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Research Article

FACTORS ASSOCIATED WITH POSTOPERATIVE URINARY RETENTION AFTER SIGMOID COLON AND RECTAL CANCER SURGERY IN MEN: THE ROLE OF BENIGN PROSTATIC HYPERPLASIA, PROSTATE ENLARGEMENT, AND TUMOR LEVEL

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ABSTRACT

Objective: Postoperative urinary retention (POUR) is a frequent complication after colorectal surgery and may adversely affect postoperative recovery. This study aimed to evaluate factors independently associated with POUR in male patients undergoing surgery for sigmoid colon or rectal adenocarcinoma, with particular emphasis on benign prostatic hyperplasia (BPH), prostate enlargement, and tumor level.

Materials and Methods: This retrospective cohort study included 111 male patients who underwent emergency or elective resection for sigmoid colon or rectal adenocarcinoma between January 2022 and December 2025. POUR was defined as failure to void after catheter removal requiring recatheterization. Multivariable logistic regression analysis was performed to identify factors independently associated with POUR. A sensitivity analysis was conducted by replacing clinical BPH with CT-defined prostate enlargement (prostate volume ≥30 mL).

Results: POUR occurred in 32 patients (28.8%). In the main multivariable model, increasing age (OR: 1.08, 95% CI: 1.02–1.15; p=0.015), preoperative BPH (OR: 16.85, 95% CI: 5.05–56.23; p<0.001), and middle/lower rectal tumor location (OR: 8.00, 95% CI: 2.02–31.76; p=0.003) were independently associated with POUR. In the sensitivity model, CT-defined prostate enlargement remained independently associated with POUR (OR: 3.31, 95% CI: 1.13–9.71; p=0.030).

Conclusion: POUR was observed in nearly one-third of male patients undergoing sigmoid colon or rectal cancer surgery. Increasing age, preoperative BPH, prostate enlargement, and middle/lower rectal tumor location were independently associated with POUR. Integration of preoperative urological assessment and tumor-level evaluation may improve risk stratification and support individualized perioperative bladder management in high-risk patients.

Keywords: Urinary Retention, Colorectal Neoplasms, Rectal Neoplasms, Prostatic Hyperplasia, Prostate, Postoperative Complications

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INTRODUCTION

Postoperative urinary retention (POUR) is a common and clinically significant complication following colorectal surgery, particularly in male patients undergoing resection for sigmoid colon and rectal cancer (1). Defined as the inability to void spontaneously after urinary catheter removal necessitating recatheterization, POUR contributes to patient discomfort, increased risk of urinary tract infections, delayed mobilization, prolonged hospitalization, and overall increased healthcare burden (2,3). Despite its clinical relevance, the multifactorial pathophysiology of POUR remains incompletely understood, involving an interplay of patient-related factors, surgical technique, anesthetic management, and perioperative care (4).

Pelvic autonomic nerve injury during rectal cancer surgery is a key contributor to POUR (5). The extent of pelvic dissection, especially in mid and low rectal tumors requiring total mesorectal excision (TME), predisposes to disruption of the hypogastric and pelvic splanchnic nerves, which are critical for coordinated bladder function (6). Consequently, tumor location within the rectum is a recognized risk factor, with mid and low rectal tumors associated with higher rates of POUR compared to sigmoid or upper rectal tumors (7).

Male patients are particularly vulnerable due to pre-existing urological conditions such as benign prostatic hyperplasia (BPH), which is highly prevalent with advancing age and can cause bladder outlet obstruction (8). The presence of BPH and prostate enlargement may exacerbate postoperative voiding dysfunction by impairing detrusor contractility and urethral relaxation, thereby increasing the risk of POUR (4). Objective assessment of prostate volume via preoperative imaging, such as computed tomography or ultrasound, offers a reproducible measure to quantify this risk beyond clinical diagnosis alone (9,10). Perioperative analgesic exposure may also influence postoperative voiding function, although such variables should be interpreted in relation to the postoperative clinical course (11).

Although urological disease and lower rectal tumor location have been reported as risk factors for POUR after colorectal surgery, the combined contribution of preoperative urological status and tumor level has not been sufficiently clarified in male patients undergoing surgery for sigmoid colon or rectal cancer (1). In particular, the relative roles of clinically documented BPH, CT-defined prostate enlargement, and middle/lower rectal tumor location remain clinically relevant because these factors can be identified before or during routine preoperative evaluation.

Therefore, this study aimed to evaluate factors associated with POUR in this specific male colorectal cancer surgery cohort, with particular emphasis on preoperative BPH, prostate enlargement, and tumor level.

MATERIALS AND METHODS

Study Design and Setting

This retrospective cohort study was conducted at Trakya University Faculty of Medicine Hospital by the Departments of General Surgery and Urology. The study was approved by the Trakya University Non-Interventional Clinical Research Ethics Committee (approval no: 2026/309) and followed the ethical principles outlined in the Declaration of Helsinki. Owing to the retrospective design, the requirement for informed consent was waived by the ethics committee.

Study Population

The cohort included adult male patients who underwent either emergency or elective resection for histopathologically confirmed sigmoid colon or rectal adenocarcinoma. Patients were required to have complete clinical, operative, pathological, urological, and postoperative follow-up data, including urinary catheter removal and postoperative urinary retention (POUR) status. Routine preoperative screening for urinary tract infection was not performed in all patients. Urinalysis and/or urine culture were obtained when urinary infection was clinically suspected, and patients with confirmed infection received appropriate treatment before surgery. The patient selection process is summarized in Figure 1.

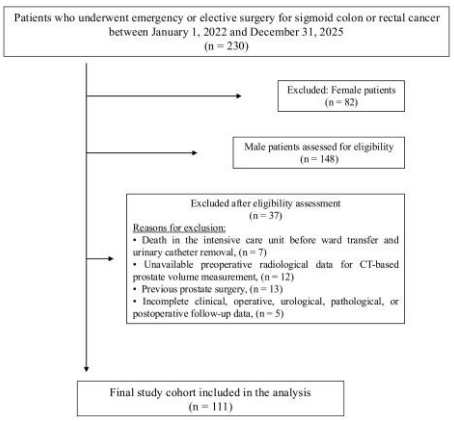

Figure 1 Flow diagram of patient selection. Note. ICU, intensive care unit; CT, computed tomography.

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Inclusion Criteria

- Male sex, age ⩾18 years at surgery
- Histopathological diagnosis of sigmoid colon or rectal adenocarcinoma
- Emergency or elective surgical resection of the primary tumor
- Availability of preoperative urological data, including benign prostatic hyperplasia (BPH) status, prostate-specific antigen (PSA) level, and CT-based prostate volume measurement
- Complete data on catheter removal and POUR status

Exclusion Criteria

- Female sex or age <18 years
- Tumor location outside sigmoid colon or rectum
- Benign colorectal disease or non-adenocarcinoma histology
- Surgery without primary tumor resection (e.g., diverting stoma, bypass, exploratory laparotomy only)
- Recurrent or metachronous colorectal cancer after prior surgery
- History of prostate cancer or prior prostate surgery
- Pre-existing indwelling urinary catheter or neurogenic bladder
- Major pre-existing lower urinary tract pathology (e.g., urethral stricture, bladder neck contracture)
- Incomplete or unclear data regarding catheter removal or POUR

Definitions

- Primary Outcome: Postoperative urinary retention (POUR) was defined as the failure to urinate after catheter removal, requiring reinsertion of a urinary catheter. Recatheterization for reasons other than retention (e.g., urinary fistula) was excluded.

- Urinary Catheter Removal: As part of routine institutional practice, urinary catheter removal after sigmoid colon and rectal surgery was generally planned for postoperative day 4. However, the timing could be advanced or delayed according to the individual patient's clinical course and the treating surgeon's judgment. A formal ERAS-based catheter removal protocol was not routinely applied in this patient population.

- Benign Prostatic Hyperplasia (BPH): Documented clinical diagnosis prior to colorectal surgery.

- Prostate Volume: Prostate volume was measured by a single investigator using the most recent preoperative CT examination performed for colorectal cancer staging. The investigator was blinded to POUR status, clinical follow-up information, and patient-identifying information. Imaging studies were reviewed using study-specific IDs only. Measurements were obtained using the ellipsoid formula: transverse diameter × anteroposterior diameter × craniocaudal diameter × 0.52. CT-defined prostate enlargement was defined as prostate volume ⩾ 30 mL.

- Tumor Location: Categorized as sigmoid colon/upper rectum versus middle/lower rectum to reflect the extent of pelvic dissection and potential autonomic nerve involvement.

- Postoperative Opioid Use: Opioid use was recorded as opioid administration within the first 48 hours and opioid requirement after 48 hours. Opioid requirement after 48 hours was evaluated as a postoperative clinical course variable and was not included in the main multivariable risk factor model.

Data Collection

Data were extracted from electronic medical records, operative reports, pathology records, urology consultations, and imaging archives. Variables collected included demographics (age, body mass index [BMI]), comorbidities (Charlson Comorbidity Index [CCI], American Society of Anesthesiologists [ASA] physical status, smoking, alcohol use, diabetes, hypertension, coronary artery disease, chronic obstructive pulmonary disease, cerebrovascular disease), preoperative urological parameters (BPH diagnosis, prostate volume, PSA, urological medication use), tumor characteristics (location, staging, neoadjuvant therapy), operative details (surgical approach, resection type, operative duration), analgesic use (epidural analgesia, opioid use), postoperative course (catheter removal day, intensive care unit stay, length of hospital stay, postoperative radiotherapy and postoperative chemotherapy), and pathological findings (AJCC 8th edition T, N, M staging, histological subtype, differentiation grade, lymphovascular, perineural, venous invasion, total mesorectal excision quality).

Statistical analysis

Continuous variables were assessed for normality using the Shapiro–Wilk test and visual inspection of distribution plots. Continuous variables were presented as median [interquartile range], and categorical variables were summarized as number (%). Patients were divided into two groups according to the development of postoperative urinary retention. Continuous variables were compared between groups using the Mann–Whitney U test.

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Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Fisher's exact test was preferred for variables with small expected cell counts or multiple categories.

Multivariable binary logistic regression analysis was performed to identify factors independently associated with POUR. Because of the limited number of POUR events, the multivariable model included only a limited set of clinically selected variables to minimize model overfitting. The main model included age, preoperative BPH, and middle/lower rectal tumor location. Results were reported as odds ratios with 95% confidence intervals.

To assess the robustness of the urological risk association, a sensitivity model was constructed by replacing preoperative BPH with CT-defined prostate enlargement, defined as prostate volume $\geqslant 30$ mL. The sensitivity model therefore included age, CT-defined prostate enlargement, and middle/lower rectal tumor location. Preoperative BPH, prostate volume, and PSA were not entered simultaneously into the same model because these variables represent interrelated prostate-related parameters.

Postoperative variables that may occur after or be influenced by POUR, such as length of hospital stay and opioid requirement after 48 hours, were evaluated as clinical course variables and were not included in the multivariable risk factor model. All statistical tests were two-sided, and a p value <0.05 was considered statistically significant. Statistical analyses were performed using jamovi software, version 2.3.21.0.

Table 1. Baseline Demographic, Clinical, and Urological Characteristics According to Postoperative Urinary Retention Status

Variable	No POUR n=79	POUR n=32	p value
Age, years, median [IQR]	65 [11.0]	65.5 [13.3]	0.060
Age, ≥65 years, n (%)	44 (55.7)	20 (62.5)	0.511
BMI, kg/m², median [IQR]	26.3 [4.65]	26.4 [3.00]	0.850
ASA group, n (%)			0.048
ASA I–II	53 (67.1)	15 (46.9)	
ASA III–IV	26 (32.9)	17 (53.1)	
CCI group, n (%)			0.403
CCI = 0	39 (49.4)	13 (40.6)	
CCI ≥1	40 (50.6)	19 (59.4)	
Smoking, n (%)	62 (78.5)	24 (75.0)	0.691
Alcohol, n (%)	42 (53.2)	21 (65.6)	0.230
Diabetes mellitus, n (%)	21 (26.6)	9 (28.1)	0.868
Hypertension, n (%)	40 (50.6)	22 (68.8)	0.082
Coronary artery disease, n (%)	16 (20.3)	9 (28.1)	0.368
COPD, n (%)	4 (5.1)	1 (3.1)	1.000
Cerebrovascular disease, n (%)	5 (6.3)	2 (6.2)	1.000
Preoperative BPH, n (%)	8 (10.1)	19 (59.4)	<0.001
Preoperative prostate volume, mL, median [IQR]	30.7 [12.6]	47.5 [23.0]	0.001
Preoperative prostate volume ≥30 mL, n (%)	46 (58.2)	26 (81.3)	0.021
Preoperative total PSA, ng/mL, median [IQR]	1.34 [1.09]	1.93 [1.37]	<0.001
Preoperative total PSA ≥4 ng/mL, n (%)	5 (6.3)	4 (12.5)	0.281

Note. Values are presented as median [interquartile range] or number (%). Continuous variables were compared using the Mann–Whitney U test. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. ASA, American Society of Anesthesiologists; BPH, benign prostatic hyperplasia; BMI, body mass index; CCI, Charlson Comorbidity Index; COPD, chronic obstructive pulmonary disease; IQR, interquartile range; PSA, prostate-specific antigen; POUR, postoperative urinary retention.

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RESULTS

Patient Selection and Incidence of Postoperative Urinary Retention (POUR)

A total of 230 patients underwent emergency or elective surgery for sigmoid colon or rectal cancer between January 2022 and December 2025. After applying inclusion and exclusion criteria, 111 male patients formed the final cohort (Figure 1). POUR occurred in 32 patients (28.8%), while 79 patients (71.2%) did not experience urinary retention after catheter removal.

Baseline Characteristics

The median age of the cohort was 65 years. Patients who developed POUR were slightly older, though this difference was not statistically significant (median 65.5 vs. 65 years; p=0.060). No significant between-group differences were observed in BMI, CCI group, smoking status, alcohol use, diabetes mellitus, hypertension, coronary artery disease, COPD, or cerebrovascular disease, although hypertension was numerically more frequent in the POUR group. The ASA physical status classification showed a higher proportion of ASA III–IV patients in the POUR group (53.1% vs. 32.9%; p=0.048) (Table 1). Preoperative urological parameters differed markedly. The prevalence of clinically diagnosed benign prostatic hyperplasia (BPH) was significantly higher in patients with POUR (59.4% vs. 10.1%; p<0.001). Median prostate volume measured by CT was greater in the POUR group (47.5 mL vs. 30.7 mL; p=0.001), and prostate volume ⩾30 mL was more frequent among POUR patients (81.3% vs. 58.2%; p=0.021). Total PSA levels were also higher in the POUR group (median 1.93 vs. 1.34 ng/mL; p<0.001) (Table 1).

Tumor and Operative Characteristics

Tumor location was significantly associated with POUR. Middle and lower rectal tumors were more common in the POUR group (87.5% vs. 57.0%; p=0.002). The distribution of resection types differed, with a higher frequency of very low anterior resection in the POUR group (59.4% vs. 34.2%; p=0.014). No significant differences were found in neoadjuvant treatment, surgical approach, or operative duration (Table 2).

Perioperative and Postoperative Course

The median day of catheter removal was similar between groups (4 days). Epidural analgesia and opioid use within the first 48 hours did not differ significantly. However, opioid use beyond 48 hours was significantly higher in the POUR group (43.8% vs. 5.1%; p<0.001). Patients with POUR had longer hospital stays (median 11.5 vs. 9 days; p=0.010) (Table 3).

Table 2. Tumor-Related and Operative Characteristics According to Postoperative Urinary Retention Status

Variable	No POUR n=79	POUR n=32	p value
Neoadjuvant radiotherapy, n (%)	47 (59.5)	24 (75.0)	0.123
Neoadjuvant chemotherapy, n (%)	49 (62.0)	24 (75.0)	0.192
Tumor distance from the anal verge, mm, median [IQR]	70 [100]	60 [43.8]	0.074
Surgical priority, n (%)			0.411
Elective	70 (88.6)	30 (93.8)	
Emergency	9 (11.4)	2 (6.3)	
Surgical approach, n (%)			0.389
Open	56 (70.9)	20 (62.5)	
Laparoscopic	23 (29.1)	12 (37.5)	
Resection type, n (%)			0.014
Anterior resection / sigmoid resection	18 (22.8)	1 (3.1)	
Low anterior resection	18 (22.8)	4 (12.5)	
Very low anterior resection	27 (34.2)	19 (59.4)	
Abdominoperineal resection	16 (20.3)	8 (25.0)	
Operation duration, min, median [IQR]	195 [90]	225 [90]	0.151
Operation duration ≥240 min, n (%)	26 (32.9)	14 (43.8)	0.281
Tumor localization, n (%)			0.003
Sigmoid colon	19 (24.1)	1 (3.1)	
Upper rectum	15 (19.0)	3 (9.4)	
Middle rectum	13 (16.5)	14 (43.8)	
Lower rectum	32 (40.5)	14 (43.8)	
Tumor level group, n (%)			0.002
Sigmoid colon/upper rectum	34 (43.0)	4 (12.5)	
Middle/lower rectum	45 (57.0)	28 (87.5)	

Note. Values are presented as median [interquartile range] or number (%). Continuous variables were compared using the Mann–Whitney U test, and categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Mid-low rectal tumor was defined as tumors located in the middle or lower rectum; sigmoid colon and upper rectal tumors were used as the reference group. APR, abdominoperineal resection; IQR, interquartile range; POUR, postoperative urinary retention.

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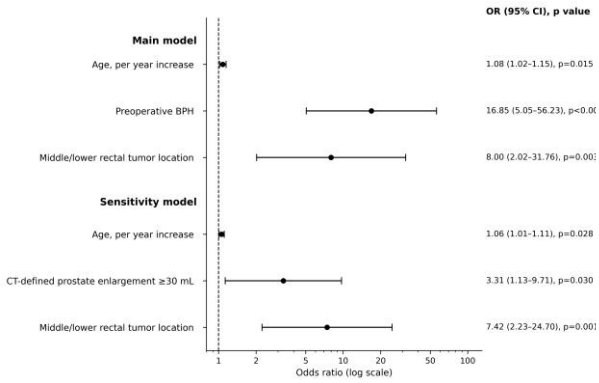

Figure 2. . Forest plot of multivariable logistic regression models for postoperative urinary retention.

Multivariable Logistic Regression Analysis

The results of the multivariable logistic regression models are presented in Table 4. In the main model, increasing age, preoperative BPH, and middle/lower rectal tumor location were independently associated with POUR. Each one-year increase in age was associated with a higher likelihood of POUR (OR: 1.08, 95% CI: 1.02–1.15, p=0.015). Preoperative BPH showed the strongest independent association with POUR (OR: 16.85, 95% CI: 5.05–56.23, p<0.001). Middle/lower rectal tumor location also remained independently associated with POUR (OR: 8.00, 95% CI: 2.02–31.76, p=0.003).

To evaluate the robustness of the urological risk association, a sensitivity model was constructed by replacing preoperative BPH with CT-defined prostate enlargement. In this model, prostate volume ⩾30 mL remained independently associated with POUR (OR: 3.31, 95% CI: 1.13–9.71, p=0.030). Increasing age (OR: 1.06, 95% CI: 1.01–1.11, p=0.028) and middle/lower rectal tumor location (OR: 7.42, 95% CI: 2.23–24.70, p=0.001) also retained their independent associations with POUR. The multivariable logistic regression models are visually summarized in Figure 2.

Pathological and Oncological Characteristics

Detailed pathological and oncological characteristics are provided in Supplementary Table 1. No significant differences were observed between the groups in AJCC T status, N status, M status, final pathological stage, histopathological subtype, differentiation grade, lymphovascular invasion, perineural invasion, venous invasion, TME quality, or postoperative oncological treatment.

DISCUSSION

In this retrospective cohort study of male patients undergoing surgery for sigmoid colon or rectal cancer, postoperative urinary retention occurred in 28.8% of patients. The main finding was that increasing age, preoperative BPH, and middle/lower rectal tumor location were independently associated with POUR. In addition, when preoperative BPH was replaced by CT-defined prostate enlargement in the sensitivity model, prostate volume ⩾30 mL remained independently associated with POUR. These findings suggest that both patient-specific urological vulnerability and the anatomical extent of pelvic surgery contribute to the development of POUR in this selected male colorectal cancer surgery population.

The strongest association in the main multivariable model was observed for preoperative BPH. This result is consistent with previous evidence identifying pre-existing urological disease and BPH as important risk factors for POUR after colorectal surgery (1,4). This association is clinically plausible, as BPH may cause varying degrees of bladder outlet obstruction and lower urinary tract dysfunction before surgery (8). In the postoperative period, the effects of anesthesia, perioperative fluid shifts, pain, immobility, opioid exposure, and urinary catheter manipulation may further unmask or aggravate pre-existing voiding impairment (2,11). In this context, a documented preoperative diagnosis of BPH appears to identify a subgroup of patients with substantially increased susceptibility to POUR. Importantly, the association was not limited to clinical BPH diagnosis. In the sensitivity model, CT-defined prostate enlargement also remained independently associated with POUR, supporting the relevance of objective prostate assessment

Table 3. Perioperative and Postoperative Clinical Course According to Postoperative Urinary Retention Status

Variable	No POUR n=79	POUR n=32	p value
Catheter removal day, median [IQR]	4 [1]	4 [2]	0.236
Epidural analgesia, n (%)	32 (40.5)	16 (50.0)	0.360
Opioid use within the first 48 h, n (%)	49 (62.0)	24 (75.0)	0.192
Opioid requirement after 48 h, n (%)	4 (5.1)	14 (43.8)	<0.001
ICU stay, days, median [IQR]	1 [1]	1 [1.25]	0.429
Length of hospital stay, days, median [IQR]	9 [4]	11.5 [3.5]	0.010
Anastomotic leakage, n (%)	2 (2.5)	3 (9.4)	0.143

Note. Values are presented as median [interquartile range] or number (%). Continuous variables were compared using the Mann–Whitney U test, and categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Opioid requirement after 48 h and length of hospital stay were evaluated as postoperative clinical course variables and were not included in the multivariable risk factor model. POUR, postoperative urinary retention; ICU, intensive care unit; IQR, interquartile range.

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Table 4. Multivariable Logistic Regression Models for Postoperative Urinary Retention

Model	Variable	OR	95% CI	p value
Main model	Age, per year increase	1.08	1.02–1.15	0.015
	Preoperative BPH	16.85	5.05–56.23	<0.001
	Mid–low rectal tumor location	8.00	2.02–31.76	0.003
Sensitivity model	Age, per year increase	1.06	1.01–1.11	0.028
	CT-defined prostate enlargement ≥30 mL	3.31	1.13–9.71	0.030
	Mid–low rectal tumor location	7.42	2.23–24.70	0.001

Note. The main model included age, preoperative BPH, and mid-low rectal tumor location. In the sensitivity model, preoperative BPH was replaced by CT-defined prostate enlargement, defined as prostate volume ≥30 mL. BPH, benign prostatic hyperplasia; CI, confidence interval; CT, computed tomography; OR, odds ratio; POUR, postoperative urinary retention

in preoperative risk stratification. This supports the practical value of incorporating routinely available prostate-related information into perioperative risk assessment in male colorectal cancer patients.

The use of CT-based prostate volume measurement is particularly relevant in this patient population because abdominopelvic CT is routinely obtained for colorectal cancer staging. Therefore, prostate volume can be assessed without an additional diagnostic procedure (9,10). This represents a practical advantage, as prostate enlargement can be incorporated into preoperative risk assessment using imaging that is already available for oncological staging. Although prostate volume alone does not fully capture symptom burden, bladder outlet obstruction, or detrusor function, it may serve as an accessible anatomical marker of urological risk (8,12). The higher PSA levels observed in the POUR group may also reflect a greater underlying prostatic disease burden (13); however, PSA was not included in the multivariable models because of its close relationship with other prostate-related variables. Accordingly, the present findings should not be interpreted as showing a direct causal role for PSA, but rather as supporting the broader importance of preoperative prostatic status.

Tumor level was another independent factor associated with POUR. Patients with middle or lower rectal tumors had a markedly higher frequency of POUR than those with sigmoid colon or upper rectal tumors, and this association persisted in both multivariable models. This observation is in line with previous studies reporting a higher risk of urinary dysfunction after surgery for lower rectal cancer (6,7,14). This association is anatomically plausible given the functional implications of deep pelvic dissection. Surgery for middle and lower rectal tumors often requires more extensive dissection within the pelvis, where the hypogastric nerves, pelvic splanchnic nerves, and inferior hypogastric plexus are closely related to the surgical field. Even when autonomic nerve preservation is intended, traction, thermal injury, inflammation, or manipulation during rectal mobilization may affect postoperative bladder function (5,15). The higher rate of very low anterior resection among patients with POUR likely reflects this anatomical complexity rather than an isolated effect of the resection type itself.

Age also remained independently associated with POUR in both the main and sensitivity models. Increasing age may reflect a combination of reduced bladder contractility, greater prevalence of subclinical lower urinary tract dysfunction, higher comorbidity burden, and decreased physiological reserve (1,16). Although age did not reach statistical significance in the univariate comparison, its independent association in the multivariable models suggests that its effect may be more apparent after adjustment for urological and anatomical surgical factors. Similarly, ASA III–IV status was more frequent in the POUR group in the baseline comparison, but it was not included in the final multivariable model in order to avoid overfitting given the limited number of POUR events.

In the postoperative clinical course analysis, patients who developed POUR had a longer hospital stay and more frequent opioid requirement after 48 hours. These findings are consistent with previous reports describing POUR as a complication associated with delayed recovery, increased catheter-related interventions, and prolonged hospitalization (2,17). However, these variables should be interpreted cautiously. Length of hospital stay is more appropriately considered a consequence or correlate of postoperative recovery rather than a preoperative risk factor. Likewise, opioid requirement after 48 hours may reflect postoperative pain, delayed recovery, complications, or clinical decisions made after the early postoperative period; previous studies also support the relationship between perioperative analgesic strategies and postoperative opioid exposure or urinary retention (11,18). For this reason, these variables were not included in the multivariable risk factor model. Nevertheless, the association between POUR and prolonged opioid requirement supports the need for careful postoperative monitoring and may justify further prospective evaluation of opioid-sparing analgesic strategies in high-risk patients (19).

The findings of this study have practical implications. Male patients with known BPH, enlarged prostate volume

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on staging CT, advanced age, or middle/lower rectal tumor location may benefit from preoperative recognition as a higher-risk subgroup, consistent with previous evidence linking urological disease, older age, and lower rectal cancer surgery with postoperative urinary dysfunction (1,4,7). In such patients, closer postoperative bladder monitoring, individualized timing of urinary catheter removal, structured voiding trials, and early urological input may reduce unnecessary delays and complications (20, 21). The results also suggest that routinely available staging CT images may provide useful additional information beyond oncological staging by identifying prostate enlargement before surgery (9, 10).

This study has several limitations. First, the retrospective design and single-center setting may have introduced selection bias and may limit external validity. Second, POUR was defined according to clinical documentation of inability to void requiring recatheterization; standardized post-void residual volume measurements were not available for all patients. Third, detailed preoperative lower urinary tract symptom profiles and validated symptom scores, such as the International Prostate Symptom Score, were not systematically available, and preoperative urodynamic data were also lacking. In addition, anticholinergic medication use was not systematically recorded. Therefore, the potential influence of baseline voiding dysfunction and anticholinergic medication use on POUR could not be evaluated. Fourth, although prostate volume was measured using a standardized CT-based method, measurements were performed retrospectively and by a single investigator. Fifth, the number of POUR events was limited; therefore, the multivariable model was deliberately restricted to a small number of prespecified variables to reduce the risk of overfitting. Finally, postoperative variables such as opioid requirement and length of hospital stay may be influenced by POUR itself or by other postoperative events, and causal inferences cannot be made from these associations. Prospective studies using standardized residual urine assessment, validated symptom questionnaires, and longitudinal follow-up of urinary function are needed to confirm these findings and define optimal bladder management strategies in high-risk male patients.

CONCLUSION

Postoperative urinary retention was observed in nearly one-third of male patients undergoing sigmoid colon or rectal cancer surgery. Increasing age, preoperative BPH, prostate enlargement, and middle/lower rectal tumor location were independently associated with an increased risk of POUR. The persistence of the association when clinical BPH was replaced by CT-defined prostate enlargement underscores the clinical relevance of preoperative prostate assessment. Integrating urological risk evaluation with tumor-level assessment may improve preoperative risk stratification and support individualized perioperative bladder management strategies.

Acknowledgments
Not applicable.

Authorship contributions
YEA and GÇ contributed to the conception and design of the study, data collection, data analysis, literature review, and manuscript preparation. SBG, BBT, MŞY, SGY, and CG contributed to data collection, data interpretation, literature review, and critical revision of the manuscript. DA contributed to the study design and critically revised the manuscript for important intellectual content. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data availability statement
The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interest
The authors declare no competing interests.

Ethics
Ethical approval was obtained from the Ethics Committee of Trakya University Faculty of Medicine (approval number: TUTF-BAEK 2026/309). The study was conducted in accordance with the Declaration of Helsinki.

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REFERENCES

1. Huang L, Yin Y, Liao Y, Liu J, Zhu K, Yuan X, Xue L, Pan H. Risk factors for postoperative urinary retention in patients undergoing colorectal surgery: a systematic review and meta-analysis. Int J Colorectal Dis. 2022 Dec;37(12):2409-2420. doi: 10.1007/s00384-022-04281-w. Epub 2022 Nov 11. PMID: 36357736.
2. Cambise C, De Cicco R, Luca E, Punzo G, Di Franco V, Dottarelli A, Sacco T, Sollazzi L, Aceto P. Postoperative urinary retention (POUR): A narrative review. Saudi J Anaesth. 2024 Apr-Jun;18(2):265-271. doi: 10.4103/sja.sja_88_24. Epub 2024 Mar 14. PMID: 38654881; PMCID: PMC11033892.

3. Castelo M, Sue-Chue-Lam C, Kishibe T, Acuna SA, Baxter NN. Early urinary catheter removal after rectal surgery: systematic review and meta-analysis. BJS Open. 2020 Aug;4(4):545-553. doi: 10.1002/bjs5.50288. Epub 2020 May 7. PMID: 32379937; PMCID: PMC7397370.
4. Kim IK, Lee CS, Bae JH, Han SR, Lee DS, Lee IK, Lee YS. Immediate urinary catheter removal after colorectal surgery with the enhanced recovery after surgery protocol. Int J Colorectal Dis. 2023 Jun 7;38(1):162. doi: 10.1007/s00384-023-04460-3. PMID: 37284881.
5. Arai S, Kagawa H, Shiomi A, Yamaoka Y, Manabe S, Maeda C, Tanaka Y, Kasai S, Notsu A, Kinugasa Y. Effect of autonomic nervous system resection extent on urinary dysfunction in robotic rectal cancer surgery. Ann Gastroenterol Surg. 2024 Nov 4;9(3):476-485. doi: 10.1002/ags3.12878. PMID: 40385347; PMCID: PMC12080188.
6. Lee TH, Kwak JM, Yu DY, Yang KS, Baek SJ, Kim J, Kim SH. Lower Incidence of Postoperative Urinary Retention in Robotic Total Mesorectal Excision for Low Rectal Cancer Compared with Laparoscopic Surgery. Dig Surg. 2022;39(2-3):75-82. doi: 10.1159/000522229. Epub 2022 Feb 7. PMID: 35130545.
7. Kikuchi R, Sasaki K, Sato Y, Niimi A, Sakamoto A, Nozawa H, Murono K, Emoto S, Yokoyama Y, Kaneko K, Kume H, Ishihara S. Association of urinary dysfunction after lower rectal cancer surgery with renal function: a single-center study. Int J Colorectal Dis. 2025 Jul 14;40(1):158. doi: 10.1007/s00384-025-04955-1. PMID: 40658254; PMCID: PMC12259756.
8. Ng M, Leslie SW, Baradhi KM. Benign Prostatic Hyperplasia. 2024 Oct 20. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan–. PMID: 32644346.
9. Narayanamurthy V, Mishra K, Mahran A, Bukavina L, Ponsky L, Gnessin E. Inter-imaging accuracy of computed tomography, magnetic resonance imaging, and transrectal ultrasound in measuring prostate volume compared to the anatomic prostatic weight. Turk J Urol. 2020 Jan 1;46(1):50-56. doi: 10.5152/tud.2019.19148. PMID: 31905124; PMCID: PMC6944424.
10. Iorga M, Useva A, Regan B, Pinkhasov A, Byler T, Wiener S. Prostate volume on computed tomography correlates well with magnetic resonance imaging measurements and is reproducible across rater training levels. Int Urol Nephrol. 2024 Oct;56(10):3241-3247. doi: 10.1007/s11255-024-04036-2. Epub 2024 May 22. PMID: 38776056.
11. Al-Sawat A, Lee CS, Hong SH, Shim JW, Chae MS, Han SR, Bae JH, Lee IK, Lee D, Lee YS. Clinical effect of rectus sheath block compared to intrathecal morphine injection for minimally invasive colorectal cancer surgery: a propensity score-matched study. Int J Colorectal Dis. 2022 Mar;37(3):665-672. doi: 10.1007/s00384-022-04094-x. Epub 2022 Feb 4. PMID: 35119522.
12. Gravas S, Gacci M, Gratzke C, Herrmann TRW, Karavitakis M, Kyriazis I, Malde S, Mamoulakis C, Rieken M, Sakalis VI, Schouten N, Speakman MJ, Tikkinen KAO, Cornu JN. Summary Paper on the 2023 European Association of Urology Guidelines on the Management of Non-neurogenic Male Lower Urinary Tract Symptoms. Eur Urol. 2023 Aug;84(2):207-222. doi: 10.1016/j.eururo.2023.04.008. Epub 2023 May 17. PMID: 37202311.
13. Aigbe E, Irekpita E, Ogbetere FE, Alili UI. Correlation between prostate volume and prostate-specific antigen in Nigerian men with symptomatic histologically-diagnosed benign prostatic hyperplasia. Niger J Clin Pract. 2022 Sep;25(9):1523-1528. doi: 10.4103/njcp.njcp_67_22. PMID: 36149214.
14. Toritani K, Watanabe J, Suwa Y, Suzuki S, Nakagawa K, Suwa H, Ishibe A, Ota M, Kunisaki C, Endo I. The risk factors for urinary dysfunction after autonomic nerve-preserving rectal cancer surgery: a multicenter retrospective study at Yokohama Clinical Oncology Group (YCOG1307). Int J Colorectal Dis. 2019 Oct;34(10):1697-1703. doi: 10.1007/s00384-019-03374-3. Epub 2019 Aug 30. PMID: 31471695.
15. Shiraishi T, Ito M, Sasaki T, Nishizawa Y, Tsukada Y, Ikeda K. Association between urinary function and resected pattern of the autonomic nerve system after transanal total mesorectal excision for rectal cancer. Colorectal Dis. 2021 Feb;23(2):405-414. doi: 10.1111/codi.15416. Epub 2021 Jan 21. PMID: 33124126.
16. Nishii H. A Review of Aging and the Lower Urinary Tract: The Future of Urology. Int Neurourol J. 2021 Dec;25(4):273-284. doi: 10.5213/inj.2142042.021. Epub 2021 Dec 31. PMID: 34991304; PMCID: PMC8748297.
17. Huang BY, Leslie SW. Postoperative Urinary Retention. [Updated 2026 Feb 15]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK549844/
18. Gedda C, Nygren J, Garpenbeck A, Hoffström L, Thorell A, Soop M. Multimodal Analgesia Bundle and Postoperative Opioid Use Among Patients Undergoing Colorectal Surgery. JAMA Netw Open.2023;6(9):e2332408. doi:10.1001/jamanetworkopen.2023.32408
19. Irani JL, Hedrick TL, Miller TE, Lee L, Steinhagen E, Shogan BD, Goldberg JE, Feingold DL, Lightner AL, Paquette IM. Clinical practice guidelines for enhanced recovery after colon and rectal surgery from the American Society of Colon and Rectal Surgeons and the Society of American Gastrointestinal and Endoscopic Surgeons. Surg Endosc. 2023 Jan;37(1):5-30. doi: 10.1007/s00464-022-09758-x. Epub 2022 Dec 14. PMID: 36515747; PMCID: PMC9839829.
20. McIntosh S, Hunter R, Scrimgeour D, Bekheit M, Stevenson L, Ramsay G. Timing of urinary catheter removal after colorectal surgery with pelvic dissection: A systematic review and meta-analysis. Ann Med Surg (Lond). 2021 Dec 13;73:103148. doi: 10.1016/j.amsu.2021.103148. PMID: 34976383; PMCID: PMC8685994.
21. Ballstaedt L, Leslie SW, Woodbury B. Bladder Post Void Residual Volume. [Updated 2024 Feb 28]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539839/