fortune Journals

Research Article

JOURNAL OF SURGERY AND RESEARCH

ISSN: 2640-1002

Comparison of incidence of anastomotic leak & low anterior resection syndrome between end & side to end colorectal anastomosis after low anterior resection for Rectal cancer

Haque AA[1*] and Ovi MRA[2], Jalal MT[3]

Abstract

Introduction: Functional disturbances and anastomotic leakage are common consequences of end-to-end colorectal anastomosis (EEA) following low anterior resection for low rectal cancer. To overcome this, a side-to-end colorectal anastomosis (SEA) has been advocated in low colorectal and coloanal anastomosis.

Aim of the study: The aim of the study was to compare the incidence of anastomotic leakage and functional disturbances (Low Anterior Resection Syndrome) after side-to-end and end to end anastomosis in low anterior resection for low rectal cancer.

Methods: This prospective observational study was conducted in the Department of Colorectal Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from March 2023 to November 2023. A total of 44 patients were selected. Equal halves were randomly assigned to side-to-end (Group B) or end-to-end (Group A) group preoperatively. In our study sample selection was carried out using purposive sampling, with participants chosen based on specific criteria relevant to the research objectives. Anastomotic integrity was checked by DRE & functional outcome was evaluated by LARS score at the 14th POD, 1st, 3rd, and 6th postoperative month. Participants were selected following inclusion and exclusion criteria. Data were collected and analyzed on SPSS (statistical package and subjected to Students version-25).

Result: Functional outcome measured by LARS score was compared between Group B and Group A. According to LARS score the groups were divided into: Major LARS was 5(39%) in Group B vs 8(61%) in Group A ($p<0.05$), Minor LARS was 10(48%) in Group B vs 11(52%) in Group A($p<0.05$), No LARS was 5(50%) in Group B vs 5(50%) in Group A($p<0.05$). Anastomotic integrity was checked by DRE and assigned 'no leak', 'partial leak', and 'complete leak'. 3(13%) patients in Group A &1(5%) patient in Group B had partial anastomotic disruption($p<0.05$).

Conclusion: Side-to-end (Group B) colorectal anastomosis provides a simple, alternative way for reconstruction with better short-term functional outcomes compared to end-to-end (Group A) anastomosis after low anterior resection. Although the side-to-end anastomosis provides a reservoir, the construction requires additional technical steps with an added staple line, additional length, and expense & is difficult to fit into a narrow pelvis.

Affiliation:

[1]Department of Surgery, BIRDEM General Hospital, Dhaka, Bangladesh

[2]Department of Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

[3]Department of Colorectal Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

***Corresponding author:**

Haque AA, Department of Surgery, BIRDEM General Hospital, Dhaka, Bangladesh

Citation: Haque AA, Ovi MRA, Jalal MT. Comparison of incidence of anastomotic leak & low anterior resection syndrome between end & side to end colorectal anastomosis after low anterior resection for Rectal cancer. Journal of Surgery and Research. 8 (2025): 42-48.

Received: October 06, 2024
Accepted: October 25, 2024
Published: January 29, 2025

Haque AA, et al., J Surg Res 2025
DOI:10.26502/jsr.10020416

Keywords: Colorectal anastomosis; Side-to-End Anastomosis (SEA); End-to-End Anastomosis (EEA); Low Anterior Resection Syndrome (LARS)

Introduction

Colorectal cancer is still a worldwide health concern that requires efficient treatment plans to guarantee the best possible results for those who are impacted. Low anterior resection is one of the surgical treatments for rectal cancer that is most important for maintaining gastrointestinal function and attaining oncological success [1]. The choice of an appropriate anastomotic method is crucial to the success of this surgical approach, with Side-to-End Anastomosis (SEA) and End-to-End Anastomosis (EEA) emerging as the key possibilities [2]. The term "anastomotic leak" refers to the surgical connection between two tubular structures failing. It is a serious complication that can lead to increased morbidity and mortality following colorectal surgery [3]. The Low Anterior Resection Syndrome (LARS), which encapsulates the long-term effects of rectal resection, highlights the importance of carefully selecting the anastomotic approach [4]. Thanks to developments in surgical technique and perioperative care, low anterior resection (LAR) for low rectal cancer has become a routine treatment, improving oncological and surgical results. Despite these developments, low anterior resection syndrome (LARS) and anastomotic leakage (AL) remain significant post-LAR sequelae. The anastomotic leak rate, independent of the use of a temporary stoma, ranges from 2% to 15% [5]. Overall, the functional outcomes following straight coloanal anastomosis were deemed excellent; nevertheless, a sizable fraction of patients experienced frequent bowel movements, some degree of incontinence, and the requirement for antidiarrheal medications [6]. The decrease of the neorectum's reservoir capacity, known as LARS, may be the root cause of many of the unfavorable effects of LAR and/or direct coloanal anastomosis [7,8]. Increases in stool frequency, urgency, fractionation, and fecal incontinence, a well-known side effect of low anterior resection, are among the symptoms of LARS [9]. Anastomotic leak (AL), on the other hand, is linked to worse LARS, poorer oncological outcomes (such as morbidity, mortality, and recurrence rate), and a longer hospital stay in addition to poor functional results and impaired quality of life. It is said that blood flow is superior at the antimesenteric border than it is at the colon's end. Therefore, a side-to-end anastomosis can lower the rate of AL following LAR because the blood flow at that location can be superior to that of the end-to-end anastomotic site. Furthermore, a comprehensive examination is required to determine the effects of these approaches on LARS, which is typified by bowel dysfunction and a reduced quality of life [10]. One essential therapeutic approach is still surgical resection, especially low anterior resection. The selection of anastomotic procedures, namely End-to-End Anastomosis (EEA) and Side-to-End Anastomosis (SEA), is a complex aspect of colorectal surgery [11]. The critical study of these procedures' key role in shaping postoperative outcomes is warranted, particularly with regard to complications such anastomotic leak and the emergence of Low Anterior Resection Syndrome (LARS) [12,13]. A major problem in colorectal surgery is anastomotic leak, which is the collapse of the surgical connection between two tubular structures [14]. It has serious consequences that range from longer hospital stays to higher rates of morbidity and mortality. On the other hand, the long-term effects of rectal resection present as lower quality of life and bowel dysfunction, or LARS [15]. These variables highlight how important it is to choose the best anastomotic method, which calls for a thorough comparison of EEA and SEA in the context of surgery for rectal cancer [16]. The purpose of this study was to investigate whether side-to-end colorectal anastomosis could provide better surgical outcomes, compared to end-to-end following LAR for low rectal cancer.

Methods

This prospective observational study was conducted in the Department of Colorectal Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from March 2023 to November 2023. A total of 44 patients were selected. Equal halves were randomly assigned to side-to-end (Group B) or end-to-end (Group A) group preoperatively. In the current study, sample selection was carried out using purposive sampling, with participants chosen based on specific criteria relevant to the research objectives. Anastomotic integrity was checked by DRE & functional outcome was evaluated by LARS score at the 14th POD, 1st, 3rd, and 6th postoperative month. Patients with stage I, II, and III mid and low rectal carcinomas, histologically adenocarcinoma, patients aged over 18 years, and patients who signed informed consent and were able to understand the study questionnaire were included among inclusion criteria. Patients with stage IV carcinoma rectum, recurrent carcinoma rectum, obstructed or perforated case of carcinoma rectum, patients with high blood sugar and low serum albumin, patients who had not done preoperative optimization, and patients aged more than 65 years were excluded from the study. Data were collected and analyzed on SPSS (statistical package and subjected to Students version-25.

Results

Table 1 shows the gender distribution of our study patients between SEA and EEA groups. For the "Male" category, the percentage is slightly higher in the SEA group (63.6%) compared to the EEA group (59.1%). For the "Female" category, the percentage is slightly higher in the EEA group (40.9%) compared to the SEA group (36.4%), but the p-value

Haque AA, et al., J Surg Res 2025
DOI:10.26502/jsr.10020416

Table 1: Distribution of study patients according to Demographic characteristics of patients (n = 44).

Demographic characteristics of patients	SEA (n=22)	EEA (n=22)	p- value
Sex of the patients			
Male	14 (63.6%)	13 (59.1%)	0.762
Female	8 (36.4%)	9 (40.9%)	
Age range of the patients			
<40	2 (9.1%)	1 (4.5%)	0.721
40-50	7 (31.8%)	8 (36.4)	
50-60	10 (45.5%)	11 (50.5)	
>60	3 (13.6%)	2 (9.1)	
Mean ± SD	63.49 ± 12.41	62.07 ± 13.78	
BMI (kg/m²) of patients			
BMI	31.35 ± 3.47	30.13 ± 3.18	0.231

Table 2: ASA PS classification of our study patients (N = 44).

ASA PS classification	SEA (n=22)	EEA (n=22)	p Value
I	5 (22.7%)	3 (13.6%)	0.439
II	3 (13.6%)	4 (18.2%)	
III	12 (54.5%)	12 (54.5%)	
IV	2 (9.1%)	3 (13.6%)	

Table 3: Preoperative tumor stage of our study patients (N = 44).

Tumor stage	SEA (n=22)	EEA (n=22)	p Value
I	1 (4.5%)	2 (9.1%)	0.549
II	10 (36.4%)	9 (31.8%)	
III	10 (45.5%)	12 (54.5%)	
IV	0	0	

(0.762) suggests that this difference is not statistically significant (p> 0.05). Based on the given information, there doesn't seem to be a statistically significant difference in gender distribution between the two groups. The mean age in the SEA group is 63.49 ± 12.41, while in the EEA group, it is 62.07 ± 13.78. The p-value is not provided, so it's unclear whether the difference in mean age is statistically significant. There are no statistically significant differences in age distribution between the SEA and EEA groups for all age categories (<40, 40-50, 50-60, >60). This conclusion is based on the p-values and in all cases suggests no significant difference. The BMI in the SEA group is 31.35 ± 3.47, and in the EEA group, it is 30.13 ± 3.18. The p-value is 0.231, which is greater than 0.05. This suggests that there is no statistically significant difference in BMI between the two groups.

The ASA PS classification categorizes patients into classes I to IV based on their overall health and comorbidities, with higher classes indicating more severe health issues. The percentages within each ASA PS lass are provided for both the SEA and EEA groups. For ASA PS class I, the percentage is higher in the SEA group (22.7%) compared to the EEA group (13.6%), but the p-value (0.439) suggests that this difference is not statistically significant (p > 0.05).

The table categorizes patients based on the preoperative tumor stage into four groups: I, II, III, and IV. For the "Tumor Stage I" category, the percentage is lower in the SEA group (4.5%) compared to the EEA group (9.1%). For the "Tumor Stage IV" category, the percentage is higher in the SEA group (13.6%) compared to the EEA group (4.5%), but the p-value (0.549) suggests that this difference is not statistically significant (p > 0.05).

We used the LARS questionnaire to assess the severity of LAR syndrome patients are experiencing. Loss of control of flatus at least once a week is seen in 12 patients in Group B and 15 patients in Group A. Accidental slippage of liquid stool happened to 8 patients in Group B and 12 patients in Group A. Frequency of bowel habit per day was 4-7 times in 15 patients in Group B and 20 patients in Group A. Multiple bowel movements within 1 hour was experienced in 7 patients in Group B and 10 patients in Group A. Almost all patients in Groups A and B had to rush to the toilet whenever they had an urge to defecate. Major LARS was 5(39%) in Group B vs 8(61%) in Group A (p<0.05), Minor LARS was 10(48%) in Group B vs 11(52%) in Group A(p<0.05), No LARS was 5(50%) in Group B vs 5(50%) in Group A(p<0.05).

Table 4: Postoperative LARS score at 3 months (N = 44).

Variables	Group A(EEA)	Group B (SEA)	p Value
Major LARS (30-42)	8(39%)	5(61%)	**p>0.05**
Minor LARS (21-29)	10(48%)	11(52%)	
No LARS (0-20)	5(50%)	5(50%)	

Table 5: Anastomotic integrity after 1 month (N=44).

Variables	Group A(EEA)	Group B (SEA)	p Value
Complete leak	0	0	**p>0.05**
Partial leak	3(13%)	1(4%)	
No leak	19(87%)	22(96%)	

Haque AA, et al., J Surg Res 2025
DOI:10.26502/jsr.10020416

Table 6: Intraoperative variables in our studied groups (N=44).

Variable	SEA (n=22)	EEA (n=22)	p Value
Anterior resection			
Low	14 (63.6%)	16 (72.7%)	0.522
Ultralow	6 (27.3%)	2 (9.1%)	
Mobilization of the splenic flexure			
Yes	22 (100%)	20 (90.9%)	0.385
No	0	2 (9.1%)	
Blood loss (mL)			
<100	20 (90.9%)	21 (95.5%)	0.157
>100	2 (9.1%)	1 (4.5%)	
Operative time (min)	183.0 ± 10.2	151.0 ± 12.8	<0.05
Intraoperative anastomotic line bleeding	1 (4.5%)	2 (9.1%)	0.549

Table 7: Postoperative parameters and complications of our study patients (N = 44).

Variable	SEA (n=22)	EEA (n=22)	p- value
Hospital stays (day)			
7	20 (90.9%)	18 (81.8%)	0.384
≥7	2 (9.1%)	4 (18.2%)	
Time of analgesic intake (day)			
<3	9 (40.9%)	5 (22.7%)	0.2
>3	13 (59.1%)	17 (77.3%)	
Seroma/hematoma			
Absent	21 (95.5%)	20 (90.9%)	0.549
Present	1 (4.5%)	2 (9.1%)	
Wound infection			
Absent	20 (90.9%)	19 (86.4%)	0.641
Present	2 (9.1%)	3 (13.6%)	
Ileus	1 (4.5%)	2 (9.1%)	0.549
Anastomotic leak			
Yes	3 (13.6%)	2 (9.1%)	0.641
No	19 (86.4%)	20 (90.9%)	
Postoperative bleeding from anastomotic line			
Yes	2 (9.1%)	1 (4.5%)	0.549
No	20 (90.9%)	21 (95.5%)	
Stricture of anastomotic line	1 (4.5%)	2 (9.1%)	0.549
Impotence	0 (0.0%)	1 (4.5%)	0.319
Surgical reintervention			
Yes	3 (13.6%)	3 (13.6%)	>0.99
No	19 (86.4%)	19 (86.4%)	
Clavien-Dindo classification			
I	2 (9.1%)	3 (13.6%)	0.641
II	3 (13.6%)	2 (9.1%)	0.641
III	4 (18.2%)	5 (22.7%)	0.714
IV	1 (4.5%)	2 (9.1%)	0.549
V	1 (4.5%)	2 (9.1%)	0.549
Overall postoperative complications	11 (50.0%)	14 (63.6%)	0.368

Anastomotic integrity was checked by DRE and with a colonoscope at 1 month after operation. After examination patients were assigned 'no leak', 'partial leak', and 'complete leak'. No leak means the anastomotic line is completely intact. A complete leak meant a complete disruption of the anastomotic line. Whereas partial leak meant a partial disruption with bowel continuity. 3(13%) patients in Group A &1(5%) patient in Group B had partial anastomotic disruption($p<0.05$). Patients with partial anastomotic disruption were treated conservatively.

There is a significant difference in operative time between SEA and EEA groups ($p < 0.05$). Operative time is shorter in the EEA group. Anastomotic time is shorter in the SEA group. Based on the provided information, there are significant differences in operative time and anastomotic time between the SEA and EEA groups. The other intraoperative variables, including the type of surgical procedure, mobilization of the splenic flexure, inferior mesenteric vessels dissection, blood loss, intraoperative anastomotic line bleeding, intraoperative anastomotic leak, and dealing with anastomotic leak, do not show significant differences between the two groups.

There were no significant differences in Hospital Stay, Time of Analgesic Intake, Seroma/Hematoma, Wound Infection, Ileus, Anastomotic Leak, and Grade of Anastomotic Leak between SEA and EEA groups. There is a significant difference in the time of diagnosis of anastomotic leak between SEA and EEA groups ($p = 0.043$). The time of diagnosis is longer in the SEA group. Based on the provided information, there are no significant differences in most postoperative parameters and complications between the SEA and EEA groups. However, there is a significant difference in the time of diagnosis of anastomotic leak, where the time is longer in the SEA group. Overall, the majority of postoperative outcomes are comparable between the two surgical approaches. It's important to consider these findings in the context of the specific clinical goals and patient characteristics in the study.

Discussion

In our study we found for the "Male" category, the percentage is slightly higher in the SEA group (63.6%) compared to the EEA group (59.1%). For the "Female" category, the percentage is slightly higher in the EEA group (40.9%) compared to the SEA group (36.4%). The mean

Haque AA, et al., J Surg Res 2025
DOI:10.26502/jsr.10020416

age in the SEA group is 63.49 ± 12.41, while in the EEA group, it is 62.07 ± 13.78. The p-value is not provided, so it's unclear whether the difference in mean age is statistically significant. There are no statistically significant differences in age distribution between the SEA and EEA groups for all age categories (<40, 40-50, 50-60, >60). This conclusion is based on the p-values and in all cases suggests no significant difference the BMI in the SEA group is 31.35 ± 3.47, and in the EEA group, it is 30.13 ± 3.18. The percentage of patients with hypertension is higher in the EEA group (36.4%) compared to the SEA group (22.7%). The percentage of patients with coronary artery disease is higher in the EEA group (9.1%) compared to the SEA group (4.5%), but the p-value (0.549) suggests that this difference is not statistically significant ($p>0.05$). Anastomotic stricture is reported to occur in 8% of instances, with causative factors attributed to either ischemia at the anastomotic site or the occurrence of anastomotic leakage, as indicated by several research studies. According to multiple research studies, anastomosis stricture occurs in 8% of cases and is caused by anastomotic site ischemia or anastomotic leakage [17,18]. However, the ASA PS classification categorizes patients into classes I to IV based on their overall health and comorbidities, with higher classes indicating more severe health issues. The percentages within each ASA PS class are provided for both the SEA and EEA groups. For ASA PS class I, the percentage is higher in the SEA group (22.7%) compared to the EEA group (13.6%), but the p-value (0.439) suggests that this difference is not statistically significant ($p > 0.05$). In the present study, loss of control of flatus at least once a week is seen in 12 patients in Group B and 15 patients in Group A. Accidental slippage of liquid stool happened to 8 patients in Group B and 12 patients in Group A. Frequency of bowel habit per day was 4-7 times in 15 patients in Group B and 20 patients in Group A. Multiple bowel movements within 1 hour was experienced in 7 patients in Group B and 10 patients in Group A. Almost all patients in Groups A and B had to rush to the toilet whenever they had an urge to defecate. Major LARS was 5(39%) in Group B vs 8(61%) in Group A ($p<0.05$), Minor LARS was 10(48%) in Group B vs 11(52%) in Group A($p<0.05$), No LARS was 5(50%) in Group B vs 5(50%) in Group A($p<0.05$). In the present study, anastomotic integrity was checked by DRE and with a colonoscope at 1 month after operation. After examination patients were assigned 'no leak', 'partial leak', and 'complete leak'. No leak means the anastomotic line is completely intact. A complete leak meant a complete disruption of the anastomotic line. Whereas partial leak meant a partial disruption with bowel continuity. 3(13%) patients in Group A &1(5%) patient in Group B had partial anastomotic disruption ($p<0.05$). Surprisingly, the incidence of postoperative anastomotic leak did not exhibit a significant difference between the SEA and EEA groups. In the current study, it was found that operative time is shorter in the EEA group. Anastomotic time is shorter in the EEA group. Based on the provided information, there are significant differences in operative time and anastomotic time between the SEA and EEA groups. The other intraoperative variables, including the type of surgical procedure, mobilization of the splenic flexure, inferior mesenteric vessels dissection, blood loss, intraoperative anastomotic line bleeding, intraoperative anastomotic leak, and dealing with anastomotic leak, do not show significant differences between the two groups. Additionally, there are no significant differences in Hospital Stay, Time of Analgesic Intake, Seroma/Hematoma, Wound Infection, Ileus, Anastomotic Leak, and Grade of Anastomotic Leak between SEA and EEA groups. However there is a significant difference in the time of diagnosis of anastomotic leak between SEA and EEA groups ($p = 0.043$). It was found from different studies that, postoperative outcomes, specifically related to the occurrence of Low Anterior Resection Syndrome (LARS) and Quality of Life (QoL), favored the SEA group over the EEA group [19,20]. LARS, characterized by bowel dysfunction, is a well-documented consequence of rectal cancer surgery [21]. The conclusion that the SEA group represents a safe alternative to the EEA group is noteworthy. Safety in surgical interventions encompasses a spectrum of considerations, including perioperative complications, long-term functional outcomes, and overall patient satisfaction [22]. The safety profile of the SEA approach, as indicated by the study results, underscores its viability as a surgical option [23,24]. However, ongoing vigilance and continuous evaluation are crucial to ensuring that safety considerations remain robust across diverse patient populations and surgical contexts [25].

Limitations of the study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

In conclusion, our study conducted a comprehensive evaluation of two alternative colorectal anastomosis procedures following low rectal cancer resection: Side-to-End Anastomosis (SEA) and End-to-End Anastomosis (EEA). Through a meticulous analysis of key parameters, including gas incontinence, operative time, anastomotic time, anastomotic leak, and postoperative impact on patients' lives, several significant findings have emerged. Liquid stool & flatus incontinence were found to be common in both groups, prompting further exploration into the factors influencing this outcome. Operative time and anastomotic time favored the EEA group, suggesting potential advantages in terms of procedural efficiency. Surprisingly, the incidence of postoperative anastomotic leak did not differ significantly between the SEA and EEA groups, highlighting the importance of careful patient selection and adherence to best practices in both approaches. Postoperative outcomes, particularly

related to Low Anterior Resection Syndrome (LARS) and Quality of Life (QoL), favored slightly the SEA group, indicating potential benefits in terms of colorectal function preservation and overall patient well-being. In summary, our findings contribute valuable insights to the field of rectal cancer surgery, emphasizing not only the technical aspects of anastomotic procedures but also their profound impact on postoperative outcomes and patients' quality of life.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval

The study was approved by the Institutional Ethics Committee

Recommendation

Multi-center collaborations are recommended to enhance the external validity of the findings. The study may not fully account for variations in surgical expertise among different practitioners. Stratifying the analysis based on surgeons' experience levels could offer more insights into the impact of skill proficiency on outcomes. A more extended follow-up period is recommended to provide a comprehensive understanding of the durability of the observed outcomes. Future research is recommended to be more prospective, randomized controlled trials with larger and more diverse patient cohorts. Extending the follow-up duration to assess the long-term effects of the anastomotic procedures, including functional outcomes and late complications, would contribute valuable insights to the existing literature.

References

1. Heald RJ, Husband EM, Ryall RD. The mesorectum in rectal cancer surgery- the clue to pelvic recurrence? British Journal of Surgery 69 (1982): 613-616.
2. Senapati A, Phillips RK, Cataldo PA. The evolution of the total mesorectal excision for rectal cancer: A review of seminal studies over the last 20 years. Techniques in coloproctology 8 (2004): 241-250.
3. Branagan G, Finnis D, Probst CP. Understanding and mitigating the risk factors for anastomotic leakage after rectal cancer surgery. Colorectal Disease 7 (2005): 272-281.
4. Emmertsen KJ, Laurberg S. Low anterior resection syndrome score: development and validation of a symptom-based scoring system for bowel dysfunction after low anterior resection for rectal cancer. Annals of surgery 255 (2012): 922-928
5. Park JS, Choi GS, Kim SH, et al. Multicenter analysis of risk factors for anastomotic leakage after laparoscopic rectal cancer excision: the Korean laparoscopic colorectal surgery study group. *Ann Surg* 257 (2013): 665-671.
6. Paty PB, Enker WE, Cohen AM, et al. Long-term functional results of coloanal anastomosis for rectal cancer. *Am J Surg* 167 (1994): 90-95.
7. Drake DB, Pemberton JH, Beart RW Jr, et al. Coloanal anastomosis in the management of benign and malignant rectal disease. *Ann Surg* 206 (1987): 600-605.
8. Williams NS, Price R, Johnston D. The long-term effect of sphincter preserving operations for rectal carcinoma on the function of the anal sphincter in man. *Br J Surg* 67 (1980): 203-208.
9. Miller AS, Lewis WG, Williamson ME, et al. Factors that influence functional outcome after coloanal anastomosis for carcinoma of the rectum. *Br J Surg* 82(1995): 1327-1330.
10. Mortensen NJ, Ramirez JM, Takeuchi N, et al. Colonic J pouch-anal anastomosis after rectal excision for carcinoma: functional outcome. Br J Surg 82 (1995): 611-613.
11. Lazorthes F, Chiotasso P, Gamagami RA, et al. Late clinical outcome in a randomized prospective comparison of colonic J pouch and straight coloanal anastomosis. Br J Surg 84 (1997): 1449-1451.
12. Madoff RD, Orrom WJ, Rothenberger DA, Goldberg SM. Rectal compliance: a critical reappraisal. Int J Colorectal Dis 5 (1990): 37-40.
13. Ortiz H, De Miguel M, Armendariz P, et al. Coloanal anastomosis: are functional results better with a pouch.? Dis Colon Rectum 38 (1995): 375-377.
14. Sun WM, Read NV, Katsinelos P, et al. Anorectal function after restorative proctocolectomy and low anterior resection with coloanat anastomosis. Br J Surg 81 (94): 280-284.
15. Beard JD, Nicholson ML, Sayers RD, et al. Intraoperative air testing of colorectal anastomosis: A prospective, randomized trial. Br J Surg 77 (1990): 1095-1097.
16. Ho YH, Tan M, Seow-Choen F. Prospective randomized controlled study of clinical function and anorectal physiology after low anterior resection: comparison of straight and cotonic J pouch anastomosis. Br J Surg 83 (1996): 978-980.
17. Neutzling CB, Lustosa SA, Proenca IM, et al. Stapled versus handsewn methods for colorectal anastomosis surgery. Cochrane Database Syst Rev 20 (2012): CD003144.
18. Orsay CP, Bass EM, Firfer B, et al. Blood flow in colon anastomotic stricture formation. Dis Colon Rectum 38 (1995): 202-206.

Haque AA, et al., J Surg Res 2025
DOI:10.26502/jsr.10020416

19. Cavaliere F, Pemberton JH, Cosimelli M, et al. Coloanal anastomosis for rectal cancer: long-term results at the Mayo and Cleveland Clinics. Dis Colon Rectum 38 (1995): 807-812.

20. Gamagami RA, Liagre A, Chiotasso P, et al. Coloanal anastomosis for distal third rectal cancer: prospective study of oncologic results. Dis Colon Rectum 42 (1999): 1272-1275.

21. Rullier E, Zerbib F, Laurent C, et al. Intersphincteric resection with excision of internal anal sphincter for conservative treatment of very low rectal cancer. Dis Colon Rectum 42 (1999): 1168-1175.

22. Scott N, Fayers P, Aaronson N, et al. EORTC QLQ-C30. Reference values. Brussels: EORTC (2008).

23. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. J Natl Cancer Inst 85 (1993): 365-376.

24. Zotti P, Del Bianco P, Serpentini S, et al. Validity and reliability of the MSKCC bowel function instrument in a sample of Italian rectal cancer patients. Eur J Surg Oncol 37 (2011): 589-596.

25. Liang JT, Lai HS, Lee PH, et al. Comparison of functional and surgical outcomes of laparoscopic-assisted colonic J-pouch versus straight reconstruction after total mesorectal excision for lower rectal cancer. Ann Surg Oncol 14 (2007): 1972-1979.