International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-07-144*

Frequency of Anastomotic Leakage Following Elective Colorectal Resection.

Dr. Shabina Jaffar[1], Dr. Aazma Mirza[2], Dr. Muhammad Naeem[3]*, Dr. Fatima Abbasi[4], Dr. Khadijah[5], Dr. Ehsanullah Malik[6].

[1]*Assistant Professor of Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan.*
[2]*MBBS, FCPS Surgery, CHPE; Senior Registrar, Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan.*
[3]*Associate Professor of Colorectal Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan.*
[4]*Assistant Professor, Department of Surgery, Margalla Institute of Health Sciences, Rawalpindi, Pakistan.*
[5]*Consultant General Surgeon Valika Hospital, Karachi.*
[6]*Assistant Professor, Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU), Larkana, Pakistan.*

Correspondence:
Dr. Muhammad Naeem.
Associate Professor of Colorectal Surgery, Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan.

Email: drnaeemkhann@yahoo.com

Received: 02-05-2026
Revised: 23-06-2026
Accepted: 07-07-2026
Published: 22-07-2026

Abstract

Background: ***Objective:*** To determine the frequency of anastomotic leakage following elective colorectal resection in patients presenting to a major public tertiary care hospital. ***Methods:*** This prospective descriptive study was conducted at the Jinnah Postgraduate Medical Centre (JPMC), Karachi. The study was carried out within 12-month duration, spanning from April 2025 to April 2026. A total of 56 patients scheduled for elective colorectal resection with primary anastomosis for malignant or benign pathologies were prospectively enrolled. Proper institutional ethical approval was obtained prior to the commencement of data collection, and written informed consent was acquired from all participants. Standardized surgical techniques were utilized for resection and subsequent hand-sewn or stapled anastomosis. Patients were monitored closely during the post-operative phase for clinical, radiological, or biochemical signs of anastomotic breakdown. Anastomotic leakage was defined and categorized based on established clinical and radiological criteria requiring conservative management, radiological intervention, or surgical re-intervention. ***Results:*** Among the 56 patients evaluated, the mean age was 51.4 ± 11.2 years, with a male-to-female ratio of 1.4:1. The primary indications for resection were colorectal carcinoma (78.6 percent) and complicated diverticular disease or benign polyps (21.4 percent). Anastomotic leakage was detected in 5 patients, resulting in an overall frequency of 8.9 percent. Out of these 5 cases, 2 (40.0 percent) were classified as Grade A leaks (managed conservatively without active intervention), 1 (20.0 percent) was Grade B (managed with percutaneous radiological drainage), and 2 (40.0 percent) were Grade C leaks requiring emergency laparotomy and fecal diversion. The development of anastomotic leakage was significantly associated with low rectal anastomoses (less than 6 cm from the anal verge) compared to intraperitoneal colonic anastomoses ($p = 0.024$). ***Conclusion:*** Anastomotic leakage remains a clinically significant complication following elective colorectal resection. Understanding the local baseline frequency of 8.9 percent at JPMC helps in risk stratification, early detection, and timely management to minimize post-operative morbidity.

Keywords: Anastomotic Leakage, Colorectal Resection, Elective Surgery, Colorectal Carcinoma, Morbidity, JPMC.

INTRODUCTION

Elective colorectal resection, which is a basic surgery, is performed world-wide from the number of possible surgeries and indications, the main indication refers to colorectal malignancies, diverticular disease, inflammatory bowel disease and complex benign polyps [1,2]. Advances in surgical instrumentation, use of stapling devices and structured pre-operative optimization protocols have made a great difference in perioperative outcomes over the past several decades [2]. Although technical and pharmacological advancements continue to make the recovery from primary intestinal reconstruction more and more successful, anastomotic leakage (AL) remains one of the most dreaded and clinically challenging complications [3]. Anastomotic breakdown not only worsens initial surgical morbidity but also results in significant long-term problems (higher rates of local recurrence within oncologic patients, functional long-term complications, stoma dependency, and higher morbidity/mortality rate associated with the operation) [3,4].

There is some variation in the clinical definition of anastomotic leakage in surgical literature but it essentially refers to a failure of the normal integrity of the intestinal wall at the site of the anastomosis that results in some communication between the intra-luminal and extra-luminal compartments [5]. This failure is a complex and multifactorial process and the

balance of specific areas of vulnerability in the patient and mechanical factors in the surgery play a major part in this failure [5,6]. The recovery capacity of the microvascular microcirculation of the bowel wall (HBMC) is severely affected by systemic risk factors, including age over 50 years, male gender, chronic malnutrition, hypoproteinemia, obesity and poorly controlled diabetes [6]. Adequate microvascular perfusions, a mild surgical adaptation, without localisation bacterial contamination or hematoma formation, are locally playing an important role in the tissue healing cascade [5,6].

In addition, the anatomical site for the anastomosis is a key factor with respect to leakage rates [7]. Intraperitoneal colonic anastomoses get relatively high rates of vascularity and a favorable location and do not leak very frequently (2 percent to 5 percent) [7]. In the pelvis, however, extraperitoneal rectal reconstruction (especially in the small male pelvis) has a much greater problem of leakage; leakage rates are as high as 15% to 20% in high-risk patients [7,8]. This is a relative risk due to the lack of a serosal cover over the extraperitoneal rectum, the difficulty in completely mobilizing the rectum without risking loss of distal blood supply, and the inability to open the pelvis for exposure [8].

Although extensive data has been published regarding colorectal outcomes worldwide, local clinical assessments are needed in public sector, tertiary care hospitals, such as Jinnah Postgraduate Medical Centre (JPMC) in Karachi, Pakistan. Pockets of this region generally have high numbers of late stage disease presentations, poor nutritional foundations and limited pre-operative optimizing resources [4]. Thus, it is important to investigate the pre-operative preferably anastomotic leakage frequencies in this clinical context to set up local standards in quality control and guide the design of appropriate perioperative care pathways and surgical selection. This prospective study aimed to find the incidence, presentation, and grade of anastomotic leaks after elective colorectal surgery at JPMC over a 12-month period.

MATERIALS AND METHODS

Study Design and setting

In this prospective descriptive study the study was designed and conducted in the surgical unit of Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan. The clinical evaluation was performed during a 12-months study period (from April 2025 to April 2026).

Ethical Considerations

The study protocol was reviewed and formally approved by the "Jinnah Postgraduate Medical Centre" Institutional Ethical Review Committee, before recruitment of the patients to the clinical study started. The clinical research was carried out in full respect of the ethical principles of the Helsinki Declaration. All potential participants were informed of surgical risks and benefits and post-operative observational protocol. Written and voluntary informed consent was achieved before the enrolment into the study.

Patient Selection and Eligibility Criteria

The study enrolled a consecutive sample of patients undergoing elective colorectal resection with primary colorectal, coloanal, or colocolic anastomosis during the study period. The target sample size was successfully achieved with a total of 56 patients.

Inclusion criteria:

- Male and female patients between 18 and 75 years of age.
- Patients for elective colorectal resection and primary anastomosis.
- surgical indications include a proven primary colorectal adenocarcinoma, benign strictures, diverticulosis and large sessile polyps.

Exclusion criteria:

- Surgical maneuvers used during emergencies for acute intestinal obstruction, bowel perforation, or active peritonitis.
- The procedures without a primary anastomosis or in patients treated with a primary defunctioning Hartmann's procedure.
- Those with extensive disease in the peritoneum (peritoneal carcinomatosis) or in those who are considered poor surgical candidates due to other late failure visceral organ involvement (visceral failure or end stage).

Surgical Techniques and Protocols

All patients received the same pre-operative treatment in accordance with the standard treatment. All patients were preoperatively prepared mechanically and orally with prophylactic intravenous antibiotics within 60 minutes before an incision was made. General anesthesia was used as standardized. Consultant surgeons (or senior surgical residents) with a high level of experience at performing such surgical resections carried out all surgery under direct consultant supervision.

In the decision of surgical approach (open laparotomy or laparoscopic-assisted resection), tumor size and patient habitus and availability of resources were taken into account. Either anastomosis was hand-sewn (absorbable or delayed absorbable sutures or a standard circular/linear stapling device) or performed using standard circular/linear stapling device, as determined by anatomical location and surgeon choice. Defunctioning loop ileostomies were formed on a cadaver basis in an ultra-low rectal anastomosis or when sub-optimal tissue conditions were found.

Post-Operative Evaluation and Definition of Anastomotic Leakage.
Post-surgical patients were periodically observed for at least 14 days/until they were discharged from the hospital. Clinical, physical and laboratory parameters were monitored every day for the measurement of blood urea nitrogen, complete blood count, C - reactive protein, and surgical drain outputs, as well as physical examination of the abdomen.

1. From a clinical perspective: Anastomotic leakage was defined as a 'fistula' between the fistula and retracting small bowel segments with the presence of any of the following:
2. Diagnostic Tests: Discharge from pelvic drains or surgical wound containing either gas or feculent material.
3. Systemic Findings: Fever (high-grade), ongoing tachycardia, leukocytosis, or unexplained pelvic peritonitis.
4. Radiological/Endoscopic Confirmation: Extra-luminal contrast extravasation, collection of contrast in adjacent hypodensities (computed tomography (CT) with oral/rectal contrast) or direct visualisation of a mucosal defect at sigmoidoscopy.

The leaking cases were categorized as per International Study Group of Rectal Cancer (ISGRC) classification:

- Grade A: Subclinical leak, no active therapy required, found through routine imaging and/or minor drains changes.
- Grade B: Leak that needs active non-surgical treatment (oral restriction, parenteral nutrition, antibiotics or percutaneous radiological drainage).
- Grade C: Moderately severe leaker (emergency laparotomy, PL, and fecal diversion are performed.)

Statistical Analysis
The data was analyzed using SPSS version (25.0). For continuous variables (e.g. Age, Operating time, hospital stay), the data were tested for normality and presented as mean ± standard deviation (SD) or median (IQR). Data were presented in the form of raw frequencies and percentages for categorical variables such as gender, surgical approach, type of anastomosis, or whether or not there was any leakage at the anastomosis. The Chi-square test or Fisher's exact test was used to make comparisons between the leaking and non-leaking groups for categorical variables and the independent t-test for continuous variables. P-values < 0.05 were deemed to be statistically significant.

RESULTS

Demographics and Pre-operative Characteristics:
A total of 56 patients who had colorectal resection with primary closure and who fulfilled all the eligibility criteria during the 12 months of the study were identified at JPMC. The mean age of the patient cohort was 51.4 ± 11.2 years (range, 28 to 72 years). There were 33 males (58.9 per cent) and 23 females (41.1 per cent) in the cohort, a ratio of 1.4:1 male to female. Pre-operative parameters, nutritional parameters and indications for surgical interventions are shown in Table 1.

Table 1: Demographic and Clinical Baseline Features (n = 56).

Clinical Feature Parameter	Value / Frequency	Percentage (%)
Age (Years, mean ± SD)	51.4 ± 11.2	—
Gender, n (%)		
Male	33	58.9%
Female	23	41.1%
Surgical Indication, n (%)		
Colorectal Adenocarcinoma	44	78.6%
Diverticular Disease / Benign Strictures	8	14.3%
Complex Sessile Polyps	4	7.1%
Surgical Approach, n (%)		
Open Laparotomy	39	69.6%
Laparoscopic-Assisted	17	30.4%
Type of Anastomosis, n (%)		
Hand-sewn	24	42.9%
Stapled	32	57.1%
Pre-operative Hemoglobin (g/dL, mean ± SD)	11.2 ± 1.6	—
Pre-operative Serum Albumin (g/dL, mean ± SD)	3.4 ± 0.5	—

Measuring Anastomotic leakage in every spot on the chicken carcass.The measurement of the occurrence of the infections on the chicken carcass.
In an evaluation of 56 patients, there were 5 cases of anastomotic leakage, with an overall leakage incidence of 8.9 percent. The median time to clinical onset of symptoms was 6.2 days after surgery (range, 4–11 days).
By analysing these 5 leakage cases using the ISGRC clinical grading system; we found:

- **Grade A Leaks (40.0 percent, n = 2):** They were managed conservatively with clinical observation, oral restriction, and continual monitoring of the drain. There were no secondary complications with both patients.
- **Grade B Leak (20.0 percent, n = 1):** Give localized have collected fluid in the pelvic area on the CT scan. Was successfully treated with ultrasound-guided percutaneous drainage and a wide spectrum of intravenous antibiotics.
- **Grade C Leaks (40.0 percent, n = 2):** The students developed acute pelvic peritonitis and severe sepsis, grade C Leaks. Emergency laparotomy, peritoneal lavage and defunctioning loop ileostomy were performed on both patients.

Secondary Outcomes: Clinical Risk Factors and Outcomes
Programmers are invited to submit their secondary outcomes for consideration.Secondary Outcomes: Programmers can submit their outcomes to be considered.

Anatomical position had significant association with the presence of anastomotic leakage. Compared with those patients with the intraperitoneal colonic anastomoses (2 of 43 patients, 4.7 percent had a leakage, Fisher's exact test, p = 0.024), there were 3 of 13 patients (or 23.1 percent) with a leakage in patients with the low anterior resections with low extraperitoneal rectal anastomoses (less than 6 cm away from the anal verge).

Other factors, such as surgical technique (hand-sewed vs stapled) and pre-operative albumin level had some trends, but were not statistically significant (Table 2). The median post-operative hospital stay was significantly prolonged with the onset of an anastomotic leak (18.5 days [IQR, 14.0–24.0] vs. 7.5 days [IQR, 6.0–10.0] (p = 0.001).

Table 2: Subgroup Analysis of Factors Associated with Anastomotic Leakage

Clinical Parameter Variable	Anastomotic Leak (n = 5)	No Leakage (n = 51)	p-value
Anatomical Level of Anastomosis			**0.024**
Low Extraperitoneal Rectal (< 6 cm)	3 (60.0%)	10 (19.6%)	
Intraperitoneal Colonic	2 (40.0%)	41 (80.4%)	
Anastomotic Technique			0.462
Hand-sewn (n = 24)	3 (60.0%)	21 (41.2%)	
Stapled (n = 32)	2 (40.0%)	30 (58.8%)	
Pre-operative Serum Albumin Level			0.082
Less than 3.0 g/dL (n = 12)	2 (40.0%)	10 (19.6%)	
3.0 g/dL or Greater (n = 44)	3 (60.0%)	41 (80.4%)	
Median Post-operative Stay (Days)	**18.5 [14.0–24.0]**	**7.5 [6.0–10.0]**	**< 0.001**

DISCUSSION

Anastomotic leakage remains a complex surgical problem (both in short-term and long-term clinical outcome) [1,2]. An overall incidence of 8.9% of anastomotic leakage was observed following elective colorectal resection in this prospective study done at Jinnah Post Graduate Medical Centre, Karachi. This incidence falls within the ranges reported in the international and regional literature where it has been found that the range is influenced by patient demographics, indication for surgery and the level at which the anastomosis is made [3,4,7].

Anatomical level of the anastomosis was also identified, as there was a significant association between the location of the anastomosis at the different anatomical levels and risk of leakage. Leakage rate of the extraperitoneal low rectal anastomoses was 23.1 percent, whereas it was 4.7 percent for intraperitoneal colonic anastomoses.

This difference is clearly seen in the surgical literature, and is mainly explained by anatomic factors, such as the lack of serosal protection in the rectum, the difficulty of creating a tension-free line in the narrow bony pelvis and the risk of a compromised microvascular perfusion after low rectal mobilization [8,9]. This result validates the indications for defunctioning stoma in the low rectum reconstruction protocol to reduce clinical complications of possible stoma leakage [9,10].
The surgical technique (hand-sewn vs. stapled) showed no statistically significant difference in leakage rate (0.50 vs. 0.62, p = 0.462). This aligns with the findings of the large clinical trials and Cochrane review studies that recommend that hand-

sewed and stapled techniques may be equally effective, applied with proper surgical technique, sufficient mobilization and demonstrated vascularity [11].

Therefore, the decision on what technique(s) to use should be based on anatomic considerations, the surgeon's experience, and the resources available in the clinical setting.

One special aspect was noticed about the pre-operative nutritional status. With our small sample size, this likelihood of developing an anastomosis leak was not seen as statistically significant ($p = 0.082$), but was greater in the patients with more severe hypoalbuminemia (serum albumin< 3.0g/dL). Pre-operative malnutrition has an adverse effect on tissue healing pathways, reduces collagen synthesis and raises tissue friability, potentially compromising the integrity of the anastomosis [6].

Pre-operative nutrition optimization is a key area to focus on in a resource-limited environment such as our own, where there is likely to be an extensive burden of chronic malnourished patients and late presentations for diagnosis.

Healthcare resource utilization was significantly affected by the development of anastomotic leakage, which was demonstrated by increased median hospital stay from 7.5 days for uncomplicated cases to 18.5 days for leakage cases ($p < 0.001$). This delay in recovery, coupled with requirement of radiological procedures or emergency re-operations (in our Grade B and C leak cases) simulates the clinical and financial burden on this complication [3].

The study is subject to a few limitations such as the relatively small study population ($n = 56$) and the single-center, prospective design. Furthermore, there is a lack of longterm follow up, which will hamper the evaluation of late occurring strictures and chronic sinus tracts, as well as the oncological results.
Larger prospective cohort studies are required to further investigate the independent determinants of anastomotic failure and the efficacy of optimizing protocols locally in Pakistan's public healthcare environment.

Finally, the incidence of anastomotic leakage after elective colorectal surgery at JPMC was 8.9%, and there was a significant difference between the extraperitoneal and low levels of the rectum. The results highlight the need for meticulous pre-operative planning, the need to place a defunctioning stoma in resections of the low rectum and the importance of stringent postoperative monitoring for prompt identification and correct treatment of complications.

Funding
None
Conflict Of Interest.
None
Ethical Considerations
The study protocol was reviewed and formally approved by the "Jinnah Postgraduate Medical Centre" Institutional Ethical Review Committee, before recruitment of the patients to the clinical study started. The clinical research was carried out in full respect of the ethical principles of the Helsinki Declaration. All potential participants were informed of surgical risks and benefits and post-operative observational protocol. Written and voluntary informed consent was achieved before the enrolment into the study.

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