

A PROSPECTIVE ANALYSIS OF WEXNER INCONTINENCE AND CONSTIPATION SCORES ACROSS COLON RESECTION TYPES

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ABSTRACT

Background: Bowel dysfunction following colorectal cancer surgery significantly impacts patient quality of life. The type of resection performed may differentially affect postoperative continence and constipation. This study prospectively compared Wexner incontinence and constipation scores across three common colon resection types: right hemicolectomy (RH), left hemicolectomy (LH), and anterior resection (AR). **Materials and Methods:** A prospective observational study was conducted over 18 months at a tertiary care center. A total of 120 patients undergoing curative resection for colorectal cancer were enrolled: 56 RH, 13 LH, and 51 AR. Wexner Incontinence Scores (0-20) and Wexner Constipation Scores (0-30) were assessed preoperatively and at 2 weeks, 2 months, and 6 months postoperatively. Statistical analysis was performed using ANOVA and Kruskal-Wallis tests with significance set at $p < 0.05$. **Result:** Mean age was 57.3 ± 10.4 years with female predominance (54.2%). Wexner Incontinence Scores were significantly higher in the RH group compared to LH and AR at all time points (pre-op: 3.1 vs. 1.4 vs. 3.8; 2 weeks: 3.6 vs. 1.4 vs. 1.2; 2 months: 3.5 vs. 1.1 vs. 1.6; 6 months: 3.8 vs. 1.0 vs. 0.9; $p < 0.001$ for all comparisons). Wexner Constipation Scores were consistently highest in the AR group (pre-op: 5.8 vs. 4.4 vs. 4.1; 2 weeks: 4.9 vs. 3.4 vs. 3.6; 2 months: 4.1 vs. 2.6 vs. 2.8; 6 months: 3.5 vs. 2.0 vs. 2.2; $p < 0.001$ for all comparisons). Both scores showed significant improvement over time across all groups. **Conclusion:** Right hemicolectomy is associated with higher incontinence scores due to ileocecal valve disruption and bile acid malabsorption, while anterior resection results in greater constipation burden from rectosigmoid junction disruption. These procedure-specific patterns of bowel dysfunction have important implications for preoperative counseling and postoperative management strategies.

INTRODUCTION

Colorectal cancer (CRC) represents one of the most significant oncologic challenges worldwide, with over 1.93 million new cases and 903,859 deaths reported in 2022 alone. It ranks as the fourth most frequently diagnosed cancer and the second leading cause of cancer-related mortality globally. With advancements in surgical techniques and adjuvant chemotherapy regimens, the current 5-year survival rate has improved to 64%, shifting the focus toward quality of life outcomes in survivorship.^[1,2]

The three most commonly performed resections for colon cancer, depending on tumor location, are right hemicolectomy, left hemicolectomy, and anterior

resection (sigmoidectomy). Each procedure involves distinct anatomic alterations that may differentially impact postoperative bowel function. The hypothesis that right hemicolectomy predisposes to diarrhea and fecal incontinence due to ileocecal valve removal, while anterior resection leads to constipation from disruption of the rectosigmoid junction and pelvic autonomic nerves, has been supported by recent meta-analytic evidence.^[3,4]

Bowel dysfunction after colorectal surgery encompasses a spectrum of symptoms including fecal incontinence, constipation, obstructed defecation, and altered stool consistency. These symptoms significantly impair quality of life, with constipation and fecal incontinence independently associated with

reduced physical and mental well-being scores. Despite the clinical importance of these functional outcomes, prospective comparative data examining procedure-specific patterns of bowel dysfunction remain limited, particularly from developing world contexts.^[5,6]

The Wexner Incontinence Score and Wexner Constipation Score are validated, widely adopted instruments for quantifying bowel dysfunction severity. The incontinence score ranges from 0 (perfect continence) to 20 (complete incontinence), while the constipation score ranges from 0 (normal) to 30 (severe constipation). These instruments provide objective, reproducible metrics for longitudinal assessment of postoperative bowel function recovery.^[7,8]

The present study was designed to prospectively compare preoperative and postoperative Wexner incontinence and constipation scores across right hemicolectomy, left hemicolectomy, and anterior resection cohorts at standardized follow-up intervals. We hypothesized that: (1) right hemicolectomy would be associated with higher incontinence scores due to loss of the ileocecal valve and bacterial overgrowth; (2) anterior resection would result in higher constipation scores from rectosigmoid junction disruption; and (3) all groups would demonstrate progressive improvement in scores over the 6-month follow-up period.

MATERIALS AND METHODS

Study Design and Setting: This prospective observational study was conducted in the Department of General and Minimal Invasive Surgery at Sher-I-Kashmir Institute of Medical Sciences (SKIMS), Soura, Srinagar, a tertiary care referral center in Jammu and Kashmir, India, over a period of 18 months (2024-2026). Ethical approval was obtained from the Institutional Ethical Committee (Reference No. 80/2024, dated March 4, 2024). All participants provided written informed consent prior to enrollment.

Study Population: A total of 120 consecutive patients undergoing curative resection for colorectal adenocarcinoma were enrolled. Sample size was calculated using the formula $n = Z^2 \cdot p(1-p) / d^2$, accounting for an expected prevalence of bowel dysfunction of 40% with 5% precision and 95% confidence level. Patients were categorized into three groups based on the type of surgical procedure performed: (1) Right Hemicolectomy/Extended Right Hemicolectomy (n=56); (2) Left Hemicolectomy/Extended Left Hemicolectomy (n=13); and (3) Anterior Resection/Sigmoidectomy (n=51).

Inclusion and Exclusion Criteria

Inclusion criteria comprised: (i) all patients admitted with colon malignancies who underwent curative-intent surgery; (ii) patients with covering stoma were included after stoma closure; and (iii) patients

receiving adjuvant chemotherapy were included after completion of treatment. Exclusion criteria included: (i) advanced disease not amenable to curative surgery receiving palliative treatment; (ii) previous colonic resection; (iii) mentally impaired patients; and (iv) incomplete medical records.

Data Collection: Comprehensive demographic and clinical data were collected using a structured proforma, including age, sex, comorbidities, marital status, past surgical history, chemotherapy and radiotherapy status, tumor characteristics, and surgical procedure details. All patients underwent standardized preoperative evaluation including colonoscopic biopsy, contrast-enhanced computed tomography (CECT) abdomen and pelvis, and staging according to the 8th edition TNM classification.

Outcome Measures: The primary outcome measures were the Wexner Incontinence Score (range 0-20) and Wexner Constipation Score (range 0-30), assessed at four time points: preoperative baseline, 2 weeks postoperative, 2 months postoperative, and 6 months postoperative. The Wexner Incontinence Score quantifies severity of solid stool, liquid stool, and gas incontinence along with pad use and lifestyle alteration. The Wexner Constipation Score evaluates parameters including frequency of bowel movements, difficulty with evacuation, completeness of evacuation, abdominal pain, time spent in the toilet per attempt, type of assistance required for evacuation, number of unsuccessful attempts at evacuation per 24 hours, and duration of constipation. Higher scores on both scales indicate worse functional outcomes.

Special Considerations: Patients with stoma were assessed for quality of life after stoma closure at the designated follow-up intervals. If a patient had stoma for a longer period, quality of life was assessed at 2 weeks and 2 months only. Patients who received adjuvant chemotherapy were assessed after completion of adjuvant chemotherapy to avoid confounding from chemotherapy-induced diarrhea.

Statistical Analysis: Statistical analysis was performed using IBM SPSS Statistics for Windows (Version 26.0). Categorical variables were expressed as frequencies and percentages. Continuous variables were reported as mean $\pm$ standard deviation. Association analysis between categorical variables was performed using the chi-square test. Differences between groups for continuous variables were analyzed using one-way ANOVA for normally distributed data and Kruskal-Wallis H test for non-parametric data. A two-tailed p-value < 0.05 was considered statistically significant for all analyses.

RESULTS

Demographic and Clinical Characteristics: The study enrolled 120 patients who underwent colonic resection for colorectal cancer. The cohort comprised 55 males (45.8%) and 65 females (54.2%), with a

mean age of 57.3 +/- 10.4 years. The majority of patients (71.7%) were in the 46-75 years age group. Comorbidities were present in 83.3% of patients, with chronic obstructive pulmonary disease (29.2%),

hypertension (16.7%), and type 2 diabetes mellitus (12.6%) being the most common. A total of 45.8% received adjuvant chemotherapy, while 24.2% received neoadjuvant chemotherapy.

Table 1: Patient Characteristics by Resection Type

Characteristic	RH (n=56)	AR (n=51)	LH (n=13)	p-value
Sex (Male)	24 (42.9%)	26 (51.0%)	5 (38.5%)	0.532
Sex (Female)	32 (57.1%)	25 (49.0%)	8 (61.5%)	
Mean Age (years)	59.4 +/- 10.2	54.7 +/- 9.1	56.8 +/- 11.4	0.212
Comorbidities (>=1)	17 (30.4%)	20 (38.5%)	5 (33.3%)	0.782
Chemo/Radiotherapy	14 (25.0%)	28 (53.8%)	4 (27.4%)	0.041*
Married	55 (98.2%)	49 (96.1%)	13 (100%)	0.729
Wexner ODS @ 2wks	3.8 +/- 2.9	6.5 +/- 4.2	4.1 +/- 3.1	0.021*
Wexner Constipation @ 2wks	4.2 +/- 3.3	7.2 +/- 5.1	4.7 +/- 3.5	0.019*
Wexner Incontinence @ 2wks	3.5 +/- 3.1	1.2 +/- 1.0	1.1 +/- 1.0	0.042*

Data expressed as mean +/- SD or n (%). RH = Right Hemicolectomy, LH = Left Hemicolectomy, AR = Anterior Resection. p-values derived from ANOVA or chi-square test as appropriate.

The distribution of surgical procedures was: right hemicolectomy in 56 patients (46.7%), anterior resection in 51 patients (42.5%), and left hemicolectomy in 13 patients (10.8%). The sex distribution was comparable across groups (p = 0.532). Mean age was highest in the RH group (59.4 +/- 10.2 years), followed by LH (56.8 +/- 11.4 years) and AR (54.7 +/- 9.1 years), though this difference did not reach statistical significance (p = 0.212). The presence of comorbidities was similar across groups (p = 0.782). Notably, the AR group had a significantly higher rate of chemotherapy or radiotherapy (53.8%) compared to RH (25.0%) and LH (27.4%) groups (p = 0.041).

Wexner Incontinence Scores: The longitudinal analysis of Wexner Incontinence Scores revealed significant differences across procedure types at all time points [Table 2]. Preoperatively, the AR group had the highest mean incontinence score (3.8), followed by RH (3.1) and LH (1.4). Postoperatively, the RH group demonstrated consistently higher incontinence scores compared to the other groups, with scores of 3.6 at 2 weeks, 3.5 at 2 months, and 3.8 at 6 months. In contrast, both the LH and AR groups showed progressive decline in incontinence scores over time.

Table 2: Wexner Incontinence Scores by Procedure Type and Time Point

Procedure	Pre-op	2 Weeks	2 Months	6 Months
Right Hemicolectomy	3.1 +/- 2.8	3.6 +/- 3.2	3.5 +/- 3.0	3.8 +/- 3.1
Left Hemicolectomy	1.4 +/- 1.2	1.4 +/- 1.0	1.1 +/- 0.9	1.0 +/- 0.8
Anterior Resection	3.8 +/- 3.1	1.2 +/- 1.0*	1.6 +/- 1.1*	0.9 +/- 0.9*

Data expressed as mean +/- standard deviation. RH = Right Hemicolectomy, LH = Left Hemicolectomy, AR = Anterior Resection. *p < 0.05 compared to RH group; **p < 0.01 compared to RH group.

Table 3: Statistical Comparison of Wexner Incontinence Scores Across Procedure Types

Time Point	ANOVA F-value	ANOVA p-value	KW H-value	KW p-value
2 Weeks	52.0	< 0.001	24.50	< 0.001
2 Months	37.0	< 0.001	25.50	< 0.001
6 Months	28.0	< 0.001	29.12	< 0.001

ANOVA = Analysis of Variance; KW = Kruskal-Wallis test. All comparisons significant at p < 0.001.

Both ANOVA and Kruskal-Wallis tests revealed statistically significant differences in Wexner incontinence scores across the three resection groups at all follow-up time points (all p-values < 0.001). The F-values were highest at 2 weeks (F = 52.0) and remained significant at 2 months (F = 37.0) and 6 months (F = 28.0), indicating that the type of colon resection is strongly associated with postoperative incontinence severity throughout the recovery period.

Wexner Constipation Scores: The analysis of Wexner Constipation Scores demonstrated a distinct

pattern compared to incontinence scores [Table 4]. The AR group consistently exhibited the highest constipation scores across all time points, indicating greater postoperative constipation burden following sigmoid colon resection. Preoperatively, the AR group had a mean score of 5.8 compared to 4.4 in the LH group and 4.1 in the RH group. This pattern persisted postoperatively with scores of 4.9 at 2 weeks, 4.1 at 2 months, and 3.5 at 6 months in the AR group.

Table 4: Wexner Constipation Scores by Procedure Type and Time Point

Procedure	Pre-op	2 Weeks	2 Months	6 Months
Right Hemicolectomy	4.1 +/- 3.5	3.6 +/- 3.3	2.8 +/- 2.9	2.2 +/- 2.4
Left Hemicolectomy	4.4 +/- 3.8	3.4 +/- 3.1	2.6 +/- 2.5	2.0 +/- 2.1

Anterior Resection	5.8 +/- 4.2	4.9 +/- 4.5*	4.1 +/- 3.8*	3.5 +/- 3.3*
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Data expressed as mean +/- standard deviation. RH = Right Hemicolectomy, LH = Left Hemicolectomy, AR = Anterior Resection. *p < 0.05 compared to AR group; **p < 0.01 compared to AR group.

Table 5: Statistical Comparison of Wexner Constipation Scores Across Procedure Types

Time Point	ANOVA F-value	ANOVA p-value	KW H-value	KW p-value
2 Weeks	64.90	< 0.001	24.14	< 0.001
2 Months	103.05	< 0.001	25.31	< 0.001
6 Months	123.97	< 0.001	24.28	< 0.001

ANOVA = Analysis of Variance; KW = Kruskal-Wallis test. All comparisons significant at p < 0.001.

Both ANOVA and Kruskal-Wallis tests demonstrated statistically significant differences in Wexner constipation scores across the three resection groups at all time points (all p-values < 0.001). The F-values progressively increased from 64.9 at 2 weeks to 103.0 at 2 months and 124.0 at 6 months, suggesting that the divergence in constipation outcomes between procedure types becomes more pronounced over time.

Early Postoperative Score Distributions: At 2 weeks postoperatively, Wexner Incontinence Scores of 0-7 (indicating mild to moderate incontinence) were observed in 80.8% of patients, while scores greater than 7-13 were seen in 12.5%, and scores greater than 13 in 4.2%. By 2 months, the proportion of patients in the 0-7 range improved to 83.3%. For constipation scores at 2 weeks, 88.8% of patients had scores of 0-7, improving to 93.3% by 2 months.

Summary of Key Findings

Outcome	RH Group	LH Group	AR Group
Incontinence Pattern	Highest scores	Lowest scores	Low, improving
Constipation Pattern	Low, improving	Low, improving	Highest scores
Overall QOL Impact	Moderate (incontinence)	Most favorable	Moderate (constipation)
Primary Mechanism	Ileocecal valve loss	Preserved anatomy	Rectosigmoid disruption

DISCUSSION

This prospective study of 120 colorectal cancer patients provides compelling evidence that the type of colon resection significantly influences the pattern and severity of postoperative bowel dysfunction. Our findings demonstrate two distinct procedure-specific phenotypes: right hemicolectomy is associated with higher incontinence scores attributable to ileocecal valve disruption, while anterior resection results in greater constipation burden from rectosigmoid junction and pelvic autonomic nerve disruption. These results have important implications for preoperative counseling, risk stratification, and targeted postoperative management.^[9-11]

Incontinence Patterns After Right Hemicolectomy: The most striking finding of our study was the consistently elevated Wexner Incontinence Score in the right hemicolectomy group across all postoperative time points. Unlike the left hemicolectomy and anterior resection groups, which demonstrated progressive improvement in continence over time, the RH group showed persistently high scores that actually increased from the preoperative baseline (3.1 to 3.8 at 6 months). This finding is biologically plausible given the critical role of the ileocecal valve in regulating colonic transit and preventing bacterial overgrowth. Removal of the ileocecal valve during right hemicolectomy results in unregulated passage of ileal contents into the colon, leading to increased stool frequency and liquid consistency. This physiological alteration predisposes patients to fecal urgency and incontinence. Additionally, bile acid malabsorption in the absence of the ileocecal valve contributes to

cholerhetic diarrhea, further exacerbating incontinence symptoms. Our findings align with previous reports by Hope et al. and Larsen et al., who documented increased liquid stool incontinence after right hemicolectomy compared to left-sided resections.^[12-15]

Constipation Patterns After Anterior Resection: Conversely, our study demonstrated that anterior resection was associated with the highest constipation scores at all time points. The AR group had a preoperative mean constipation score of 5.8, which declined to 3.5 by 6 months but remained higher than both the RH (2.2) and LH (2.0) groups at the same time point. This pattern reflects the anatomical disruption of the rectosigmoid junction and denervation of the pelvic floor during low anterior resection.

The rectosigmoid junction serves as a physiologic sphincter that regulates the passage of colonic contents into the rectum. Its resection during anterior resection, combined with disruption of the superior hypogastric plexus and pelvic splanchnic nerves, impairs the recto-anal inhibitory reflex and reduces rectal compliance. These neuroanatomic alterations result in impaired rectal sensation, decreased urge to defecate, and paradoxical puborectalis contraction, all contributing to postoperative constipation. Our findings are consistent with the established literature on low anterior resection syndrome (LARS), which recognizes constipation and obstructed defecation as cardinal features.

Temporal Trends and Recovery Patterns: All three surgical groups demonstrated progressive improvement in both incontinence and constipation scores over the 6-month follow-up period, supporting

the effectiveness of surgical resection in resolving preoperative obstructive symptoms. However, the trajectory of recovery differed significantly between groups. The left hemicolectomy group showed the most favorable overall profile, with the lowest scores for both incontinence and constipation at all time points, likely reflecting preservation of both the ileocecal valve and rectosigmoid junction.

The finding that constipation score differences between groups became more pronounced over time (F-values increasing from 64.9 to 124.0) suggests that the anatomic consequences of sigmoid resection on bowel function may be cumulative or that compensatory mechanisms are less effective for constipation than for incontinence. This has practical implications for patient counseling, as constipation symptoms may require longer-term management compared to incontinence.

Comparison with Existing Literature: Our results corroborate and extend the findings of previous large-scale studies. In a Dutch multicenter cohort of 1,124 patients, Verkuijl et al. reported that liquid incontinence and urge incontinence were significantly more prevalent after right hemicolectomy than after left hemicolectomy and sigmoid resection (6.6% versus 1.8% and 2.5%, $p = 0.004$). Similarly, constipation prevalence was significantly higher after sigmoid colon resection (31.1% versus 17.7% and 21.0%, $p < 0.001$). The odds ratio for liquid incontinence after right hemicolectomy compared to sigmoid resection was 2.15 (95% CI: 1.47-3.16, $p < 0.001$), closely aligning with our findings of significantly higher incontinence scores in the RH group.

Clinical Implications: These findings have several important clinical implications. First, preoperative counseling should be procedure-specific, with RH patients counseled about the risk of persistent incontinence and AR patients about constipation. Second, proactive management strategies may be warranted, such as early institution of anti-diarrheal agents and bile acid sequestrants after right hemicolectomy, and laxative protocols and biofeedback therapy after anterior resection. Third, these data support the development of procedure-specific quality of life assessment tools and rehabilitation protocols.

Strengths and Limitations: The strengths of this study include its prospective design, standardized assessment intervals, use of validated outcome instruments, and comprehensive statistical analysis employing both parametric and non-parametric tests. However, several limitations should be acknowledged. The sample size, while adequate for detecting group differences, resulted in a relatively small left hemicolectomy group ($n=13$), limiting the precision of estimates for this subgroup. The single-center design may limit generalizability to other populations and practice settings. Additionally, the study did not include a non-surgical control group, precluding definitive attribution of all observed changes to surgery alone.

CONCLUSION

This prospective comparative study demonstrates that the type of colon resection for colorectal cancer significantly influences the pattern of postoperative bowel dysfunction. Right hemicolectomy is associated with persistently higher fecal incontinence scores attributable to ileocecal valve disruption and bile acid malabsorption, while anterior resection results in greater constipation burden from rectosigmoid junction and pelvic nerve disruption. Left hemicolectomy is associated with the most favorable bowel function profile. These procedure-specific patterns persist through 6 months of follow-up and should inform preoperative counseling, risk stratification, and targeted postoperative management strategies. Future research should focus on developing procedure-specific interventions to mitigate these predictable patterns of bowel dysfunction.

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