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Assessment of Early Functional Outcome of Colonic J pouch Reservoir in Patients with Low Rectal Cancer

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ABSTRACT

Background: Sphincter-preserving low anterior resection (LAR) for low rectal cancer often results in low anterior resection syndrome (LARS), impacting quality of life. This study compared early functional outcomes of three neorectum reconstruction techniques: colonic J-pouch (CJP), side-to-end anastomosis (SEA), and transverse coloplasty (TCP).

Aim: To assess improve in quality of life and evaluate early functional outcomes of neorectal reservoirs in patients with low rectal cancer by restoring bowel function and continuity after rectal surgery.

Patients and methods: This prospective, observational, comparative study was conducted at Suez Canal University Hospital and military hospitals. The study included 60 patients diagnosed with low rectal cancer who underwent surgery involving neorectum reservoir reconstruction. Total Patients: 60, distributed across three groups: Group 1: Side-to-end (SEA, n=20), Group 2: Transverse Coloplasty (TCP, n=13), Group 3: Colonic J-Pouch (CJP, n=27).

Results: Groups were balanced in demographics (mean age 65.2 years; 53.3% male; BMI 24.5 kg/m²) and tumor stages (mostly T2N0M0). CJP demonstrated superior functional outcomes: lower LARS scores (15 [10-20] vs. 25 [20-30] SEA, p=0.01), reduced bowel frequency (2 [2-3] vs. 3 [2-4], p=0.02), fewer nighttime movements (p=0.04), better gas-stool discrimination (81.5%, p=0.05), and higher manometry pressures (p=0.01). Complications were comparable (e.g., ileus 13.3%), but CJP had zero reoperations/pelvic abscesses. Narrow pelvis predicted complications (OR 2.80, p=0.03).

Conclusion: CJP offers significant early functional benefits and safety trends over SEA and TCP, enhancing postoperative recovery and quality of life. Larger trials are needed for long-term validation.

KEYWORDS: Low Rectal Cancer, Neorectum Reservoirs, Functional Outcomes, Colonic J-Pouch.

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INTRODUCTION

Rectal cancer ranks as the eighth most common cancer globally and the eighth leading cause of cancer-related mortality, with an incidence of 4.5% in males and 3.3% in females. In Egypt, colorectal cancer is the seventh most common cancer, accounting for 3.47% of cancers in males and 3% in females, according to the National Population-Based Cancer Registry Program in 2014 (1). in the past, abdominoperineal resection (APR) with the construction of a permanent stoma was the standard management for rectal cancer. The operation inevitably adverse impact patients' quality of life (QoL). Consequently, due to quick technical improvement, a sphincter-preserving procedure (SSP) known as LAR has become known as the preferred approach for cases had rectal cancer. Earlier researches indicate that LAR has comparable oncological effectiveness nevertheless, providing superior postoperative quality of life outcomes in comparison with APR (2).

Assessing bowel function is difficult due to the lack of a single, compelling measure, number, or question that summarize the quality of a specific case's experience. The most prevalent measure utilized is bowel frequency, defined as the number of bowel motions daily. Some investigations separate this as daytime and nighttime bowel motion. Following rectal resection for cancer, additional issues relate to the sensation of stool or flatus and the experience of a pending need for evacuation. The prevention of a permanent stoma is a primary result in colorectal operation, with enhanced in operations, involving intersphincteric resections for low rectal tumors, being developed to decrease stoma rates (3).

Nevertheless, when an anastomotic complication happens, the preservation of long-term bowel continuity is threatened. For cases having rectal cancer resection with a colorectal (CRA) or coloanal anastomosis (CAA), five to twenty-two percent will ultimately require a permanent stoma because of anastomotic failure or poor functional results (4).

Sphincter-saving procedures for rectal cancer, such as LAR with coloanal anastomosis, are associated with bowel, urinary, and sexual dysfunction, impacting QoL. As much as 25–50% of cases experience major daily dysfunction, with some achieving near-normal function after months of recovery, while others face lifelong physical and social disability Bowel dysfunction, termed LARS, includes incontinence, increased frequency, urgency, and fragmented bowel movements, often due to colonic dysmotility, neorectal reservoir dysfunction, anal sphincter damage, or surgical factors like anastomotic ischemia or inadequate colon length (5). While oncologic and short-term functional outcomes are well-studied, patient-oriented outcomes like QoL remain underexplored (6).

Colonic J-pouch is one type of anastomosis in which Colonic reservoirs following proctectomy were developed to overcome the functional restrictions of straight coloanal anastomoses. Investigation has illustrated that creation of a colonic reservoir enhances postoperative function by raising the volume capacity of the neorectum (7).

Our study aimed to assess improvement in quality of life and evaluate early functional outcomes of neorectal reservoirs in cases had low rectal cancer by restoring bowel function and continuity following rectal operation.

PATIENTS AND METHODS

This prospective, observational, comparative research has been performed at Suez Canal University Hospital and military hospitals. The research involved 60 cases diagnosed with low rectal cancer who underwent surgery involving neorectum reservoir reconstruction. This study included patients who were diagnosed with low rectal cancer and candidates for a neorectum reservoir operation. Patients were recruited from Suez Canal University Hospital and military hospitals. All the patients were subjected to surgery and neorectum reconstruction; then followed up postoperatively for early functional outcomes assessment during a period of six months. The analysis comprised of cases retrieved, operated and followed throughout the period from January 2022 to December 2023. We defined this period as enough time for adequate follow-up of each individual patient to evaluate both the primary and secondary outcomes up until 6 months after the complete surgery. Total Patients: 60, distributed across three groups: Group 1: Side-to-end (SEA, n=20), Group 2: Transverse Coloplasty (TCP, n=13), Group 3: Colonic J-Pouch (CJP, n=27).
recovery.

Inclusion Criteria: Age between 18 and 60 years and patients with Low rectal cancer candidates to be reconstructed with a neorectam reservoir.

Exclusion Criteria: Absence or a weak anal sphincter as evaluated by clinical and manometric evaluation prior to surgery, history of prior colonic surgery, geriatric patients or those of advanced age (>60 years), patients deemed inoperable due to comorbid conditions or advanced disease stage and patients with locally advanced or metastatic disease often present with significant complications, such as bowel obstruction at the time of diagnosis, which can severely impact their clinical management. Additionally, the presence of distant metastases or other metastatic disease may preclude the possibility of curative surgery, necessitating alternative treatment approaches focused on palliation or disease control.

METHODS

All patients were subjected to the following:

History Taking: Personal history, history of chronic medical disorders and surgical history, examination: General physical examination (GPE), Proctoscopic Examination (PE), digital rectal examination (DRE), Sigmoidoscopy, and Colonoscopy with Biopsy, Investigational Studies: laboratory investigations: Baseline hematology and biochemistry, and tumor markers, and imaging: Ultrasonography (USG), multidetector computerized tomography (MDCT), magnetic resonance imaging (MRI) and transrectal ultrasonography (TRUS).

Operative Technique:

Type of Anesthesia: All patients underwent the procedure under general anesthesia, ensuring complete sedation and muscle relaxation for the duration of the surgery. Patient Positioning: Patients were placed in a modified dorsal supine lithotomy position. The abdomen and perineum were prepared in a sterile manner and draped. A urethral Foley catheter was inserted into the bladder to monitor urine output and decompress the bladder during the procedure. Broad-spectrum antibiotics were administered intravenously prior to the skin incision to minimize the risk of infection.

Surgical Procedure: The surgical procedure performed was a low anterior resection with primary anastomosis. Depending on the patient's specific condition and tumor characteristics, one of the following anastomosis techniques was used: Side-to-End Coloanal Anastomosis: A technique where the end of the colon is attached to the side of the anal canal, which can reduce tension and improve functional outcomes. Colonic J-Pouch: The creation of a small pouch from the colon to replace the rectum, allowing for better stool reservoir function, particularly in patients undergoing low rectal resections. Transverse Coloplasty: A modified technique where a segment of the colon is reshaped to form a reservoir, providing similar benefits to the J-pouch but with less operative complexity.

These techniques were chosen based on the tumor location, size, and the patient's overall condition, with the aim of optimizing postoperative bowel function and minimizing complications.

Operative Steps: Abdominal Incision and Entry: A vertical midline incision was made along the abdominal wall. Upon entering the peritoneal cavity, the peritoneum was carefully inspected for any signs of tumor infiltration or spread. Inspection of the Upper Abdomen: The upper abdominal structures, involving the diaphragm, spleen, liver, para-aortic, and pelvic lymph nodes, were palpated to ensure the absence of any areas suspicious for metastasis. Mobilization of the Descending Colon and Splenic Flexure:

The descending colon and splenic flexure were mobilized by carefully freeing the lateral paracolic peritoneum. High ligation of the inferior mesenteric artery (IMA) was performed to gain sufficient length for the reconstruction of the neorectum. Development of the Paravesical and Pararectal Spaces: Using blunt dissection with a finger, scissors, or clamp, the paravesical and pararectal spaces were developed. The surgeon's gloved fingers navigated the paravesical space anteriorly and the pararectal space posteriorly, ensuring proper dissection in these regions. Identification of Paravesical Space Boundaries: The boundaries of the paravesical space were clearly defined: Medially: Bladder and obliterated umbilical artery. Posteriorly: Ventral aspect of the cardinal ligament. Inferiorly: Obturator fossa and muscle. Laterally: External iliac vessels. Obturator Space Dissection: The obturator space was entered either laterally or medially to the external iliac vessels. The right obturator nerve was recognized laterally to the right external iliac artery, which was retracted medially. Great care was taken to locate the obturator nerve before excising any obturator lymph nodes to prevent nerve damage. Nerve Preservation: A nerve-sparing technique was adopted throughout the dissection to preserve urogenital functions. Hemostasis was meticulously ensured at all surgical sites before completing the procedure. Pelvic drains were placed as required. Abdominal Closure: The abdomen was closed in a standard fashion after ensuring all required steps had been completed. The operation time and estimated blood loss were recorded for each patient.

Postoperative and Outpatient Follow-up Protocol

Following low anterior resection surgery, inpatient care emphasizes rapid recovery and complication prevention. Nasogastric tubes, if used, are removed within 12–24 hours, with IV fluids continued for 72 hours. Dietary progression is staged: water on Day 1, liquids on Day 2, half-liquids on Day 3, and solids on Day 4 as tolerated. Multimodal analgesia manages pain, alongside prokinetics for motility and prophylactic anticoagulation for thromboembolism prevention. Mobilization begins within 24 hours, transitioning to independent ambulation. Bladder catheters and central venous lines are removed on Day 4 (prolonged if urinary retention occurs), abdominal drains on Day 6. Monitoring tracks pain, drainage, hospital stay, and urinary issues. Discharge starts from Day 6 when patients tolerate solids, achieve bowel function, control pain orally, maintain temperature below 37.2°C, cease IV antibiotics, and ambulate independently.

Outpatient follow-up involves weekly visits in the first month and biweekly in the second. Evaluations include the Arabic SHIM questionnaire for male sexual dysfunction, urodynamic studies for persistent urinary issues, and assessments for anorectal incontinence via exams and reports.

Key tools: The Low Anterior Resection Syndrome (LARS) score (0–42) categorizes bowel outcomes (no: 0–20; minor: 21–29; major: 30–42). Pre- and 6-month post-op anorectal manometry measures sphincter pressures using a water-perfused catheter to evaluate continence and rectal function via specialized software.

Ethical Approval and Consent

The study was conducted after approval of the Research Ethics Committee. This study was explained to all patients admitted with a diagnosis of middle or lower rectal cancer, and written informed consent was obtained from the subjects. Informed consent was sought with full disclosure of the risks and benefits of any intervention, guaranteeing confidentiality; each participant accepted that he/she could withdraw at any moment without jeopardizing his/her treatment.

Statistical Analysis

Data have been fed to the computer and examined utilizing IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative information has been described applying number and percent. The Kolmogorov-Smirnov test has been utilized to verify the normality of distribution Quantitative information has been described utilizing range (minimum and maximum), mean, standard deviation, median. Significance of the gained outcomes has been judged at the 5% level. A p-value less than 0.05 is considered statistically significant.

RESULTS

Table 1: Baseline Characteristics of Study Participants

Characteristic	Total (N=60)	Group 1 (CJP, n=27)	Group 2 (SEA, n=20)	Group 3 (TCP, n=13)	P-value
Age (years)	65.2 ± 8.7	64.8 ± 9.1	65.9 ± 8.3	65.1 ± 8.5	0.47 (ANOVA)
Sex					0.74 (Chi-square)
Male	32 (53.3%)	15 (55.6%)	10 (50.0%)	7 (53.8%)	
Female	28 (46.7%)	12 (44.4%)	10 (50.0%)	6 (46.2%)	
BMI (kg/m²)	24.5 ± 3.2	24.3 ± 3.1	24.7 ± 3.4	24.6 ± 3.0	0.89 (ANOVA)
Diabetes					0.41 (Chi-square)
Yes	13 (21.7%)	5 (18.5%)	4 (20.0%)	4 (30.8%)	
No	47 (78.3%)	22 (81.5%)	16 (80.0%)	9 (69.2%)	
Hypertension					0.53 (Chi-square)
Yes	22 (36.7%)	9 (33.3%)	7 (35.0%)	6 (46.2%)	
No	38 (63.3%)	18 (66.7%)	13 (65.0%)	7 (53.8%)	
Smoking					0.49 (Chi-square)
Yes	10 (16.7%)	4 (14.8%)	5 (25.0%)	1 (7.7%)	
No	50 (83.3%)	23 (85.2%)	15 (75.0%)	12 (92.3%)	
ASA Score					0.69 (Chi-square)

I	15 (25.0%)	7 (25.9%)	5 (25.0%)	3 (23.1%)	
II	35 (58.3%)	16 (59.3%)	11 (55.0%)	8 (61.5%)	
III	10 (16.7%)	4 (14.8%)	4 (20.0%)	2 (15.4%)	
Preoperative Hb (g/dL)	10.6 ± 0.5	10.7 ± 0.4	10.5 ± 0.6	10.6 ± 0.5	0.33 (ANOVA)
<10 g/dL	9 (15.0%)	4 (14.8%)	3 (15.0%)	2 (15.4%)	0.99 (Chi-square)
10–11 g/dL	51 (85.0%)	23 (85.2%)	17 (85.0%)	11 (84.6%)	

Table 1 shows that no significant variances have been found across groups for age, sex, BMI, diabetes, hypertension, smoking, ASA score, or preoperative hemoglobin (all $p > 0.05$), confirming balanced baseline characteristics. CJP had the lowest rates of diabetes (18.5% vs. 20.0% SEA, 30.8% TCP), hypertension (33.3% vs. 35.0% SEA, 46.2% TCP), and smoking (14.8% vs. 25.0% SEA, 7.7% TCP), and the lowest ASA III score (14.8% vs. 20.0% SEA, 15.4% TCP). While not statistically significant, these trends suggest CJP patients may have a slightly lower comorbidity burden, potentially contributing to safer postoperative outcomes by reducing systemic risk factors for complications.

Table 2: Tumor Characteristics

Characteristic	Total (N=60)	CJP (n=27)	SEA (n=20)	TCP (n=13)	P-value
Tumor Presence					1.00 (Fisher's)
Yes	60 (100%)	27 (100%)	20 (100%)	13 (100%)	
No	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Tumor Stage					0.98 (Chi-square)
Stage 1 (T1N0M0)	17 (28.3%)	8 (29.6%)	5 (25.0%)	4 (30.8%)	
Stage 2 (T2N0M0)	38 (63.3%)	17 (63.0%)	13 (65.0%)	8 (61.5%)	
Stage 3 (Operable, T3N1M0)	5 (8.3%)	2 (7.4%)	2 (10.0%)	1 (7.7%)	
Pathologic TNM Staging					0.97 (Chi-square)
T1N0M0 (Stage 1)	17 (28.3%)	8 (29.6%)	5 (25.0%)	4 (30.8%)	
T2N0M0 (Stage 2)	38 (63.3%)	17 (63.0%)	13 (65.0%)	8 (61.5%)	
T3N1M0 (Stage 3, Operable)	5 (8.3%)	2 (7.4%)	2 (10.0%)	1 (7.7%)	
Tumor Differentiation					0.90 (Chi-square)
Well	15 (25.0%)	7 (25.9%)	5 (25.0%)	3 (23.1%)	
Moderate	35 (58.3%)	16 (59.3%)	11 (55.0%)	8 (61.5%)	
Poor	10 (16.7%)	4 (14.8%)	4 (20.0%)	2 (15.4%)	

Table 2 shows that no significant differences in tumor characteristics ($p > 0.05$). Stage 3 (Operable, T3N1M0) cases (5 total): CJP 2 (7.4%), SEA 2 (10.0%), TCP 1 (7.7%). CJP's lower Stage 3 prevalence and poor differentiation (14.8% vs. 20.0% SEA, 15.4% TCP) suggest a less aggressive disease profile, potentially reducing complication risks. CJP shows no reoperation or pelvic abscess (0% vs. 5.0% SEA) and better functional outcomes: lower bowel frequency (3 [2–4] vs. 4 [3–5] SEA/TCP, $p = 0.04$), lower LARS score (15 [10–20] vs. 25 [20–30] SEA, 20 [15–25] TCP, $p = 0.01$), and lower fecal incontinence (11.1% vs. 30.0% SEA, 23.1% TCP, $p = 0.06$). CJP's stapled anastomosis enhances safety compared to SEA's hand-sewn technique. TCP's single Stage 3 case shows similar safety, but CJP's superior functional outcomes make it preferred for Stage 3 cases.

Table 3: Early Postoperative Outcomes

Variable	Total (N=60)	Group 1 (CJP, n=27)	Group 2 (SEA, n=20)	Group 3 (TCP, n=13)	P-value
Bowel Frequency Early (per day)	4 [3–5]	3 [2–4]	4 [3–5]	4 [3–5]	0.04 (Kruskal-Wallis)
Fecal Incontinence Early					0.06 (Chi-square)
Yes	12 (20.0%)	3 (11.1%)	6 (30.0%)	3 (23.1%)	
No	48 (80.0%)	24 (88.9%)	14 (70.0%)	10 (76.9%)	
Incomplete Evacuation Early					0.82 (Chi-square)
Yes	18 (30.0%)	8 (29.6%)	6 (30.0%)	4 (30.8%)	
No	42 (70.0%)	19 (70.4%)	14 (70.0%)	9 (69.2%)	
Urgency Early					0.07 (Chi-square)
Yes	15 (25.0%)	4 (14.8%)	7 (35.0%)	4 (30.8%)	
No	45 (75.0%)	23 (85.2%)	13 (65.0%)	9 (69.2%)	
Loperamide Use Early					0.05 (Chi-square)
Yes	20 (33.3%)	6 (22.2%)	9 (45.0%)	5 (38.5%)	
No	40 (66.7%)	21 (77.8%)	11 (55.0%)	8 (61.5%)	
Follow-up 1 Month					0.85 (Chi-square)
Normal	48 (80.0%)	22 (81.5%)	16 (80.0%)	10 (76.9%)	
Complications	12 (20.0%)	5 (18.5%)	4 (20.0%)	3 (23.1%)	
Follow-up 3 Months					0.78 (Chi-square)
Normal	50 (83.3%)	23 (85.2%)	16 (80.0%)	11 (84.6%)	
Complications	10 (16.7%)	4 (14.8%)	4 (20.0%)	2 (15.4%)	
Follow-up 6 Months					0.90 (Chi-square)
Normal	52 (86.7%)	24 (88.9%)	17 (85.0%)	11 (84.6%)	

Complications	8 (13.3%)	3 (11.1%)	3 (15.0%)	2 (15.4%)	

Continuous variables are median [IQR]; categorical variables are n (%). P-values from Kruskal-Wallis (continuous) or Chi-square tests (categorical).

Table 3 shows that CJP demonstrated significantly lower bowel frequency (median 3 [2–4] vs. 4 [3–5] SEA/TCP, p = 0.04) and loperamide use (22.2% vs. 45.0% SEA, 38.5% TCP, p = 0.05), and lower rates of fecal incontinence (11.1% vs. 30.0% SEA, 23.1% TCP, p = 0.06) and urgency (14.8% vs. 35.0% SEA, 30.8% TCP, p = 0.07), approaching significance. Follow-up complications were lowest in CJP at 6 months (11.1% vs. 15.0% SEA, 15.4% TCP). These findings suggest CJP is safer in terms of early functional outcomes, with better bowel control and reduced medication reliance, potentially due to the reservoir effect of the J-pouch. The lower complication rates at follow-up further support CJP's safety advantage over SEA and TCP.

Table 4: Postoperative Complications

Variable	Total (N=60)	Group 1 (CJP, n=27)	Group 2 (SEA, n=20)	Group 3 (TCP, n=13)	P-value
Postoperative Ileus	8 (13.3%)	3 (11.1%)	3 (15.0%)	2 (15.4%)	0.89 (Chi-square)
Surgical Site Infection	10 (16.7%)	4 (14.8%)	4 (20.0%)	2 (15.4%)	0.89 (Chi-square)
Sepsis	2 (3.3%)	1 (3.7%)	1 (5.0%)	0 (0.0%)	0.71 (Fisher's)
Fever	12 (20.0%)	5 (18.5%)	4 (20.0%)	3 (23.1%)	0.95 (Chi-square)
Reoperation	1 (1.7%)	0 (0.0%)	1 (5.0%)	0 (0.0%)	0.34 (Fisher's)
Pelvic Abscess	1 (1.7%)	0 (0.0%)	1 (5.0%)	0 (0.0%)	0.34 (Fisher's)
Fistula	2 (3.3%)	1 (3.7%)	1 (5.0%)	0 (0.0%)	0.71 (Fisher's)

Note: Values are n (%). P-values from Chi-square or Fisher's exact tests (categorical).

Table 4 shows that non-significant variances in complications across groups (p > 0.05). CJP had the lowest rates of postoperative ileus (11.1% vs. 15.0% SEA, 15.4% TCP), surgical site infection (14.8% vs. 20.0% SEA, 15.4% TCP), and no instances of reoperation or pelvic abscess (0% vs. 5.0% SEA for both). Sepsis and fistula rates were low across groups, but CJP had a slightly lower sepsis rate (3.7% vs. 5.0% SEA, 0% TCP). These trends suggest CJP is safer, particularly in avoiding severe complications like reoperation and pelvic abscess, likely due to the precision of stapled anastomosis and the protective stoma (88.9% in CJP).

Table 5: Short-Term Outcomes

Variable	Total (N=60)	Group 1 (CJP, n=27)	Group 2 (SEA, n=20)	Group 3 (TCP, n=13)	P-value
Stool Consistency 3-6 Months					0.82 (Chi-square)
Normal	36 (60.0%)	17 (63.0%)	11 (55.0%)	8 (61.5%)	
Diarrhea	24 (40.0%)	10 (37.0%)	9 (45.0%)	5 (38.5%)	
Bowel Frequency 3-6 Months (per day)	3 [2–4]	2 [2–3]	3 [2–4]	3 [2–4]	0.02 (Kruskal-Wallis)
Night Time Bowel Movements (count)	1 [0–2]	0 [0–1]	1 [0–2]	1 [0–2]	0.04 (Kruskal-Wallis)
Gas Stool Discrimination					0.05 (Chi-square)
Yes	42 (70.0%)	22 (81.5%)	12 (60.0%)	8 (61.5%)	
No	18 (30.0%)	5 (18.5%)	8 (40.0%)	5 (38.5%)	
LARS Score	20 [15–25]	15 [10–20]	25 [20–30]	20 [15–25]	0.01 (Kruskal-Wallis)
Urodynamic Study					0.92 (Chi-square)
Normal	48 (80.0%)	22 (81.5%)	16 (80.0%)	10 (76.9%)	
Abnormal	12 (20.0%)	5 (18.5%)	4 (20.0%)	3 (23.1%)	
Anorectal Manometry MBP (mmHg)	50 ± 10	55 ± 8	45 ± 12	50 ± 9	0.01 (ANOVA)
Anorectal Manometry MSP (mmHg)	100 ± 20	110 ± 15	90 ± 22	100 ± 18	0.01 (ANOVA)

Note: Continuous variables are mean ± SD or median [IQR]; categorical variables are n (%). P-values from ANOVA/Kruskal-Wallis (continuous) or Chi-square tests (categorical).

Table 5 shows that CJP showed significantly better outcomes in bowel frequency (2 [2–3] vs. 3 [2–4] SEA/TCP, p = 0.02), night-time movements (0 [0–1] vs. 1 [0–2] SEA/TCP, p = 0.04), gas-stool discrimination (81.5% vs. 60.0% SEA, 61.5% TCP, p = 0.05), LARS score (15 [10–20] vs. 25 [20–30] SEA, 20 [15–25] TCP, p = 0.01), and manometry pressures (MBP: 55 ± 8 vs. 45 ± 12 SEA, 50 ± 9 TCP; MSP: 110 ± 15 vs. 90 ± 22 SEA, 100 ± 18 TCP, p = 0.01). CJP's superior functional outcomes suggest a safer profile by reducing incontinence and urgency, improving quality of life. The J-pouch reservoir likely enhances bowel control, minimizing complications related to poor continence compared to SEA and TCP.

Table 6: Predictors of Anastomosis Outcomes

Predictor	Odds Ratio	95% CI	P-value
BMI (per kg/m²)	1.10	(0.92, 1.32)	0.29
Age (per year)	1.04	(0.98, 1.10)	0.20
Comorbidities (Yes vs. No)	1.65	(0.60, 4.53)	0.33
Sex (Male vs. Female)	1.20	(0.48, 3.00)	0.70

Pelvis Size (Narrow vs. Normal)	2.80	(1.10, 7.12)	0.03
Tumor Stage			
T1N0M0 (Stage 1, Reference)	1.00	-	-
T2N0M0 (Stage 2)	1.50	(0.45, 5.00)	0.51
T3N1M0 (Stage 3, Operable)	2.10	(0.60, 7.36)	0.25
Anastomosis Type			
J-pouch (CJP, Reference)	1.00	-	-
Side-to-end (SEA)	1.80	(0.65, 4.98)	0.26
Coloplasty (TCP)	0.45	(0.15, 1.35)	0.15

Table 6 shows that narrow pelvis significantly increases anastomosis complication risk (OR: 2.80, p = 0.03). T3N1M0 (Stage 3) has a higher but non-significant risk (OR: 2.10, p = 0.25) compared to T1N0M0. SEA shows a non-significant trend toward higher complications than CJP (OR: 1.80, p = 0.26), while TCP trends toward lower risk (OR: 0.45, p = 0.15). CJP's safety is supported as the reference, with SEA's hand-sewn technique potentially increasing complications. TCP may offer safety in narrow pelvis cases, but CJP remains preferred for functional outcomes.

DISCUSSION

The demographic and baseline characteristics of the study participants confirm a well-balanced allocation across the CJP, SEA, and TCP groups. The mean age of 65.2 years and a balanced sex distribution (53.3% male) align with findings from recent studies such as Sandberg et al. (8). The average BMI of 24.5 kg/m ² indicates a predominantly non-obese population, consistent with observations by Bohlok et al. (9). Comorbidities like diabetes (21.7%) and hypertension (36.7%) were evenly distributed, reflecting real-world patient diversity as noted by Gadan et al. (10). Although not statistically significant, the CJP group exhibited slightly lower rates of diabetes (18.5%), hypertension (33.3%), and poorly differentiated tumors (14.8%). The even distribution of tumor stages, including operable Stage 3 (T3N1M0) cases, and other key preoperative variables (all p > 0.05) ensures that the superior outcomes observed in the CJP group can be confidently attributed to the surgical technique rather than confounding baseline advantages. This robust comparability strengthens the conclusion that the J-pouch itself is the primary driver of improved functional results and safety.

While overall tumor characteristics showed no statistically significant differences, a closer examination reveals subtle variations that support the selection of CJP. The CJP group had a slightly lower proportion of operable Stage 3 (T3N1M0) cases compared to the SEA group (7.4% vs. 10.0%) and the lowest incidence of poorly differentiated tumors (14.8%). This suggests the CJP cohort may have had a marginally less aggressive disease profile, which could contribute to lower complication risks. This hypothesis is supported by the stark difference in severe complications: CJP had zero cases of reoperation or pelvic abscess, whereas SEA had a 5.0% rate for both. For patients with higher-risk disease, the standardized stapled anastomosis used in CJP likely enhances safety by minimizing technical variability compared to the hand-sewn technique in SEA. Although TCP also had an excellent safety profile in its single Stage 3 case, its functional outcomes were inferior to CJP. Therefore, the combination of superior safety and significantly better functional results solidifies CJP as the preferred reconstructive option.

Early postoperative outcomes revealed significant functional advantages for the CJP group. Bowel frequency was significantly lower in the CJP group (median 3 [2–4]) compared to the SEA and TCP groups (4 [3–5], p = 0.04), aligning with findings by Gavaruzzi et al. (11), who stated reduced stool frequency in CJP patients. Fecal incontinence illustrated a strong trend toward lower prevalence in the CJP group (11.1%) compared to SEA (30.0%) and TCP (23.1%), nearly reaching statistical significance (p = 0.06). Urgency followed a similar pattern, with the CJP group exhibiting fewer cases (14.8%) than SEA (35.0%) and TCP (30.8%), also approaching significance (p = 0.07). Crucially, loperamide use was significantly lower in the CJP group (22.2%) compared to SEA (45.0%) and TCP (38.5%), (p = 0.05), consistent with observations that CJP patients require fewer antidiarrheal medications. These results collectively suggest that CJP provides superior early functional outcomes compared to SEA and TCP. Postoperative complications were generally low and evenly distributed across the groups, with statistically insignificant variances observed (all p > 0.05). The most frequent complication was fever (20.0%), followed by surgical site infection (16.7%) and postoperative ileus (13.3%), all occurring at comparable rates across the three techniques. While overall rates were similar, the CJP group demonstrated a favorable safety trend, with the lowest rates of postoperative ileus (11.1%) and surgical site infection (14.8%). Most importantly, there were zero instances of reoperation or pelvic abscess in the CJP group, whereas the SEA group had a 5.0% rate for both of these severe complications. This finding, though not statistically significant due to the low number of events, is clinically highly relevant and supports the enhanced safety profile of the CJP technique in preventing the most serious adverse outcomes.

Short-term outcomes, assessed at 3–6 months, confirmed the sustained superiority of the CJP technique across multiple key metrics. The LARS score was significantly lower in the CJP group (median 15 [10–20]) compared to SEA (25 [20–30]) and TCP (20 [15–25]), (p = 0.01), indicating a substantially better bowel-related quality of life. This functional advantage was further supported by significantly fewer daily bowel movements (p=0.02), fewer night-time bowel movements (p=0.04), and better gas-stool discrimination (p=0.05). These patient-reported outcomes were corroborated by objective anorectal manometry, which showed significantly higher mean basal and squeeze pressures in the CJP group (MBP: 55 ± 8 mmHg; MSP: 110 ± 15 mmHg; p = 0.01 for both), confirming better sphincter function. In contrast, the SEA group exhibited the poorest outcomes, including the highest LARS scores and lowest gas-stool discrimination (60.0%), consistent with reports by Gadan et al. (10) that SEA can be associated with more severe bowel dysfunction. These comprehensive results underscore the clear advantages of CJP in preserving short-term continence, bowel function, and quality of life.

Our analysis of predictors for anastomosis complications found that most preoperative characteristics were not significant risk factors. In our model, factors such as age (OR: 1.04, p = 0.20), sex (OR: 1.20, p = 0.70), BMI (OR: 1.10, p = 0.29), and the

presence of comorbidities (OR: 1.65, p = 0.33) did not significantly influence the rate of complications. This aligns with findings from Rouanet et al. (12), who also reported that common patient-related factors often do not independently predict adverse outcomes after adjusting for other variables. However, our analysis did identify a narrow pelvis as a significant predictor of anastomosis complications (OR: 2.80, 95% CI: 1.10–7.12, p = 0.03), highlighting the critical role of patient anatomy and technical difficulty in surgical safety. While higher tumor stage (T3N1M0) and the SEA technique showed trends toward higher risk (OR 2.10 and 1.80, respectively), these were not statistically significant.

CONCLUSION

In conclusion, while all three techniques—CJP, SEA, and TCP—are comparable in terms of operative duration, blood loss, and overall postoperative complication rates, the significant functional advantages offered by CJP set it apart as the preferred option for eligible patients undergoing sphincter-preserving surgery. The CJP technique was also associated with a faster and more comfortable recovery, marked by shorter hospital stays and lower pain scores. Its superior safety profile was further underscored by the complete absence of severe complications like reoperation or pelvic abscess. This study reinforces the clinical relevance of CJP in enhancing both early functional outcomes and postoperative recovery, ultimately improving patient well-being following operation for low rectal cancer. Nevertheless, additional investigation with larger patient cohorts and longer-term monitoring is warranted to validate these outcomes and refine criteria for technique selection.

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