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Original Research Article

Operative time and surgical efficiency in end-to-end versus side-to-end colorectal anastomosis for rectal cancer

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ABSTRACT

Background: Side-to-end anastomosis (SEA) and end-to-end anastomosis (EEA) are widely used techniques in colorectal cancer surgery, yet their comparative outcomes remain a subject of debate. This study evaluates operative time, surgical efficiency, and functional outcomes of SEA versus EEA in patients undergoing low anterior resection for rectal cancer.
Methods: A prospective observational study was conducted at Bangabandhu Sheikh Mujib Medical University, (BSMMU) Dhaka, from March to November 2023. Forty-four patients were purposively sampled and randomized into SEA and EEA groups. Intraoperative variables, postoperative outcomes, and functional results, including low anterior resection syndrome (LARS) scores, were evaluated at multiple intervals. Data were analyzed using SPSS version 25, with $p<0.05$ considered significant.
Results: The ASA PS classification and preoperative tumor stages were similar across groups. Splenic flexure mobilization was universally performed in SEA (100%) and in 90.9% of EEA patients (p=0.385). Blood loss was comparable between groups (<100 mL in 90.9% of SEA and 95.5% of EEA, p=0.157). Operative time was significantly longer in SEA (183.0±10.2 minutes) compared to EEA (151.0±12.8 minutes, $p<0.05$). Postoperative LARS scores revealed no significant differences, with major LARS observed in 39% of EEA patients and 61% of SEA patients ($p>0.05$). Anastomotic line bleeding was infrequent in both groups, with no statistically significant differences.
Conclusions: Both SEA and EEA demonstrated comparable safety and functional outcomes in rectal cancer surgery. SEA was associated with longer operative times but offered similar functional and surgical efficiency. The findings highlight the viability of both techniques, with the choice depending on patient-specific and surgical considerations.

Keywords: Colorectal cancer, SEA, EEA, LARS, Rectal cancer surgery, Surgical outcomes, Operative time

INTRODUCTION

Colorectal cancer remains a significant global health concern, necessitating effective treatment strategies to ensure optimal patient outcomes. Low anterior resection (LAR) is one of the critical surgical procedures for rectal cancer, playing a pivotal role in preserving gastrointestinal continuity and achieving oncological efficacy.[1] The success of this procedure heavily depends on selecting an appropriate anastomotic technique, with SEA and EEA being the two primary options.[2] Anastomotic leak, defined as the failure of the surgical connection between two tubular structures, is a serious complication that increases the risk of postoperative morbidity and mortality in colorectal surgery.[3] The significance of choosing the correct anastomotic approach is further highlighted by the prevalence of

LARS, which encapsulates the long-term functional consequences of rectal resection.[4] Advancements in surgical techniques and perioperative care have established LAR as a standard treatment for low rectal cancer, resulting in improved oncological and surgical outcomes. Despite these advancements, anastomotic leakage (AL) and LARS remain common postoperative challenges, with AL rates ranging between 2% and 15%, even with the use of temporary stomas.[5] Although straight coloanal anastomosis often yields favorable functional results, many patients require antidiarrheal medication, experience frequent bowel movements, and face varying degrees of incontinence.[6] Adverse outcomes associated with LAR and direct coloanal anastomosis are often attributed to a reduced reservoir capacity in the neorectum, contributing to LARS.[7,8] Symptoms of LARS, such as increased frequency of bowel movements, urgency, stool fractionation, and fecal incontinence, represent a well-documented consequence of low anterior resection.[9] AL not only exacerbates LARS but also correlates with poorer quality of life, heightened recurrence rates, increased mortality, and extended hospital stays. These factors underscore the critical importance of minimizing AL.[10] The superior blood flow observed at the antimesenteric border of the colon, as compared to the end of the colon, provides a rationale for adopting SEA, which may reduce the incidence of AL following LAR. Furthermore, understanding how SEA and EEA influence LARS, a condition characterized by bowel dysfunction and diminished quality of life, requires a comprehensive assessment.[11] The selection of the optimal anastomotic technique is a fundamental aspect of colorectal surgery. SEA and EEA differ in their approaches, with potential implications for postoperative outcomes, particularly concerning AL and LARS.[12,13] AL, the disruption of the surgical connection, remains a serious complication in colorectal surgery, leading to increased morbidity, mortality, and prolonged hospitalization.[14] In contrast, LARS manifests as long-term bowel dysfunction and reduced quality of life, both of which can significantly impact postoperative recovery.[15,16] These challenges emphasize the importance of a thorough comparative evaluation of SEA and EEA in the context of rectal cancer surgery. This study aims to explore the operative time and surgical efficiency associated with end-to-end versus SEA colorectal anastomosis for rectal cancer, providing insights into their respective advantages and limitations.

METHODS

This observational study of prospective nature was carried out from March 2023 to November 2023 in the department of colorectal surgery at BSMMU, Dhaka. A total of 44 patients were enrolled and evenly distributed into two groups preoperatively: the SEA anastomosis group (Group B) and the EEA group (Group A). Participants were assigned using a purposive sampling approach based on specific eligibility criteria aligned with the research objectives. The integrity of the anastomosis was assessed through digital rectal examination (DRE), and functional outcomes were evaluated using the LARS score at the 14th postoperative day (POD) as well as during follow-ups at the 1st, 3rd, and 6th postoperative months. Inclusion criteria encompassed patients aged 18 years or older with stage I, II, or III mid- and low-rectal adenocarcinomas who provided informed consent and were capable of understanding the study questionnaire. Exclusion criteria included individuals with stage IV rectal carcinoma, recurrent rectal carcinoma, obstructed or perforated rectal carcinoma, uncontrolled diabetes, low serum albumin levels, patients without adequate preoperative optimization, and those over 65 years of age. Data collection was systematically performed, and all variables were analyzed using SPSS V25 software.

RESULTS

The American society of anesthesiologists physical status (ASA PS) classification showed no statistically significant differences between the SEA and EEA groups. In ASA PS class I, 22.7% of patients in the SEA group and 13.6% in the EEA group were categorized, while class II included 13.6% in the SEA group and 18.2% in the EEA group. The majority of patients in both groups were in class III (54.5%), and class IV accounted for 9.1% in the SEA group and 13.6% in the EEA group, with a p=0.439, indicating no significant variation between the groups.

Table 1: 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%)	

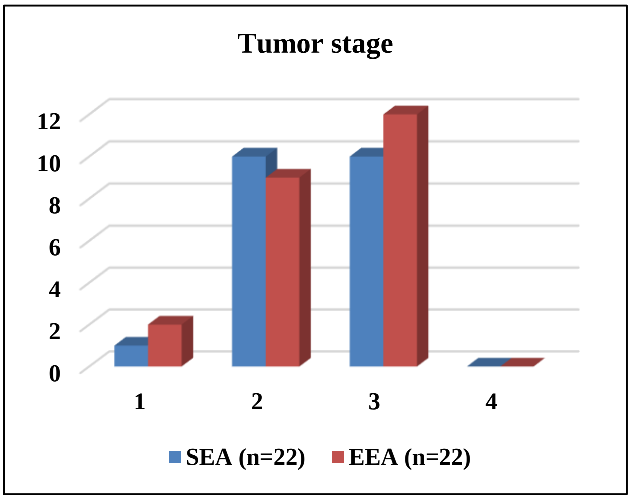

Figure 1: Preoperative tumor stage of study patients, (n=44).

From the chart, the preoperative tumor stage distribution indicates that most patients in both SEA and EEA groups were classified as stage 2 or stage 3. Stage 1 tumors were rare, and stage 4 tumors were nearly absent in both groups. The data suggest similar tumor stage distributions between the SEA and EEA groups, with no significant visual differences.

Table 2: 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%)	>0.05
Minor LARS (21-29)	10 (48%)	11 (52%)	
No LARS (0-20)	5 (50%)	5 (50%)	

At three months postoperatively, the LARS scores indicated similar distributions between the SEA and EEA groups. Major LARS was observed in 39% of patients in the EEA group and 61% in the SEA group. Minor LARS was slightly more common in the SEA group (52%) compared to the EEA group (48%). An equal proportion of patients (50%) in both groups experienced no LARS. The p value suggests no statistically significant differences between the groups in terms of LARS severity.

Table 3: Intraoperative variables in our studied groups, (n=44).

Variables	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

Intraoperative variables demonstrated some differences between the SEA and EEA groups. The proportion of low anterior resections was slightly higher in the EEA group (72.7%) compared to the SEA group (63.6%), while ultralow resections were more common in the SEA group (27.3% vs. 9.1%), though these differences were not statistically significant (p=0.522). Mobilization of the splenic flexure was performed in all patients in the SEA group (100%) compared to 90.9% in the EEA group (p=0.385). Blood loss was less than 100 mL for the majority of patients in both groups (90.9% in SEA vs. 95.5% in EEA, p=0.157). Operative time was significantly longer in the SEA group (183.0±10.2 minutes) compared to the EEA group (151.0±12.8 minutes, p<0.05). Intraoperative anastomotic line bleeding was infrequent, occurring in 4.5% of SEA patients and 9.1% of EEA patients, with no significant difference (p=0.549).

DISCUSSION

The findings of this study provide important insights into the surgical outcomes of SEA and EEA techniques in colorectal cancer surgery. Comparable preoperative patient characteristics are suggested by the absence of statistically significant variations in ASA PS categorization between the SEA and EEA groups. The majority of patients in both groups were classified as class III, which is in line with the increased risk of patients having surgery for colorectal cancer. This is in line with studies emphasizing the utility of ASA PS classification in predicting surgical outcomes but showing limited direct influence on surgical technique choice or outcomes, especially when patient optimization precedes surgery.[17] The preoperative tumor stage distribution, with most patients in stages II and III and negligible cases in stage I or IV, further supports the homogeneity of the study population. Similar observations have been reported in studies comparing SEA and EEA, where tumor stage often influences overall outcomes more than the choice of anastomotic technique.[18] Such comparability is critical in ensuring unbiased evaluation of the anastomotic methods themselves. Postoperative LARS scores revealed no significant differences between SEA and EEA, although a higher percentage of major LARS was observed in the SEA group. These findings align with prior research, which indicates that SEA may lead to slightly worse functional outcomes in some patients, particularly in the short term.[19] Planellas et al demonstrated that although both techniques perform similarly at 12 months, SEA may initially result in worse bowel function, including higher stool clustering and incontinence rates.[20] However, long-term outcomes between SEA and EEA often converge, emphasizing the need for a balanced evaluation of short- and long-term functionality.[21,22] Intraoperative variables, including the proportion of low and ultralow anterior resections and mobilization of the splenic flexure, showed no statistically significant differences between the SEA and EEA groups. Mobilization of the splenic flexure was universally performed in SEA patients but slightly less frequent in EEA patients. This difference, while not statistically significant, highlights the technical adjustments often required in SEA to achieve a tension-free anastomosis, as noted in prior studies.[23,24] Mobilization is a crucial factor in reducing tension at the anastomotic site, but its routine implementation in SEA has been debated due to the potential for increased operative time without significantly reducing complications.[25] Operative time was significantly longer in the SEA group than in the EEA group, reflecting the technical complexity of SEA. This finding is consistent with existing literature, which frequently reports prolonged operative times for SEA due to additional procedural requirements, such as precise alignment of the anastomotic site and mobilization of adjacent structures.[18,26] Despite the extended operative time, SEA is often preferred in cases where improved blood flow and reduced tension are prioritized, potentially mitigating the risk of complications such as AL.[27] Intraoperative anastomotic line bleeding was infrequent in both groups, with no statistically significant difference observed. These findings are consistent with previous studies indicating that anastomotic bleeding is generally rare and can be effectively managed intraoperatively with careful surgical techniques.[28] Studies comparing SEA and EEA have reported similar rates of anastomotic bleeding, further affirming the comparable safety profiles of these methods.[29] Collectively, these findings underline the importance of tailoring anastomotic techniques to individual patient and procedural characteristics. While SEA may offer potential advantages in specific contexts, such as enhanced blood flow and reduced tension, EEA demonstrates better efficiency with shorter operative times. The lack of significant differences in key outcomes such as LARS severity and intraoperative complications suggests that both techniques are viable options, with the choice depending on surgeon expertise, patient anatomy, and specific procedural goals.[22,30] Future research with larger sample sizes and longer follow-up periods is needed to further refine the indications and optimize outcomes for these techniques.

Limitations

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

CONCLUSION

This study highlights the comparable outcomes of SEA and EEA techniques in colorectal cancer surgery, emphasizing their viability as surgical options. Both techniques showed similar preoperative patient profiles and intraoperative safety, with no significant differences in ASA PS classification, splenic flexure mobilization, or intraoperative anastomotic line bleeding. While operative time was significantly longer for SEA, this did not translate into higher complication rates. Functional outcomes, as assessed by LARS scores, were comparable in both groups, with minor variations in severity. These findings suggest that SEA and EEA are equally effective in most clinical scenarios, with technique selection primarily influenced by surgical expertise and patient-specific anatomical considerations.

Recommendations

Further research is needed to validate these findings with larger, multicenter studies and extended follow-up periods to capture long-term functional outcomes and quality of life metrics. Additionally, exploring the impact of these techniques in high-risk patients or those requiring complex resections would provide valuable insights. Routine incorporation of standardized protocols for anastomotic site evaluation and postoperative functional assessments should be encouraged to optimize patient care and surgical decision-making.

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