Health AffairsISSN - 0278-2715 Volume 11 CURRENT ISSUE 5 page 1486-1491
Journal link: https://health-affairs.org/
Abstract Link: https://health-affairs.org/

Risk Factors for Anastomotic Leak in Colorectal Surgery

[1]Dr M. Azhar Qureshi, [2]Dr Shakeel Ahmed,[3]Dr Muhammad Parvez,[4]Dr Aman Ullah ,[5]Dr Farhat Bano, [6]Dr Kaleem Akhtar

Submission: 02 January 2026 | **Acceptance**: 04 February 2026 | **Publication**: 26 February 2026,

[1]Associate professor of General Surgery, Rawal Institute of Health Sciences Islamabad

[2]Assistant professor, Surgery department Karachi Medical and Dental college, Karachi

[3]HOD, Wah Medical College, Islamabad

[4]Petroleum Limited Sui Field Hospital, Sui Balochistan

[5]Associate professor surgery SMBBMC (Shaheed Mohtarma Benazir Bhutto Medical College)Lyari

[6]UHS

Abstract

Background

One of the most dangerous side effects after colorectal surgery is anastomotic leakage (AL), which can result in worse oncological outcomes, longer hospital stays, higher morbidity, and mortality. Determining the risk variables linked to AL is crucial for enhancing patient outcomes and directing preventative measures.

Objective

To assess the operational, disease-related, and patient-related risk factors for anastomotic leakage in patients having colorectal surgery.

Methodology

Over the course of two years, 150 patients who had elective colorectal resection with primary anastomosis were included in this retrospective observational analysis. Information was gathered on illness variables, comorbidities, dietary condition, demographics, and surgical information. Anastomotic leaking within 30 days of surgery was the main result. To find important predictors, statistical analysis was carried out using suitable univariate and multivariate techniques.

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Results

Anastomotic leaking occurred in 12% of patients overall (18/150). Diabetes mellitus (p=0.02), hypoalbuminemia (p=0.001), low rectal tumor location (p=0.01), neoadjuvant therapy (p=0.04), extended operating time (p=0.03), increased intraoperative blood loss (p=0.02), and blood transfusion (p=0.03) were among the significant risk factors found on univariate analysis. Anastomotic leakage was found to be independently predicted by hypoalbuminemia (OR=3.5, p=0.005), diabetes mellitus (OR=2.8, p=0.03), low rectal tumor (OR=2.9, p=0.02), neoadjuvant therapy (OR=2.4, p=0.048), and blood loss >500 mL (OR=2.6, p=0.04).

Conclusion

Anastomotic leakage is a complex issue that is influenced by a number of risk factors, both modifiable and non-modifiable. Reducing the risk requires cautious patient selection, rigorous comorbidity control, preoperative optimization of nutritional status, and skilled surgical technique. Implementing preventative measures and enhancing postoperative outcomes can be facilitated by early identification of high-risk individuals.

Keywords

Anastomotic leakage; Colorectal surgery; Risk factors; Hypoalbuminemia; Diabetes mellitus; Rectal cancer; Postoperative complications

Introduction

One of the most dangerous and dreaded side effects of colorectal surgery is anastomotic leakage (AL), which greatly increases postoperative morbidity and mortality. The incidence of AL remains between 2% to 10% in the majority of clinical series, indicating its ongoing clinical importance despite improvements in surgical procedures, perioperative care, and patient optimization efforts [1]. Anastomotic leaking is linked to longer hospital stays, higher medical expenses, and a lower quality of life in addition to acute consequences like sepsis, peritonitis, and multi-organ failure [2]. Additionally, AL has been associated with worse oncological outcomes, such as higher rates of local recurrence and lower long-term survival, in patients having surgery for colorectal cancer [3].

The cornerstone of curative treatment for colorectal cancer, which is one of the most frequently diagnosed cancers globally, is surgical resection combined with anastomosis to restore intestinal continuity [4]. However, the integrity of the anastomosis is crucial to the success of this surgical technique. Leakage occurs when the anastomotic site fails to heal, which can have disastrous results. In colorectal surgery, identifying patients at high risk and putting preventive measures in place are crucial objectives due to the significant clinical burden associated with AL.

Anastomotic leaking has a complicated etiology that involves intricate interactions between patient, illness, and surgical factors. Patient-related factors include comorbid conditions

including diabetes mellitus, cardiovascular disease, and malnutrition, as well as demographic traits like age and sex. Due to physical variations including a narrower pelvis and technical difficulties during rectal surgery, male gender has repeatedly been found to be an independent risk factor for AL in several investigations [5]. Another important factor is nutritional condition; hypoalbuminemia is significantly linked to poor wound healing and a higher likelihood of leakage [6]. Additionally, because of their effects on tissue perfusion and inflammatory response, lifestyle variables like obesity and smoking have been linked to the etiology of AL [7].

Anastomotic leakage risk is also greatly influenced by disease-related variables, such as tumor location, stage, and underlying pathology. Due to insufficient vascular supply and increased technical difficulty, low rectal anastomoses, especially those near the anal margin, have been linked to higher leak rates [1]. Due to the requirement for substantial surgical resection and impaired tissue integrity, patients with locally advanced cancer or inflammatory bowel illness may also be more vulnerable [6]. Additionally, it has been demonstrated that neoadjuvant treatments like chemotherapy and radiation, which are frequently used to treat rectal cancer, have a negative impact on tissue repair and raise the risk of leaking [5].

The risk of AL is similarly influenced by surgical variables. Leakage has been found to be significantly predicted by extended surgical duration, substantial intraoperative blood loss, and the requirement for blood transfusions [6]. Anastomotic integrity may be jeopardized by technical challenges and intraoperative problems, which may be reflected in these characteristics. Because careful tissue manipulation and a sufficient blood supply are necessary for efficient anastomotic healing, surgeon experience and surgical technique are also very important [1]. Current research indicates that, despite its broad popularity, laparoscopic surgery is not less effective than open surgery in terms of anastomotic leak rates [1].

Apart from these conventional risk factors, new research emphasizes the gut microbiota's function in anastomotic recovery. Anastomotic integrity may be impacted by changes in the microbial mix that affect local inflammation and collagen breakdown [8]. By allowing surgeons to choose well-perfused bowel segments for anastomosis, advances in intraoperative assessment methods, such as fluorescence angiography for assessing tissue perfusion, have also demonstrated promise in lowering the incidence of AL [8].

Because anastomotic leakage is complex, a number of scoring systems and predictive models have been created to assess patient risk and inform clinical judgment. To identify high-risk patients who might benefit from preventative treatments like redirecting stoma formation or increased postoperative surveillance, these models take into account a variety of patient, illness, and surgical characteristics [2]. Nevertheless, despite these attempts, there is still no widely used predictive tool, and risk categorization is still difficult due to the heterogeneity of current research.

Crucially, modifiable and non-modifiable elements can be used to broadly classify risk factors for AL. Modifiable factors like nutritional status, quitting smoking, and optimizing comorbidities offer options for intervention, while non-modifiable factors like sex and tumor location cannot be changed. It has been demonstrated that preoperative optimization techniques, such as careful

patient selection and dietary supplements, can lower the occurrence of postoperative problems, including AL [7].

To sum up, anastomotic leaking is a complicated, multifaceted complication of colorectal surgery that has important clinical ramifications. Improving patient outcomes requires a deep comprehension of the numerous risk factors connected to AL. Surgeons can reduce the frequency of this catastrophic consequence and improve both short-term recovery and long-term survival by identifying high-risk patients and putting specific preventive measures into place. In order to improve risk stratification and therapeutic treatment, this study attempts to assess the risk factors related to anastomotic leakage in colorectal surgery.

Methodology

Over the course of two years, from January 2022 to December 2023, this investigation was carried out as a retrospective observational study in the general surgery department of a tertiary care hospital. The study included all adult patients who had elective colon resection with primary anastomosis for either benign or malignant diseases. Patients with incomplete medical data, those who had emergency surgery, those with pre-existing stomas, and those who were lost to follow-up within 30 days following surgery were not included. The institutional review board granted ethical permission before the trial started, and patient anonymity was upheld at all times.

Using a standardized data collection form, information was gathered from postoperative follow-up charts, operation notes, and hospital medical records. Preoperative laboratory measures, including serum albumin levels, lifestyle factors (smoking status), comorbidities (such as diabetes mellitus, hypertension, and cardiovascular disease), and demographic information (age, sex) were also documented. Additionally recorded were disease-related factors such the need for surgery, the location of the tumor, and the stage of malignant cases. Operative details were documented, such as the kind of surgery (open or laparoscopic), the degree of anastomosis, the length of the procedure, intraoperative blood loss, and the requirement for a blood transfusion. Additionally noticed were the provision of neoadjuvant therapy and the usage of diverting stomas.

Anastomotic leaking within 30 days following surgery was the main outcome measure. Clinical indicators of anastomotic leakage were fever, abdominal pain, peritonitis, purulent or feculent discharge from drains, or radiologically verified leak on contrast-enhanced imaging. Patients who experienced anastomotic leakage and those who did not were divided into two groups.

SPSS version 25.0 was used for statistical analysis. Categorical variables were shown as frequencies and percentages, whilst continuous variables were given as mean ± standard deviation. The chi-square test or Fisher's exact test for categorical data and the independent t-test for continuous variables were used to evaluate the relationship between possible risk factors and anastomotic leakage. Variables with a p-value <0.05 in univariate analysis were included in multivariate logistic regression analysis to identify independent predictors of anastomotic leakage. A p-value of less than 0.05 was considered statistically significant.

Results

The study included 150 individuals who had primary anastomosis during colorectal surgery. 60% of the patients were male, and their average age was 54.2 ± 13.6 years. Anastomotic leakage (AL) was found in 18 patients, yielding a 12% overall incidence.

Table 1: Baseline Characteristics of Study Population (n = 150)

Variable	Total (n=150)	AL Group (n=18)	Non-AL Group (n=132)	p-value
Age (years, mean ± SD)	54.2 ± 13.6	58.1 ± 12.4	53.6 ± 13.8	0.18
Male Gender	90 (60%)	14 (77.8%)	76 (57.6%)	0.09
Diabetes Mellitus	45 (30%)	10 (55.6%)	35 (26.5%)	0.02*
Smoking	50 (33.3%)	9 (50%)	41 (31.1%)	0.11
Hypoalbuminemia (<3.5 g/dL)	48 (32%)	12 (66.7%)	36 (27.3%)	0.001*

Diabetes mellitus and hypoalbuminemia were more common in patients with anastomotic leakage, and both conditions were statistically significant.

Table 2: Disease-Related Factors

Variable	AL Group (n=18)	Non-AL Group (n=132)	p-value
Malignancy	13 (72.2%)	85 (64.4%)	0.51
Low Rectal Tumor	11 (61.1%)	42 (31.8%)	0.01*
Neoadjuvant Therapy	8 (44.4%)	30 (22.7%)	0.04*

Anastomotic leaking risk was substantially correlated with low rectal tumor location and neoadjuvant therapy use.

Table 3: Operative Factors

Variable	AL Group (n=18)	Non-AL Group (n=132)	p-value
Open Surgery	12 (66.7%)	70 (53.0%)	0.28
Duration of Surgery (>180 min)	10 (55.6%)	40 (30.3%)	0.03*
Blood Loss (>500 mL)	9 (50%)	32 (24.2%)	0.02*
Blood Transfusion	8 (44.4%)	28 (21.2%)	0.03*
Diverting Stoma	6 (33.3%)	50 (37.9%)	0.70

Anastomotic leaking was substantially correlated with longer operating times, higher intraoperative blood loss, and the need for blood transfusions.

Table 4: Multivariate Logistic Regression Analysis of Risk Factors for Anastomotic Leakage

Variable	Odds Ratio (OR)	95% CI	p-value
Diabetes Mellitus	2.8	1.1 – 7.2	0.03*
Hypoalbuminemia	3.5	1.4 – 8.6	0.005*
Low Rectal Tumor	2.9	1.2 – 7.5	0.02*
Neoadjuvant Therapy	2.4	1.0 – 6.1	0.048*
Blood Loss (>500 mL)	2.6	1.1 – 6.8	0.04*

Diabetes mellitus, hypoalbuminemia, low rectal tumor placement, neoadjuvant therapy, and higher intraoperative blood loss were found to be independent predictors of anastomotic leakage by multivariate analysis.

Conclusion

With a 12% incidence in our study, anastomotic leaking is still a serious and potentially fatal complication after colorectal surgery. The results showed that a variety of factors, including patient-related, disease-related, and surgical variables, lead to the development of anastomotic leakage.

Hypoalbuminemia and diabetes mellitus were found to be significant patient-related predictors among the risk factors, highlighting the importance of preoperative nutritional optimization and the management of comorbidities. Due to impaired tissue vascularity and healing capacity, disease-related characteristics such low rectal tumor placement and neoadjuvant therapy use were also substantially linked to increased risk. Anastomotic leaking was also found to be independently influenced by operating parameters, such as longer surgical times, higher intraoperative blood loss, and the requirement for blood transfusions.

These results emphasize the significance of a thorough risk assessment strategy for patients having colorectal surgery. Surgeons can apply focused preventative measures, such as preoperative nutritional support, careful surgical technique, intraoperative condition optimization, and the selective use of diverting stomas, by identifying high-risk people.

In summary, anastomotic leaking is a complex issue that necessitates a multidisciplinary approach to prevention. Its occurrence can be considerably decreased and surgical results can be enhanced by early identification of modifiable risk factors and adequate perioperative care. To confirm these results and create uniform risk prediction models for clinical use, more extensive prospective investigations are advised.

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