or required urgent surgery were followed for OS from the date of SEMS placement and censored at last follow-up or death, in accordance with the mITT framework.

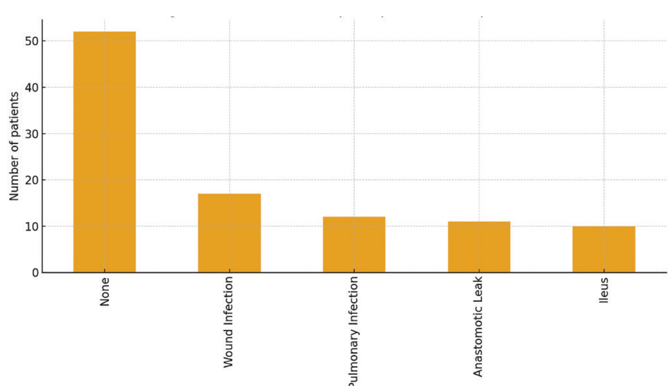

Figure 1. Distribution of postoperative complications after self-expandable metallic stent implantation as a bridge to surgery (n=95)

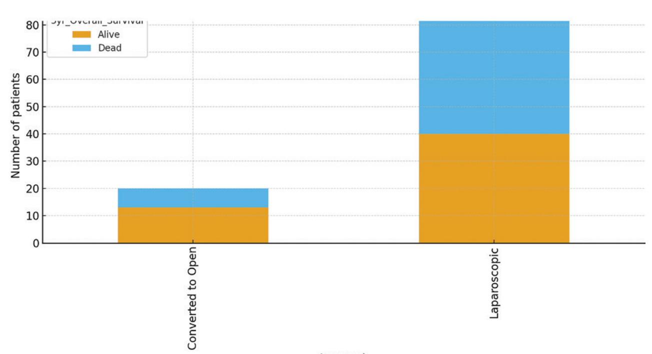

Figure 2. Overall survival by surgical approach following self-expandable metallic stent implantation as a bridge to surgery

Baseline Characteristics

Baseline demographic and clinical characteristics of the per-protocol cohort are summarized in Table 1-2. The mean age in the per-protocol cohort was 62.1±13.9 years, and most patients in this cohort were male. American Society of Anesthesiologists classifications reflected a population with moderate perioperative risk, and tumor locations were distributed across the right, transverse, left, and sigmoid colonic segments.

All patients in the per-protocol cohort underwent technically successful SEMS placement. The mean interval between stent insertion and definitive surgery was 10±3 days, which was consistent with the predefined BTS protocol. The most frequently used stent types were WallFlex and Niti-S. No stent-related perforation was observed in this cohort.

Primary Endpoint: OS

The primary endpoint of this study was OS. In the mITT cohort, OS was calculated from the date of SEMS placement, whereas in the per-protocol cohort, OS was calculated from the date of colectomy. Overall survival according to surgical approach is presented in Figure 2. Using a reverse-Kaplan-Meier methodology, the median follow-up duration was calculated to be 31.8 months (IQR: 17.2-44.3). During follow-up, 7 deaths were recorded. The estimated 3-year OS rate in the mITT cohort was 76%, as shown in Figure 4A.

When stratified by operative approach, OS estimates were within the range reported in contemporary series, with no statistically significant difference between patients who underwent a laparoscopic colectomy and those who required a conversion to open surgery [Figure 4B; hazard ratio (HR)]: 1.12, 95% CI: 0.68-1.84; p=0.64).

OS estimates in the mITT cohort (n=102) were similar in magnitude to those observed in the per-protocol cohort (n=95). Sensitivity analyses that included SEMS failures and patients who required emergency surgery did not materially alter OS estimates (HR: 1.08, 95% CI: 0.66-1.77; p=0.72). Detailed results are provided in Supplementary Table.

Table 1. Baseline characteristics of study population (n=95)

Variable	Value
Age (y)	62.1±13.9
Sex (M/F)	63/32
ASA classification I/II/III/IV	2/33/41/19
Tumor location	Right colon: 28 (29.4%), transverse: 14 (14.7%), left colon: 28 (29.4%), sigmoid: 25 (26.3%)

ASA: American Society of Anesthesiologists

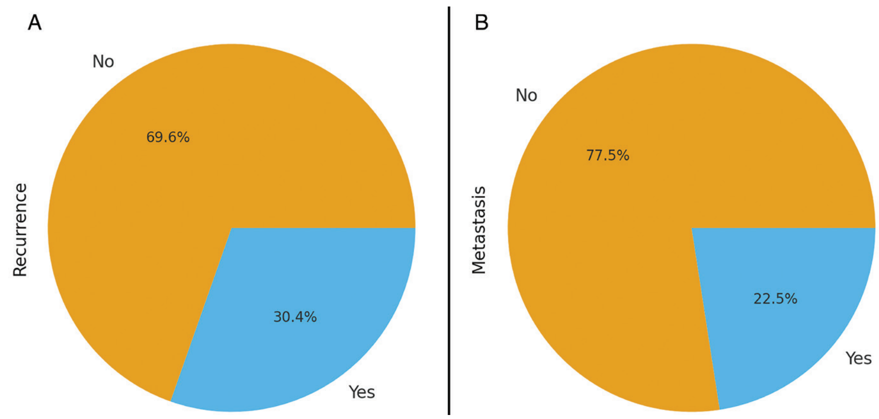

Figure 3. A) Recurrence patterns following self-expandable metallic stent implantation as a bridge to surgery, B) distant metastasis following self-expandable metallic stent implantation as a bridge to surgery

Secondary Endpoints

DFS

The estimated 3-year DFS rate was 68%, corresponding to 27 recurrence events (28.4%) during follow-up. The Kaplan-Meier curve for DFS, with accompanying number-at-risk tables, is shown in Figure 5A. Operative approach was not significantly associated with DFS (HR: 1.15, 95% CI: 0.71-1.89; p=0.58), and sensitivity analysis incorporating SEMS failures yielded comparable results.

MFS

MFS demonstrated a gradual decline over time, with an estimated 3-year MFS rate of 79%, based on 20 distant metastasis events (21%). The corresponding Kaplan-Meier curve is presented in Figure 5B, and the distribution of recurrence and metastasis patterns is summarized in Figure 3A and B. No statistically significant association between operative approach and MFS was observed.

Operative and Pathological Outcomes

Operative outcomes are summarized in Table 3. Laparoscopic colectomy was completed in 84.2% of patients, whereas 15.8% required a conversion to open surgery. Pathologic findings demonstrating adequate lymphadenectomy counts and high R0 resection rates consistent with accepted oncologic benchmarks are presented in Table 4.

Postoperative Morbidity and Adverse Events

Postoperative morbidity is illustrated in Figure 1. Anastomotic leakage occurred infrequently and without an apparent difference between surgical approaches. Major complications were uncommon, and no deaths occurred within 30 days of surgery.

Discussion

The primary endpoint of this study was OS following SEMS placement as a BTS. In the present cohort, the estimated 3-year OS rate was 76%, and survival estimates appeared

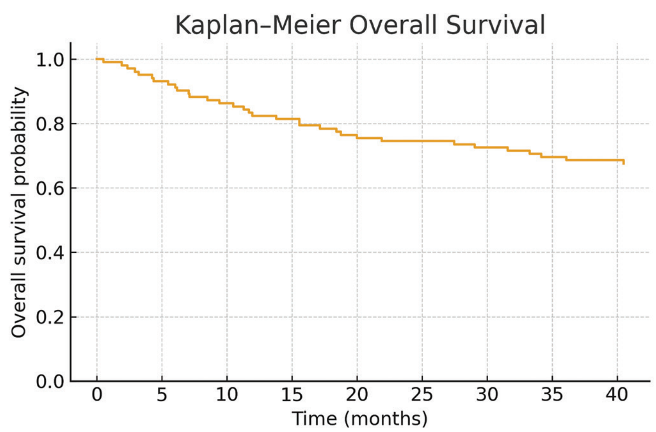

Figure 4A. Kaplan-Meier overall survival curve after self-expandable metallic stent implantation as a bridge to surgery

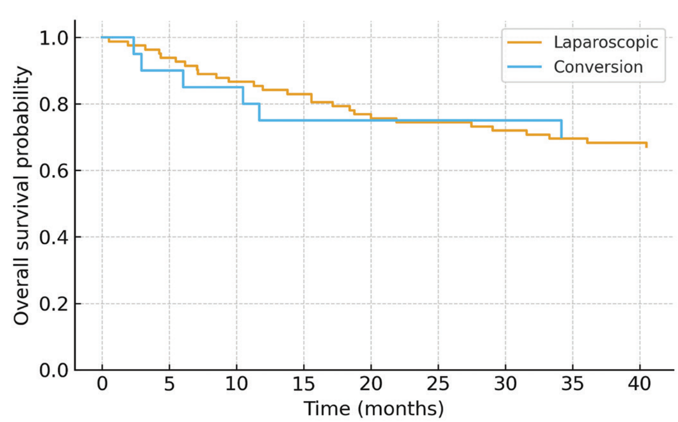

Figure 4B. Kaplan-Meier overall survival, stratified by operative approach comparable between patients who underwent laparoscopic surgery and those who required a conversion to open surgery. Within the limitations of a retrospective design, these findings suggest that long-term survival outcomes observed after SEMS implantation as a BTS fall within ranges reported in contemporary series. Similar survival patterns have been described in several observational cohorts evaluating this BTS strategy,[11-15] although randomized trials and meta-analyses have reported more heterogeneous results, particularly in settings with higher perforation rates.[16-19]

DFS and MFS curves demonstrated recurrence and distant metastasis patterns broadly consistent with those reported for resectable stage II-III colon cancers. Although approximately one-third of patients experienced a recurrence during follow-up, this proportion is comparable to rates described in previous studies assessing decompression-first strategies.[20-22] Importantly, the present analysis does not aim to establish an oncologic equivalence between SEMS implantation and emergency surgery. Experimental and clinical concerns regarding stent-related microperforation, subclinical transmural injury, and potential tumor dissemination have been described in pathological and imaging-based studies.[23-25] Although such adverse oncologic effects were not observed in this cohort, the limited number of events and absence of a control group in the present study preclude definitive conclusions.

Perioperative outcomes were generally favorable, with high rates of laparoscopic completion and an acceptable morbidity—findings that are in line with reports from high-volume centers and that highlight the improved feasibility of minimally invasive surgery following decompression with SEMS.[26,27] The absence of stent-related perforation in this series warrants cautious interpretation and should not be regarded as evidence of universal safety. Perforation has consistently been identified as a key adverse prognostic factor associated with early recurrence and reduced survival,[16,17,24] and reported rates vary considerably across institutions. These observations underscore the importance of operator experience, stent

Table 2. Treatment characteristics

Variable	Value
Neoadjuvant therapy	0%
Adjuvant therapy	62%
Stoma creation	9%
Interval between stent and surgery (days)	10±3
Stent brand/type	WallFlex, Niti-S
Perforation	0

Table 3. Perioperative outcomes

Variable	Value
Laparoscopic completion	84.2%
Conversion to open surgery	15.8%
Operative time (min)	148±32
Intraoperative complications	4.2%
Length of hospital stay (days)	6 (IQR: 4-8)

IQR: Interquartile range

Table 4. Oncologic outcomes

Variable	Value
R0 resection	93.7%
Lymph nodes retrieved	21 (IQR: 17-29)
Recurrence rate	28.4%
Metastasis rate	21.0%
3-year overall survival rate	76%
3-year disease-free survival rate	68%

IQR: Interquartile range

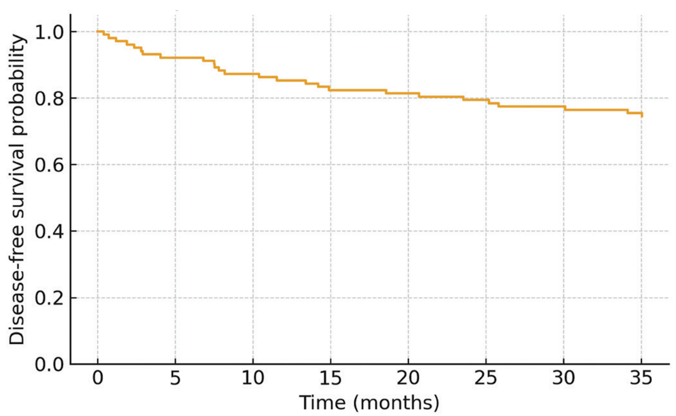

Figure 5A. Kaplan-Meier disease-free survival following self-expandable metallic stent implantation as a bridge to surgery

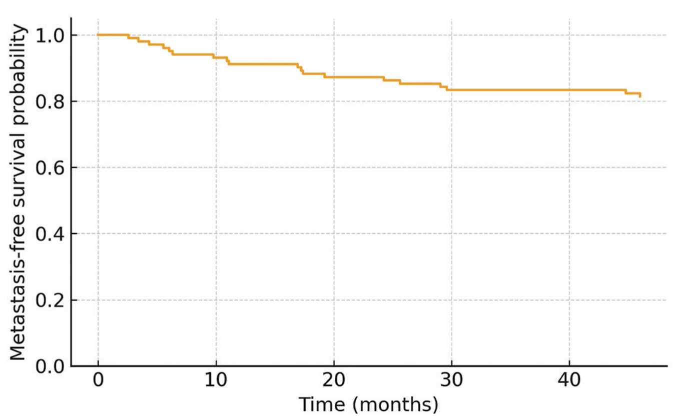

Figure 5B. Kaplan-Meier metastasis-free survival following self-expandable metallic stent implantation as a bridge to surgery selection, and careful patient selection when implementing a BTS strategy.

Several methodological limitations should be considered when interpreting the present results. The retrospective design of this study introduces the potential for selection bias, as eligibility for SEMS implantation as a BTS strategy depends on clinical stability, tumor characteristics, endoscopist availability, and institutional practice patterns. Information bias may also arise from the incomplete capture of postoperative complications and oncologic events managed at outside institutions. In addition, residual confounding related to tumor biology, perioperative optimization, adjuvant treatment strategies, and surgeon experience cannot be fully accounted for in an observational framework. The relatively small number of survival events further limits the study's statistical power and increases the risk of a type-II error. Accordingly, these findings should be interpreted with caution.

Several sources of bias inherent to the study design should be explicitly acknowledged. Selection bias is possible, as candidacy for SEMS placement was determined by clinical stability, tumor characteristics, and institutional expertise, potentially favoring patients with more favorable baseline profiles. In addition, the interval between stent placement and elective surgery introduces the possibility of immortal time bias, as patients must survive and remain clinically stable during this period to undergo definitive resection.

The prolonged inclusion period, spanning from 2013 to 2023, raises a concern about calendar period bias, as advancements in perioperative care, imaging, stent technology, surgical techniques, and systemic therapies may have influenced outcomes over time. Furthermore, the evolution of surgeon experience during the study period may have contributed to improved technical performance and perioperative outcomes in later years. Finally, despite multivariable adjustment, residual confounding related to unmeasured factors—such as tumor biology, frailty, and nuances of adjuvant treatment—cannot be fully excluded in a retrospective observational framework. These sources of bias should be considered when interpreting these results.

A further methodological consideration relates to the application of an intention-to-treat framework in a retrospective BTS cohort. Although an mITT approach was adopted, patients who experienced SEMS failure represent a clinically distinct subgroup with different perioperative trajectories. Nevertheless, sensitivity analyses incorporating SEMS failures and urgent surgeries did not materially alter survival estimates, suggesting an internal consistency within the observed results. In the absence of a control group and a fully randomized intention-to-treat design, these findings should be regarded as hypothesis-generating rather than confirmatory.

Survival analyses in BTS cohorts are inherently prone to immortal time biases related to the interval between decompression and definitive surgery. To mitigate this issue, OS in the mITT analysis was calculated from the date of SEMS placement rather than the date of colectomy.

Nevertheless, residual bias cannot be fully excluded in a retrospective design, and these findings should be interpreted as hypothesis-generating.

Despite these limitations, this study offers clinically relevant insights. In experienced centers with established endoscopic and surgical expertise, SEMS placement may facilitate a controlled transition from acute obstruction to elective oncologic resection, enabling physiologic optimization, the completion of staging, and high rates of minimally invasive surgery. Though these potential advantages may contribute to favorable perioperative recovery, the oncologic neutrality of SEMS implantation cannot be assumed and should be evaluated on an individual basis. Future prospective studies with standardized reporting of stent-related events, a uniform pathological assessment, an incorporation of molecular tumor characteristics, and long-term follow-up are required to better define the role of SEMS implantation as a BTS strategy in contemporary colorectal cancer management.

Ethics

Ethics Committee Approval: This study followed the Declaration of Helsinki in principle, and all patient data were treated strictly according to the rules of privacy in the institutions involved. Ethical approval was obtained from Scientific Research Ethics Committee of Erzurum Faculty of Medicine with decision no: BAEK 2025/03-159, date: 11.03.2025.

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: D.Ö., M.T., Concept: D.Ö., M.T., Design: D.Ö., M.T., Data Collection or Processing: D.Ö., M.T., Analysis or Interpretation: D.Ö., M.T., Literature Search: D.Ö., M.T., Writing: D.Ö., M.T.

Conflict of Interest: The authors report there are no competing interests to declare.

Financial Disclosure: The authors have no conflicts of interest including relevant financial interests, activities, relationships, and affiliations.

Supplementary Table: https://d2v96fxpocvxx.cloudfront.net/688d2d00-d207-464d-89b6-73f393f4f50c/content-images/46085f53-14c4-45e0-80e8-014a20f9957b.pdf

REFERENCES

1. Demarest K, Lavu H, Collins E, Batra V. Comprehensive diagnosis and management of malignant bowel obstruction: a review. J Pain Palliat Care Pharmacother. 2023;37:91-105.
2. van Hooft JE, Veld JV, Arnold D, Beets-Tan RGH, Everett S, Götz M, van Halsema EE, Hill J, Manes G, Meisner S, Rodrigues-Pinto E, Sabbagh C, Vandervoort J, Tanis PJ, Vanbiervliet G, Arezzo A. Self-expandable metal stents for obstructing colonic and extracolonic cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline - Update 2020. Endoscopy. 2020;52:389-407.
3. McHugh FT, Ryan ÉJ, Ryan OK, Tan J, Boland PA, Whelan MC, Kelly ME, McNamara D, Neary PC, O'Riordan JM, Kavanagh DO. Management strategies for malignant left-sided colonic obstruction: a systematic review and network meta-analysis of randomized controlled trials and propensity score matching studies. Dis Colon Rectum. 2024;67:878-894.
4. Murakami T, Isayama H, Ikeda S, Hanabata N, Enomoto T, Kuwai T, Ushigome M, Ebi M, Ohtsuka H, Endo S, Saito S, Ohki T, Yamamoto R, Kayahara T, Matsumoto S, Sasaki Y, Saida Y. A new self-expandable metallic stent with low axial force and a high axial force zero-border shows a very low perforation rate in malignant colorectal obstruction: a Japanese multicenter prospective study. J Clin Med. 2024;13:5102.
5. Arezzo A, Forcignanò E, Bonino MA, Balagué C, Targarona E, Borghi F, Giraudo G, Ghezzo L, Passera R, Morino M; collaborative ESCO study group. Long-term oncologic results after stenting as a bridge to surgery versus emergency surgery for malignant left-sided colonic obstruction: a multicenter randomized controlled trial (ESCO Trial). Ann Surg. 2020;272:703-708.
6. Suzuki H, Tsujinaka S, Sato Y, Miura T, Shibata C. Oncologic impact of colonic stents for obstructive left-sided colon cancer. World J Clin Oncol. 2023;14:1-12.
7. Park S, Lee JY, Hong SW, Hwang SW, Park SH, Yang DH, Ye BD, Myung SJ, Yang SK, Byeon JS. Influence of endoscopists' expertise level on clinical outcomes after bridge-to-surgery stenting in obstructive colorectal cancer. J Gastroenterol Hepatol. 2023;38:2152-2159.
8. Tao Y, Li GB, Zhang HY, Cao K, Wang ZJ, Han JG. Current practice for the treatment of obstructive left-sided colon cancer in China: a nationwide cross-sectional survey. Surg Today. 2023;53:459-469.
9. Ma W, Zhang JC, Luo K, Wang L, Zhang C, Cai B, Jiang H. Self-expanding metal stents versus decompression tubes as a bridge to surgery for patients with obstruction caused by colorectal cancer: a systematic review and meta-analysis. World J Emerg Surg. 2023;18:46.
10. Kanaka S, Yamada T, Matsuda A, Uehara K, Shinji S, Yokoyama Y, Takahashi G, Iwai T, Takeda K, Kuriyama S, Miyasaka T, Yoshida H. Short-term and three-year long-term outcomes of laparoscopic surgery versus open surgery for obstructive colorectal cancer following self-expandable metallic stent placement: a meta-analysis. Surg Endosc. 2024;38:5514-5527.
11. Son JT, Kim YB, Kim HO, Min C, Park Y, Lee SR, Jung KU, Kim H. Short- and long-term outcomes of subtotal/total colectomy in the management of obstructive left colon cancer. Ann Coloproctol. 2023;39:260-266.
12. Kim GH, Shin JH, Zeng CH, Park JH. Recent updates in gastrointestinal stent placement from the esophagus to the colon: a radiological perspective. Cardiovasc Intervent Radiol. 2022;45:425-437.
13. Ofluoglu CB, Aydin IC, Altuntas YE, Cetin K, Inan R, Ilhan N, Mulkut F, Kucuk HF. Impact of pelvic floor muscle training on sphincter function and quality-of-life in patients who underwent low anterior resection: a comparative evaluation. North Clin Istanb. 2024;11:336-342.
14. Cirocchi R, Arezzo A, Sapienza P, Crocetti D, Cavaliere D, Solaini L, Ercolani G, Sterpetti AV, Mingoli A, Fiori E. Current status of the self-expandable metal stent as a bridge to surgery versus emergency surgery in colorectal cancer: results from an updated systematic review and meta-analysis of the literature. Medicina (Kaunas). 2021;57:268.
15. Kim DH, Lee HH. Colon stenting as a bridge to surgery in obstructive colorectal cancer management. Clin Endosc. 2024;57:424-433.
16. Cardoso PM, Rodrigues-Pinto E. Self-expandable metal stents for obstructing colon cancer and extracolonic cancer: a review of latest evidence. Cancers. 2024;17:87.
17. Huang Y, Liao F, Chen H, Shu X. ASO author reflections: self-expanding metal stents for right-sided colonic cancer obstruction. Ann Surg Oncol. 2024;31:3242-3243.
18. Ali FS, Gandam MR, Hussain MR, Mualla N, Khuwaja S, Sundararajan N, Siddiqui SI, Naqvi S, DaVee RT, Thosani N. Self-expanding metal stents for the treatment of malignant colon obstruction from extra-colonic malignancy versus intra-colonic malignancy: a systematic review and meta-analysis. Surg Endosc. 2023;37:4179-4192.
19. Khoo MSQ, Koh FH, Sivarajah SS, Ho LM, Aw DK, Chong CX, Foo FJ, Tan WJ. Colonic stenting: is the bridge to surgery worth its cost? A cost-effectiveness analysis at a single Asian institution. Ann Coloproctol. 2024;40:555-563
20. Khomvilai S, Pattarajierapan S. Comparison of long-term outcomes of colonic stenting as a "bridge to surgery" and emergency surgery in patients with left-sided malignant colonic obstruction. Ann Coloproctol. 2023;39:17-26.
21. Sun Q, Zhang X, You J, Pang Y, Luo Z, Liu Y, Chen Y, Sun Y, Zhuang Z, Li Z, Yu A, Yao T, He M, Liu X, Zhang Y, Xiong Y, Ren Y, Xie J. Comparative effectiveness of colonic stenting alone and with neoadjuvant chemotherapy for patients with left-sided obstructive colon cancer: a meta-analysis. Int J Surg. 2025;111:7168-7180.
22. Kossenas K, Kouzeiha RA, Moutzouri O, Georgopoulos F. Impact of laparoscopic and open surgery on stoma formation and postoperative outcomes in elderly patients with obstructive colorectal cancer following self-expandable metallic stent placement: a systematic review and meta-analysis. Updates Surg. 2025;77:963-973.
23. Russo S, Conigliaro R, Coppini F, Dell'Aquila E, Grande G, Pigò F, Mangiafico S, Lupo M, Marocchi M, Bertani H, Cocca S. Acute left-sided malignant colonic obstruction: Is there a role for endoscopic stenting? World J Clin Oncol. 2023;14:190-197.
24. Shiraishi T, Tominaga T, Nonaka T, Takamura Y, Oishi K, Hashimoto S, Noda K, Ono R, Hisanaga M, Fukuda A, Moriyama M, Uchida F, Motoyama K, Kunizaki M, Matsumoto K. Impact of the log odds of positive lymph nodes on the prognosis in pathological stage 3 patients with obstructive colorectal cancer treated with colonic stents: a retrospective multicenter study in Japan. Surg Today. 2025;55:1552-1561.
25. Delgado-Plasencia L, Boluda-Aparicio A, Marrero-Marrero P, Salido-Ruíz E, Torres-Monzón E, Peñalver-Alcaraz C, Phillbrick C, Jiménez-Sosa A. Impact of self-expandable metallic prosthesis on lymph node dissemination in obstructive left-sided colorectal cancer. Surg Endosc. 2025;39:3224-3235.
26. Mäder M, Kalt F, Schneider M, Kron P, Ramser M, Lopez-Lopez V, Biondo S, Faucheron JL, Yoshiyuki S, von der Groeben M, Novak A, Teufelberger G, Lehmann K, Eshmuminov D. Self-expandable metallic stent as bridge to surgery vs. emergency resection in obstructive right-sided colon cancer: a systematic review and meta-analysis. Langenbecks Arch Surg. 2023;408:265.
27. Neri B, Citterio N, Schiavone SC, Biasutto D, Rea R, Martino M, Di Matteo FM. Malignant bowel occlusion: an update on current available treatments. Cancers (Basel). 2025;17:1522.

DOI: 10.4274/tjcd.galenos.2025.2025-6-3
Turk J Colorectal Dis 2026;36(1):27-31

CASE REPORT

Successful Non-Pharmacological Management of Ogilvie's Syndrome in a Young Adult with Intellectual Disability and Chronic Immobility: A Rare Case Report

Mehmet Berksun Tutan[1], Veysel Barış Turhan[2]

[1]Alaca State Hospital, Clinic of General Surgery, Çorum, Türkiye
[2]Hitit University Faculty of Medicine, Department of General Surgery, Çorum, Türkiye

ABSTRACT

Ogilvie's syndrome, or acute colonic pseudo-obstruction, is a rare but potentially life-threatening condition characterized by massive colonic dilatation in the absence of mechanical obstruction. It predominantly affects elderly and postoperative patients. Cases in younger individuals who are neurologically impaired remain exceedingly rare. We report a 39-year-old man with severe intellectual disability and lifelong immobility who presented with progressive abdominal distension and no defecation for 72 hours. Computed tomography imaging revealed diffuse colonic dilatation with a cecal diameter of 9.2 cm. Mechanical obstruction was excluded. Due to the unavailability of neostigmine, the patient was managed conservatively using nasogastric decompression, rectal tube placement, and intravenous metoclopramide. Substantial clinical improvement occurred within 24 hours, with the complete resolution of symptoms by day 4. The patient was discharged with a structured bowel regimen and showed no recurrence at early follow-up. Informed consent for publication was obtained from the patient's legal guardians prior to the writing of this case report. This case highlights a rare presentation of Ogilvie's syndrome in a young adult with neurodevelopmental impairment and demonstrates that non-pharmacological conservative treatment may be sufficient in the absence of neostigmine.

Keywords: Ogilvie's syndrome, pseudo-obstruction, colonic dilation, neurodevelopmental disorders, conservative treatment

Introduction

Ogilvie's syndrome, also known as acute colonic pseudo-obstruction, is a rare but potentially life-threatening condition characterized by massive colonic dilation in the absence of mechanical obstruction. It most often occurs in elderly, hospitalized patients with multiple comorbidities, particularly in association with recent surgery, trauma, electrolyte imbalance, or pharmacological triggers such as opioids and anticholinergics.[1,2] The pathophysiology is thought to involve a disruption in the autonomic regulation of colonic motility, leading to unopposed sympathetic inhibition or suppressed parasympathetic activity of the distal colon.[3] Although traditionally described in patients who are older, postoperative, or medically complex, Ogilvie's syndrome may occur in younger individuals with neurological or developmental impairment, where chronic immobility and altered autonomic function may predispose to colonic dysmotility.[2]

Early recognition of Ogilvie's syndrome is critical, as colonic dilation beyond 9-12 cm, especially of the cecum, substantially increases the risk of ischemia and perforation, which are associated with mortality rates as high as 40% in untreated cases.[1,4] Diagnosis relies on clinical evaluation supported by radiologic imaging, whereas management typically includes supportive measures, rectal decompression, and pharmacological intervention, most notably neostigmine, an acetylcholinesterase inhibitor proven effective in resolving colonic distension.[3] Where neostigmine is unavailable, alternative strategies such as rectal tubes, nasogastric suction, and prokinetic agents are employed, although data supporting their use is limited.

Address for Correspondence: Mehmet Berksun Tutan MD, Alaca State Hospital, Clinic of General Surgery, Çorum, Türkiye
E-mail: mbtutan@gmail.com **ORCID ID:** orcid.org/0000-0003-1834-7355
Received: 16.06.2025 **Accepted:** 26.08.2025 **Epub:** 19.11.2025 **Publication Date:** 31.03.2026

Cite this article as: Tutan MB, Turhan VB. Successful non-pharmacological management of Ogilvie's syndrome in a young adult with intellectual disability and chronic immobility: a rare case report. Turk J Colorectal Dis. 2026;36(1):27-31

Here, we present an unusual case of Ogilvie's syndrome in a 39-year-old man with severe intellectual disability, in whom the diagnosis was established radiologically and successfully managed without neostigmine or surgical intervention. This case underscores the need to consider Ogilvie's syndrome even in younger, non-verbal patients presenting with colonic distension, especially those with chronic immobility or neurodevelopmental disorders. We believe this case contributes to the limited body of literature by illustrating successful management in a young adult without access to standard pharmacological therapy, emphasizing the feasibility of conservative, non-operative management in resource-limited settings.

Case Report

A 39-year-old man with severe intellectual disability and lifelong immobility was admitted to the emergency department with complaints of progressive abdominal distension and absence of defecation and flatus over the preceding 72 hours. The patient was non-verbal and accompanied by caregivers, who reported decreased oral intake and lethargy. Functional status was severely limited due to a longstanding neurodevelopmental impairment, resulting in complete dependence for mobility and daily care. He had no documented history of chronic constipation, fecal incontinence, or use of laxatives. There was no associated vomiting, fever, or diarrhea. The patient's only known regular medication was oral levetiracetam for seizure prophylaxis. No history of inflammatory bowel disease was reported. A prior intra-abdominal surgical intervention involving the colon had been performed during early childhood, although surgical records were unavailable.

On initial evaluation, the patient was subfebrile (37.8 °C), tachycardic (108 bpm), and normotensive. Abdominal examination revealed marked distension with tympany on percussion and mild diffuse tenderness; there was no guarding or rebound tenderness (Figure 1). Bowel sounds were hypoactive. Digital rectal examination demonstrated a dilated rectum filled with soft fecal material, without palpable masses or evidence of bleeding. Laboratory investigations revealed leukocytosis, with a white blood cell count of 16,400/mm^3, elevated C-reactive protein (64 mg/L), normokalaemia (3.9 mmol/L), and mildly elevated serum creatinine levels (1.3 mg/dL). Serum lactate was measured at 1.61 mmol/L. These findings were consistent with a systemic inflammatory response but without evidence of metabolic acidosis or organ failure.

An upright abdominal radiograph (Figure 2) demonstrated severe colonic distension without evidence of pneumoperitoneum. Contrast-enhanced computed tomography (CT) of the abdomen confirmed diffuse dilatation of the colon from the cecum to the sigmoid colon, with a cecal diameter of approximately 9.2 cm and sigmoid colon dilation measuring approximately 9.0 cm (Figure 3). The rectum was also distended and filled with fecal content. No mechanical obstruction, transition zone, bowel wall thickening, volvulus, ascites, or pneumoperitoneum was observed. The small bowel was of normal caliber. The patient was diagnosed with Ogilvie's syndrome based on clinical and radiologic findings. The differential diagnoses included mechanical obstruction secondary to volvulus or adhesions and paralytic ileus; however, these were

Figure 1. Patient's distended abdomen on arrival

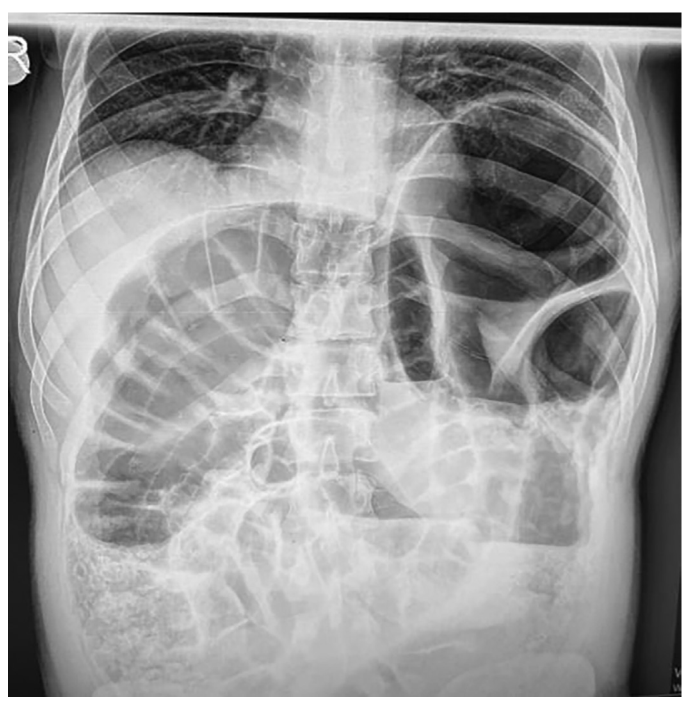

Figure 2. Plain X-ray of the patient

deemed unlikely based on the absence of a transition point or obstructive lesion on contrast-enhanced CT, the standard caliber of the small intestine, and the lack of bowel wall thickening or pneumoperitoneum. Due to the absence of a gastroenterologist at our institution, specialist consultation was not available.

Conservative management was initiated. The patient was kept nil per os, and intravenous fluid resuscitation was commenced. Electrolyte levels were monitored and maintained within normal limits. A nasogastric tube was inserted for proximal decompression, and a rectal tube was placed for distal evacuation. Rectal decompression resulted in a substantial release of gas and liquid feces, with considerable clinical improvement noted within 24 hours. Pharmacological management included intravenous metoclopramide administered at a dose of 10 mg every 8 hours, as neostigmine was unavailable at the facility. Additionally, empirical antibiotic therapy was initiated with 1 g of intravenous ceftriaxone every 12 hours and 500 mg of intravenous metronidazole every 8 hours to cover potential translocation-related enteric pathogens, given the degree of colonic distension and systemic inflammation. Surgical and endoscopic interventions were not required. On day 1, there was notable clinical improvement, accompanied by the resolution of mild tenderness. Clinical improvement continued over the subsequent 48 hours, with normalization of bowel sounds and resolution of abdominal distension. Oral intake was gradually reintroduced and was well tolerated at day 3. The patient was discharged from hospital on day 4 in a stable condition with a structured bowel regimen, including daily oral polyethylene glycol and caregiver instructions on monitoring bowel activity and signs of recurrence (Figure 4). The patient was referred for outpatient colonoscopic evaluation and surgical follow-up. No recurrence of symptoms was noted during early post-discharge follow-up, and the patient was evaluated in a surgical outpatient clinic 15 days post-discharge, with no complaints of abdominal distension or altered bowel habits.

Figure 3. Computerized tomography images of the abdomen

Discussion

Ogilvie's syndrome, or acute colonic pseudo-obstruction, is a rare but potentially life-threatening cause of colonic distension in the absence of a mechanical obstruction.[1] It typically presents in elderly or postoperative patients with multiple comorbidities, particularly those with infections, trauma, or pharmacological triggers such as opioids or anticholinergic agents.[2,5] The underlying pathophysiology involves a functional imbalance in autonomic regulation of the colon, where suppressed

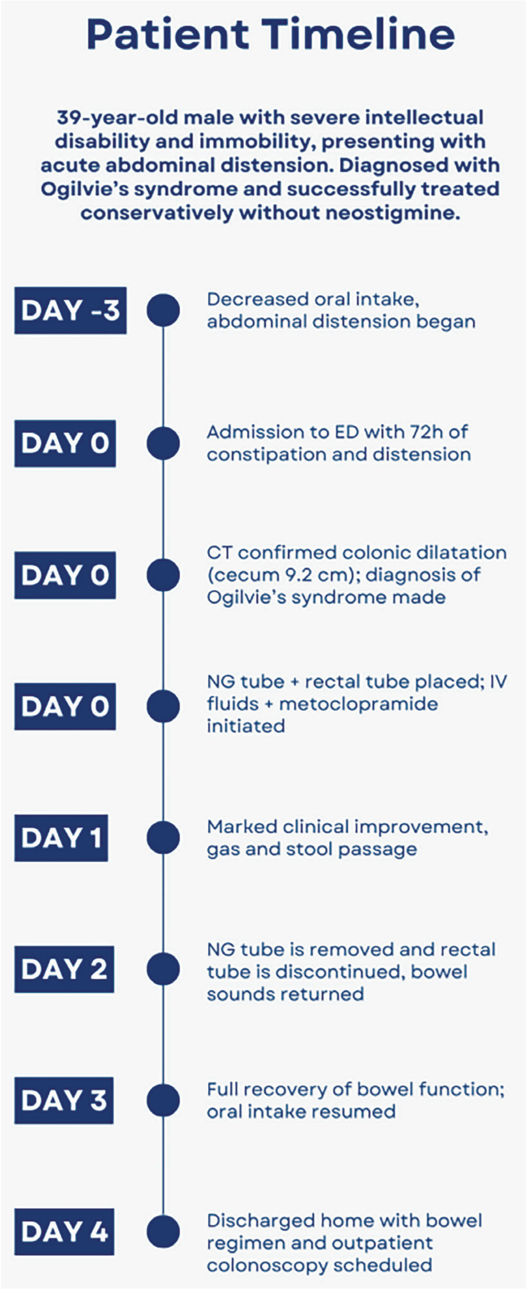

Figure 4. Patient timeline

parasympathetic or excessive sympathetic activity leads to colonic hypomotility.[1,2] Although uncommon in younger populations, Ogilvie's syndrome may occur in individuals who are neurologically impaired or chronically immobilized, where baseline autonomic dysfunction and decreased peristaltic tone can contribute to pseudo-obstruction.[6,7] Our patient -a 39-year-old man with severe intellectual disability and chronic immobility- exemplifies this atypical demographic. The presence of prior abdominal surgery, possibly colonic in nature, introduces an additional but undefined risk factor, although no evidence of mechanical obstruction or adhesions was noted radiologically. An additional challenge in the management of this case was the patient's non-verbal status, which necessitated that clinical history and treatment response be assessed through close collaboration with his legal guardians and primary caregivers, who were actively involved throughout the decision-making process.

Clinical presentation typically includes abdominal distension, hypoactive bowel sounds, and systemic features such as low-grade fever or tachycardia, without overt peritonitis. In this case, the absence of guarding or rebound tenderness, along with a distended but soft abdomen, supported a functional rather than surgical etiology. The most feared complications -colonic ischemia and perforation- are closely associated with cecal diameters exceeding 12 cm or prolonged dilation exceeding 6 days.[8] Our patient's cecum measured 9.2 cm, placing him at intermediate risk. Imaging plays a pivotal role in diagnosis. Although plain abdominal films can suggest colonic dilation, contrast-enhanced CT is the gold standard for excluding obstruction, volvulus, or perforation.[9] Our CT findings demonstrated diffuse colonic distension without a transition point or signs of bowel wall compromise, consistent with Ogilvie's syndrome. Notably, the rectum was also dilated and filled with feces, helping to exclude Hirschsprung disease or acute toxic megacolon.

Standard initial management includes bowel rest, intravenous fluid therapy, electrolyte correction -particularly of potassium and magnesium- and gastrointestinal decompression.[1] The prokinetic agent neostigmine is the pharmacological treatment of choice for medically stable patients without contraindications, with reported success rates of 60%-90%.[3,10] However, in this case, neostigmine was not available. Instead, a regimen of nasogastric decompression, rectal tube placement, and metoclopramide was used. Although metoclopramide has not been validated in high-quality trials for Ogilvie's syndrome, it may offer some prokinetic benefit and has been used in resource-limited settings.[11] In this case, rectal tube decompression produced substantial clinical improvement, consistent with findings from case series in which mechanical decompression alone resolved pseudo-obstruction in select patients.[12,13] Endoscopic decompression or surgery is typically reserved for refractory cases or those complicated by signs of ischemia or peritonitis.[1]

To contextualize this case, we compared it with previously published reports of Ogilvie's syndrome, including cases, reviews, and meta-analyses in individuals who are younger or neurologically impaired. Table 1 summarizes the clinical characteristics, treatment modalities, and outcomes of similar publications reported in the literature.[3,10,11,14-18] This case represents one of the few cases successfully managed without neostigmine in a young adult with neurodevelopmental disability.

This case adds to the limited literature on Ogilvie's syndrome in younger individuals with neurodevelopmental disability,

Table 1. Literature review of selected case reports on acute colonic pseudo-obstruction, focusing on age, neurological comorbidities, neostigmine availability, treatment approaches, and outcomes

Author (year)	Age	Mental status/risk factor	Neostigmine used	Treatment approach	Outcome
Ponec et al.[3]	64	Normal	Yes	Neostigmine	Recovery
Valle and Godoy.[10]	71	Normal	Yes	Neostigmine	90% success
Batke and Cappell.[11]	82	Alzheimer's	No	Rectal tube, IV fluids	Delayed recovery
Wilczyński and Śnieżyński J.[14]	30	Pregnancy	No	Conservative, then surgery	Recovery
Du et al. (2024) [15]	32	Normal	No	Conservative	Recovery
Dewey and Prahlow.[16]	19	Cerebral palsy, autism	No	Not specified	Death
Zimna et al.[17]	69	Multiple comorbidities	Yes	Neostigmine	Recovery
Ali et al.[18]	27	Psychosis, immobility	No	Conservative: rectal tube + fluids	Recovery (within 72 hours)
The present study (2025)	39	Intellectual disability, immobility	No	Rectal + NG tube + metoclopramide	Recovered in 4 days

IV: Intravenous, NG: Nasogastric

a population in whom diagnosis is often delayed due to communication barriers and atypical presentations. Clinicians should maintain a high index of suspicion when evaluating progressive abdominal distension in such patients. Importantly, this case illustrates that in the absence of pharmacological agents such as neostigmine, conservative non-pharmacological interventions -including mechanical decompression and supportive care- can result in successful resolution. We believe this case reinforces the potential effectiveness of conservative management in carefully selected patients and highlights the importance of individualized, context-sensitive care in resource-limited settings.

Ethics

Informed Consent: Informed consent and consent for publication were obtained from the legal guardians of the patient described in this case.

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.B.T., Concept: M.B.T., V.B.T., Design: M.B.T., V.B.T., Data Collection or Processing: M.B.T., V.B.T., Analysis or Interpretation: M.B.T., V.B.T., Literature Search: M.B.T., V.B.T., Writing: M.B.T., V.B.T.

Conflict of Interest: The authors declare that they have no conflicts of interest relevant to the content of this article.

Financial Disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Saunders MD, Kimmey MB. Systematic review: acute colonic pseudo-obstruction. Aliment Pharmacol Ther. 2005;22:917-925.
2. De Giorgio R, Knowles CH. Acute colonic pseudo-obstruction. Br J Surg. 2009;96:229-239.
3. Ponec RJ, Saunders MD, Kimmey MB. Neostigmine for the treatment of acute colonic pseudo-obstruction. N Engl J Med. 1999;341:137-141.
4. Vanek VW, Al-Salti M. Acute pseudo-obstruction of the colon (Ogilvie's syndrome). An analysis of 400 cases. Dis Colon Rectum. 1986;29:203-210.
5. Palmer SE, McLean RM, Ellis PM, Harrison-Woolrych M. Life-threatening clozapine-induced gastrointestinal hypomotility: an analysis of 102 cases. J Clin Psychiatry. 2008;69:759-768.
6. Saunders MD. Acute colonic pseudo-obstruction. Best Pract Res Clin Gastroenterol. 2007;21:671-687.
7. Wells CI, O'Grady G, Bissett IP. Acute colonic pseudo-obstruction: a systematic review of aetiology and mechanisms. World J Gastroenterol. 2017;23:5634-5644.
8. Alavi K, Poylin V, Davids JS, Patel SV, Felder S, Valente MA, Paquette IM, Feingold DL; Prepared on behalf of the Clinical Practice Guidelines Committee of the American Society of Colon and Rectal Surgeons. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the management of colonic volvulus and acute colonic pseudo-obstruction. Dis Colon Rectum. 2021;64:1046-1057.
9. Pereira P, Djeudji F, Leduc P, Fanget F, Barth X. Ogilvie's syndrome-acute colonic pseudo-obstruction. J Visc Surg. 2015;152:99-105.
10. Valle RG, Godoy FL. Neostigmine for acute colonic pseudo-obstruction: a meta-analysis. Ann Med Surg (Lond). 2014;3:60-64.
11. Batke M, Cappell MS. Adynamic ileus and acute colonic pseudo-obstruction. Med Clin North Am. 2008;92:649-670.
12. Sloyer AF, Panella VS, Demas BE, Shike M, Lightdale CJ, Winawer SJ, Kurtz RC. Ogilvie's syndrome. Successful management without colonoscopy. Dig Dis Sci. 1988;33:1391-1396.
13. Geller A, Petersen BT, Gostout CJ. Endoscopic decompression for acute colonic pseudo-obstruction. Gastrointest Endosc. 1996;44:144-150.
14. Wilczyński B, Śnieżyński J. Ogilvie's syndrome in a patient at 23 weeks of pregnancy: report of a rare case with successful surgical intervention. Am J Case Rep. 2023;24:e941283.
15. Du C, Iftikhar N, Ganti L, Smith-Gonzalez A. Acute colonic pseudo-obstruction: a case of Ogilvie syndrome. Cureus. 2024;16:5.
16. Dewey J, Prahlow JA. Acute colonic pseudo-obstruction (Ogilvie syndrome) leading to respiratory compromise and death. J Forensic Sci. 2021;66:2515-2520.
17. Zimna AI, Wróblewski H, Wróblewska K, Dziurowicz BT, Zygmunt E. A 69-year-old patient with Ogilvie's syndrome-case report. J Pre Clin Clin Res. 2023;17:109-112.
18. Ali MM, Al Saeed M, Ebrahim M, Mandeel F. Mortality due to complications associated with acute Ogilvie's syndrome in an older adult treated for psychosis: a case report. Cureus. 2023;15:e51389.

DOI: 10.4274/tjcd.galenos.2025.2025-9-8
Turk J Colorectal Dis 2026;36(1):32-33

LETTER TO THE EDITOR

Radiomics-based Artificial Intelligence in Rectal Cancer: Pathway to Surgical Integration

Alpaslan Şahin

University of Health Science Türkiye, Hamidiye Faculty of Medicine, Konya City Hospital, Department of General Surgery, Konya, Türkiye

Keywords: Rectal cancer, radiomics-based artificial intelligence, neoadjuvant chemoradiotherapy, magnetic resonance imaging-based radiomics, pathologic complete response

Dear Editor,

Accurate evaluation of tumor response after neoadjuvant chemoradiotherapy (nCRT) is pivotal in managing locally advanced rectal cancer. Identifying patients who achieve a pathological complete response (pCR) enables the implementation of organ-preserving strategies such as watch and wait, thereby reducing morbidity and improving quality of life. Because pCR is linked to survival and lower recurrence, precise prediction is essential. However, conventional tools, such as clinical examination, endoscopy, and magnetic resonance imaging (MRI), show limited sensitivity and considerable interobserver variation, and optimized MRI fails to distinguish clinical from true pCR, complicating surgical decision-making.[1,2]

Radiomics offers a promising solution by extracting quantitative MRI-based features that yield biomarkers of tumor heterogeneity and treatment-related change. Machine learning analyzes these data, detecting texture, entropy, or morphologic patterns suggestive of residual disease, fibrosis, or necrosis. Such biomarkers refine the distinction between clinical and pathological response, although standardized methods and prospective validation remain prerequisites for clinical adoption.[3,4]

Evidence for radiomics is expanding rapidly. A recent meta-analysis encompassing over 10,000 patients across 35 studies reported a pooled area under the curve of approximately 0.87 for predicting pCR, highlighting promising potential but also marked heterogeneity among included datasets.[5] Bourbonne et al.[6] synthesized multicenter evidence supporting multiparametric MRI radiomics, and Feng et al.[7] developed a multicenter radio-pathomics model, externally and prospectively validated, demonstrating strong discrimination and careful calibration. El Homsi et al.[2] reported high-performance models incorporating deep learning within MRI radiomics. Crimì et al.[3] confirmed the added value of diffusion-weighted imaging, whereas Wang et al.[4] suggested that preprocessing variations may have only limited impact on predictive performance. Collectively, these studies underscore both the promise and the fragility of current approaches.

Post-treatment imaging has also been investigated. Lee et al.[8] demonstrated that post-nCRT T2 radiomics correlated with tumor regression grade, guiding non-operative selection. Meng et al.[9] built a multi-sequence multi-regional model for lymph node metastasis, complementing risk stratification, and Peng introduced spatiotemporal radiomics to refine surgical timing.[10]

Despite encouraging progress, substantial barriers remain. The absence of standardized imaging protocols, consistent segmentation techniques, and unified feature extraction pipelines continues to limit reproducibility across institutions. Although frameworks such as the Transparent Reporting of a multivariable prediction model for Individual Prognosis or Diagnosis - Artificial Intelligence (AI), the Radiomics Quality

Address for Correspondence: Alpaslan Şahin, M.D., University of Health Science Türkiye, Hamidiye Faculty of Medicine, Konya City Hospital, Department of General Surgery, Konya, Türkiye
E-mail: alpaslan.sahin@sbu.edu.tr **ORCID ID:** orcid.org/0000-0001-5707-1203
Received: 30.09.2025 **Accepted:** 25.10.2025 **Publication Date:** 31.03.2026

Cite this article as: Şahin B. Radiomics-based artificial intelligence in rectal cancer: pathway to surgical integration. Turk J Colorectal Dis. 2026;36(1):32-33

Score, and the Checklist for AI in Medical Imaging have been developed to promote methodological transparency and standardization, adherence remains inconsistent. Most published studies are retrospective, single-center, and statistically underpowered for regulatory assessment. Interpretability also poses a challenge, as many algorithms operate as "black boxes," reducing clinicians confidence in their practical reliability. Early research by He and El Homsi suggests that temporal radiomics and explainable AI techniques, including attention mapping and feature saliency analyses, may enhance trust, yet these approaches remain underutilized. The principal obstacles to clinical translation involve the lack of standardized acquisition protocols, reproducible segmentation workflows, and harmonized feature extraction methods across centers. Effective clinical integration will ultimately depend on access to advanced imaging, reliable segmentation, automated analysis pipelines, and user-friendly interfaces embedded within routine healthcare systems.

From a surgical perspective, radiomics should augment decision-making rather than replace expertise. By providing objective biomarkers, these tools can refine surgical timing, tailor resections, and support non-operative strategies in selected patients. Future uses may include intraoperative navigation, integration with genomics and pathology, and personalized simulation platforms. Translation to clinical practice will depend less on algorithmic novelty than on rigorous validation, transparent reporting, and multidisciplinary integration. Radiomics-based AI is not a substitute for surgical judgment but a pathway toward more precise, individualized, and patient-centered rectal cancer management. The convergence of radiomics-based AI with digital pathology, molecular profiling, and intraoperative imaging may redefine precision surgery by transforming tumor assessment from static imaging into a dynamic understanding of disease biology. For surgeons, these advances offer a chance to shape future decision-making through data-driven, cross-disciplinary collaboration.

Footnotes

Conflict of Interest: No conflict of interest was declared by the author.

Financial Disclosure: The author declared that this study received no financial support.

REFERENCES

1. He J, Wang SX, Liu P. Machine learning in predicting pathological complete response to neoadjuvant chemoradiotherapy in rectal cancer using MRI: a systematic review and meta-analysis. Br J Radiol. 2024;97:1243-1254.
2. El Homsi M, Bane O, Fauveau V, Hectors S, Vietti Violi N, Sylla P, Ko HB, Cuevas J, Carbonell G, Nehlsen A, Vanguri R, Viswanath S, Jambawalikar S, Shaish H, Taouli B. Prediction of locally advanced rectal cancer response to neoadjuvant chemoradiation therapy using volumetric multiparametric MRI-based radiomics. Abdom Radiol (NY). 2024;49:791-800.
3. Crimì F, D'Alessandro C, Zanon C, Celotto F, Salvatore C, Interlenghi M, Castiglioni I, Quaia E, Pucciarelli S, Spolverato G. A machine learning model based on MRI radiomics to predict response to chemoradiation among patients with rectal cancer. Life (Basel). 2024;14:1530.
4. Wang J, Chen J, Zhou R, Gao Y, Li J. Machine learning-based multiparametric MRI radiomics for predicting poor responders after neoadjuvant chemoradiotherapy in rectal Cancer patients. BMC Cancer. 2022;22:420.
5. Rai J, Mai DVC, Drami I, Pring ET, Gould LE, Lung PFC, Glover T, Shur JD, Whitcher B, Athanasiou T, Jenkins JT. MRI radiomics prediction modelling for pathological complete response to neoadjuvant chemoradiotherapy in locally advanced rectal cancer: a systematic review and meta-analysis. Abdom Radiol (NY). 2025;50:5103-5123.
6. Bourbonne V, Schick U, Pradier O, Visvikis D, Metges JP, Badic B. Radiomics approaches for the prediction of pathological complete response after neoadjuvant treatment in locally advanced rectal cancer: ready for prime time? Cancers (Basel). 2023;15:432.
7. Feng L, Liu Z, Li C, Li Z, Lou X, Shao L, Wang Y, Huang Y, Chen H, Pang X, Liu S, He F, Zheng J, Meng X, Xie P, Yang G, Ding Y, Wei M, Yun J, Hung MC, Zhou W, Wahl DR, Lan P, Tian J, Wan X. Development and validation of a radiopathomics model to predict pathological complete response to neoadjuvant chemoradiotherapy in locally advanced rectal cancer: a multicentre observational study. Lancet Digit Health. 2022;4:e8-e17.
8. Lee YD, Kim HG, Seo M, Moon SK, Park SJ, You MW. Machine learning-based response assessment in patients with rectal cancer after neoadjuvant chemoradiotherapy: radiomics analysis for assessing tumor regression grade using T2-weighted magnetic resonance images. Int J Colorectal Dis. 2024;39:78.
9. Meng Y, Ai Q, Hu Y, Han H, Song C, Yuan G, Hou X, Weng W. Clinical development of MRI-based multi-sequence multi-regional radiomics model to predict lymph node metastasis in rectal cancer. Abdom Radiol (NY). 2024;49:1805-1815.
10. Peng J, Wang W, Jin H, Qin X, Hou J, Yang Z, Shu Z. Develop and validate a radiomics space-time model to predict the pathological complete response in patients undergoing neoadjuvant treatment of rectal cancer: an artificial intelligence model study based on machine learning. BMC Cancer. 2023;23:365.

DOI: 10.4274/tjcd.galenos.2025.2025-10-1
Turk J Colorectal Dis 2026;36(1):34-35

LETTER TO THE EDITOR

Use of Platelet-rich Plasma in the Treatment of Pilonidal Disease

Barış Sevinç

Uşak University Medical School, Department of General Surgery, Uşak, Türkiye

Keywords: Pilonidal disease, platelet-rich plasma, proctology, surgery

Dear Editor,

I read with great interest the article entitled "Controversies in the Management of Pilonidal Disease: Expert Recommendations from a Modified Delphi Survey and Review of the Literature" by Arslan et al.[1], which was recently published in your journal. The authors have provided valuable insights into treatment options for pilonidal sinus disease and have contributed to the ongoing discussion on optimizing management strategies for this condition.

However, one important point that I believe deserves mention is the role of platelet-rich plasma (PRP) in pilonidal sinus treatment. PRP has been increasingly studied as a minimally invasive method that promotes wound healing and reduces recurrence rates.[2,3] Several recent studies have reported encouraging outcomes with PRP plus curettage. The role of PRP in the treatment of pilonidal disease (PD) has also been described in a book chapter.[4] Moreover, combining PRP with other surgical techniques has shown promising results.[5] A recent systematic review concluded that PRP can be used as an adjuvant treatment in PD surgery to improve therapeutic outcomes and reduce adverse events.[6] That review included nine studies using PRP as an adjunct to surgical or minimally invasive methods and demonstrated a shorter healing time with PRP use, including in open surgical approaches. Additionally, it found that minimally invasive procedures combined with multiple PRP applications achieved more positive outcomes.

Another systematic review and meta-analysis by Brewer et al.[7] reported reduced healing time, postoperative pain, and time off work with PRP application. As heterogeneity in PRP preparation and application methods remains a major limitation, both reviews emphasized the need for well-designed, high-powered, randomized controlled trials.

In my opinion, the omission of PRP from the discussion leaves out a potentially useful therapeutic option that could further enrich the perspective offered by the article. Including data on PRP-based management would provide readers with a more comprehensive overview of the current treatment landscape for pilonidal sinus disease.

Footnotes

Conflict of Interest: No conflict of interest was declared by the author.

Financial Disclosure: The author declared that this study received no financial support.

REFERENCES

1. Arslan Ç, Tatar C, Erol T, Smeenk R, Immerman S, Wysocki P, Toorenvliet B, Chiu B, Yıldırım Y, Bişgin T, Kozan R, Maeda Y, Abbas MA. Controversies in the management of pilonidal disease: expert recommendations from a modified Delphi survey and review of the literature. Turk J Colorectal Dis. 2025;35:79-92.
2. Sevinç B, Damburacı N, Karahan Ö. Long term results of minimally invasive treatment of pilonidal disease by platelet rich plasma. J Visc Surg. 2020;157:33-35.
3. Sevinç B, Damburaci N, Karahan Ö. Comparison of curettage plus platelet-rich plasma gel and curettage plus phenol application in treatment

Address for Correspondence: Barış Sevinç, MD, Uşak University Medical School, Department of General Surgery, Uşak, Türkiye
E-mail: drbarissevinc@gmail.com **ORCID ID:** orcid.org/0000-0001-5878-6649
Received: 02.10.2025 **Accepted:** 18.10.2025 **Publication Date:** 31.03.2026
Cite this article as: Sevinç B. Use of platelet-rich plasma in the treatment of pilonidal disease. Turk J Colorectal Dis. 2026;36(1):34-35

of pilonidal sinus disease: a randomized trial. Dis Colon Rectum. 2022;65:735-741.

4. Sevinç B. Platelet-rich plasma in der Therapie des Sinus pilonidalis in Chirurgie des Sinus pilonidalis.Berlin; Springer. 2024:123-132.

5. Chousein B, Olcucuoglu E, Kaya IO. The power of platelet-rich plasma on operated pilonidal disease: a prospective randomized controlled trial. Ann Surg Treat Res. 2025;108:124-134.

6. Zhuang Y, Feng WZ. Platelet-rich plasma for pilonidal disease: a systematic review. J Int Med Res. 2023;51:3000605231216590.

7. Brewer CF, Correia IFS, Miranda BH. Platelet-rich plasma (PRP) for sacrococcygeal pilonidal disease: an updated systematic review and meta-analysis.World J Surg. 2022;46:2910-2918

DOI: 10.4274/tjcd.galenos.2026.2026-2-5
Turk J Colorectal Dis 2026;36(1):36-37

LETTER TO THE EDITOR

Advancing Evidence-Based Management of Pilonidal Sinus Disease: The Need for Structured Scientific Collaboration

Dietrich Doll

St. Marys Hospital Vechta, Academic Teaching Hospital of MH Hannover, Department of Procto-Surgery and Pilonidal Sinus, Vechta, Germany

Keywords: International PiloNerds Network, pilonidal sinus surgery, scientific surgery

Dear Editor,

Pilonidal sinus disease (PSD) affects large numbers of predominantly young patients worldwide, yet continues to be characterized by heterogeneous surgical approaches, inconsistent outcome definitions, and insufficient long-term follow-up. For such a high-volume condition, fragmented evidence is no longer sustainable.

At a time of rising patient numbers and increasing expectations for evidence-based care, scientifically grounded management of PSD has become more necessary than ever.

Importantly, PSD represents a substantial burden among adolescents and young adults in Türkiye, underscoring the urgency for structured, evidence-driven management strategies. At the same time, the growing number of high-quality Turkish publications reflects increasing national awareness and commendable academic engagement in this field.[1]

The Turkish Journal of Colorectal Disease contributes meaningfully to this evolving landscape by providing a respected academic platform for colorectal and pilonidal research. Together with other dedicated international journals and investigators, it helps sustain scientific focus on a disease that has long been underestimated.

This momentum is further reflected by the Turkish Congress for Pilonidal Disease 2025 in İstanbul, which represents a strong signal of national commitment to advancing pilonidal science and clinical care. However, publications and scientific meetings alone are not sufficient to resolve the methodological challenges that continue to limit comparability and long-term progress in this field.

The next step forward requires structured collaboration: harmonized definitions, meaningful long-term outcome assessment, shared datasets, and transparent comparison of surgical strategies across centers and countries.

PiloNERDs International (Pilonidal Network for Expertise, Research, and Development) represents one such initiative. As a clinician-led, globally connected framework, it seeks to facilitate coordinated multicenter research, methodological alignment, and transparent outcome reporting. By encouraging collaboration across institutions, it aims to support the development of more robust evidence and clearer standards in the management of PSD.

Recent multicenter analyses conducted within this collaborative framework have examined long-term outcomes of established techniques and the impact of surgical case load on recurrence rates, contributing to a more data-driven understanding of pilonidal disease management.[2,3]

Clinicians and researchers committed to strengthening methodological rigor and collaborative research in pilonidal disease may consider engaging in structured international initiatives that promote standardized reporting and shared scientific development.

Address for Correspondence: Prof. Dietrich Doll, St. Marys Hospital Vechta, Academic Teaching Hospital of MH Hannover, Department of Procto-Surgery and Pilonidal Sinus, Germany
E-mail: pilonerds@gmail.com **ORCID ID:** orcid.org/0000-0001-9832-4545
Received: 18.02.2026 **Accepted:** 30.03.2026 **Publication Date:** 31.03.2026

Cite this article as: Doll D. Advancing evidence-based management of pilonidal sinus disease: the need for structured scientific collaboration. Turk J Colorectal Dis. 2026;36(1):36-37

Footnotes

Financial Disclosure: The author declared that this study received no financial support.

REFERENCES

1. Doll D, Stauffer V, Diekmann M, Van Wyk P, Luedi MM. Turkey is leading in the 21st century pilonidal sinus disease research. Turk J Surg. 2020;36:284-290.
2. Doll D, Hackmann T, Haas S, Laurberg S; Pilonidal Network for Expertise, Research and Development (PiloNERDs International). Evaluation of outcomes for Karydakis operation for pilonidal sinus disease: comparison of original reports with later results. World J Surg. 2025;49:584-589.
3. Doll D, Maak M, Faurschou IK, Hackmann T, von Sochaczewski CO, Braun-Münker M, Iesalnieks I, Haas S; Pilonidal Network for Expertise, Research and Development (PiloNERDs International). Impact of surgical case load on recurrence rates in pilonidal sinus disease: a cross-study data synthesis. Int J Colorectal Dis. 2025;40:126.

DOI: 10.4274/tjcd.galenos.2025.2025-9-9
Turk J Colorectal Dis 2026;36(1):38-40

TECHNICAL NOTE

Triangular Excision with Advancement Flap in Pilonidal Disease: Technical Pearls for Wider Adoption

Burak Güney

Çerkezköy State Hospital, Clinic of General Surgery, Tekirdağ, Türkiye

ABSTRACT

Triangular excision with an advancement flap is an effective yet underreported technique for pilonidal sinus disease with unilateral superolateral secondary pits, where minimally invasive methods often fail. The inverted triangular design allows complete excision of the sinus cavity and pits, and the defect is closed with a tension-free advancement flap, ensuring rapid recovery. Applicable to disease of varying vertical extent within or beyond the navicular area, this approach preserves healthy tissue and provides a practical alternative to conventional flap procedures.

Indications

The triangular excision and advancement flap is a practical option for PDS with one-sided superolateral secondary pits, particularly when minimally invasive treatments are likely to fail, and accumulated experience supports its safe and effective use while noting design considerations.[1,2]

Method

Starting with marking may be preferable. The right-angled inverted triangular design incorporates unilateral superior secondary pits, the adjacent sinus cavity, and inferior midline primary pits, with a horizontal superior base edge enabling en bloc removal of the upper affected area. The triangle's apex, opposite the base, is located inferolateral to the most inferior pit. The vertical edge lies on the healthy side, approximately 2 cm from the midline (Figure 1). Only a short segment of the hypotenuse crosses the midline, minimizing the healing challenge posed by the dynamic area.[2] Although the vertical edge may appear midline during recovery, it lies on the "hillside" rather than the "valley bottom," reducing exposure to intergluteal mobility, sweat, and moisture (Figure 2).

Figure 1. Upper images: natal cleft exposed with adhesive tapes and prepared with povidone-iodine. Lower images: two cases with a right-sided unilateral sinus cavity and a secondary pit included within a right-angled triangular marking, along with the midline primary pits

It is important to ensure that the flap is applied with minimum tension. A horizontal incision, equal to or slightly longer than the triangular excision's base, creates a triangular peninsular

Address for Correspondence: Burak Güney MD, Çerkezköy State Hospital, Clinic of General Surgery, Tekirdağ, Türkiye
E-mail: buraquney@gmail.com **ORCID ID:** orcid.org/0000-0003-0468-3673
Received: 03.10.2025 **Accepted:** 16.11.2025 **Publication Date:** 31.03.2026

Cite this article as: Güney B. Triangular excision with advancement flap in pilonidal disease: technical pearls for wider adoption. Turk J Colorectal Dis. 2026;36(1):38-40

Figure 2. Although the incision appears to lie along the longitudinal axis in the natal cleft, its design incorporates a slight obliquity, facilitating faster healing. Images are from postoperative day 15

fasciocutaneous flap. Meticulous dissection separates fatty tissue from the gluteus maximus muscle, and the broad base of the flap maintains vascular supply despite some perforator loss. After releasing the navicular area exposer hip tapes, flap edges are aligned and overlapped with the excision margins. The defect is closed with thick polyglactin sutures through the presacral fascia encountered after total sinus excision. In wide defects, pre-suturing placement of a closed-suction drain prevents suture interference (Figure 3). This technique is applicable to pilonidal sinus disease (PDS) of varying vertical extent, including unilateral secondary pits beyond or inside the navicular area, which represent a frequently observed clinical presentation.[3] Dog ears at the superior corner of the triangular flap base often result from extra gluteal mobilization, overlapping the apex with the opposite corner, but this can be corrected. Placement of a few sutures can draw the corner inward, allowing apex alignment with less mobilization and reduced tension, thus promoting faster healing (Figure 4).

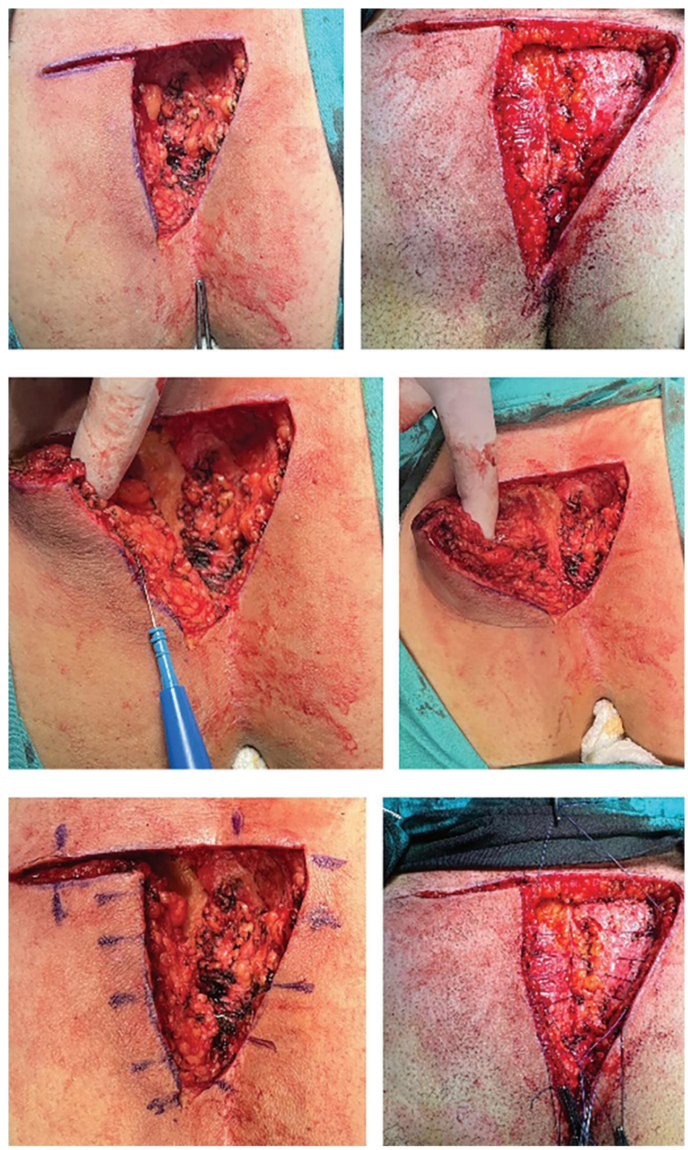

Figure 3. Defect margins aligned with markings before suturing following meticulous dissection of the fasciocutaneous flap from the gluteus maximus for tension-free closure after en bloc cyst excision

Comparison With Other Methods

In cases of superior unilateral pits extending far laterally, the Bascom cleft lift, similar to the rhomboid excision with a modified Limberg flap, requires a relatively wide excision of healthy tissue, which may prolong wound healing and increase the risk of postoperative complications.[1,3,5] By contrast, triangular excision with an advancement flap minimizes unnecessary tissue removal. When adequate mobilization allows for a tension-free closure, healing tends to be rapid (Figure 2). Furthermore, the resulting minimal subcutaneous dead space and the total excision of omissible midline primary pits with this technique may further contribute to a lower risk of recurrence.[1,4] This technique allows efficient closure and minimal sacrifice of healthy tissue, which may be advantageous in managing PDS with unilaterally extending secondary pits. In this

Figure 4. Dog-ear deformities are prevented by a few sutures at the healthy corner, reducing tension and flap apex advancement distance; horizontal incision may be extended 45° cranio-laterally if correction is needed

series of 26 patients, including 4 recurrent cases amenable to this technique, all of whom provided written informed consent for publication and underwent surgery between May 2016 and September 2025, no recurrences or major early postoperative complications occurred during follow-up. These findings support previous reports suggesting that limited excision of perianal tissue may reduce the risk of perianal complications.[1] This technical note seeks to encourage broader acceptance of this non-mainstream procedure.

Acknowledgments

I sincerely thank my senior colleagues at the former Okmeydanı Training and Research Hospital for introducing me to this technique, which I have had the opportunity to refine and improve over the course of more than a decade of clinical experience.

Ethics

Informed Consent: Written informed consent was obtained from all patients for publication of their data and images.

Footnotes

Financial Disclosure: The author declared that this study received no financial support.

REFERENCES

1. Kızıltoprak N, Turan İ, Mazlum AF, Genç MS, Kalın M, Ercan G, Kesici U. Triangle excision and advancement flap in pilonidal disease: a single-center prospective case series. Turk J Colorectal Dis. 2024;34:69-74.
2. Doll D, Maak M. Refining the triangle advancement flap technique for pilonidal sinus disease: a commentary on Kiziltoprak et al. Turk J Colorectal Dis. 2024;34:145-146.
3. Guner A, Cekic AB, Boz A, Turkyilmaz S, Kucuktulu U. A proposed staging system for chronic symptomatic pilonidal sinus disease and results in patients treated with stage-based approach. BMC Surg. 2016;16:18.
4. Wysocki AP, Andersson RE, Gips M, Girgin M, Guner A, Immerman S, Kanat BH, Kayaalp C, Milone M, Petersen S, Senapati A, Tezel E, Doll D. Towards a classification for sacrococcygeal pilonidal disease – Berlin 2017. Pilonidal Sinus J. 2018;4:5-12.
5. Shrager B. The data mounts: 261 cleft lifts for complex pilonidal disease and excisional failures. Cureus. 2023;15:e50174.