



STUDY OF FACTORS AFFECTING OUTCOME OF INTESTINAL ANASTOMOSIS

General Surgery

Dr. Urvi V. Modiya	Post graduate, Department of General Surgery, Zydus medical college and hospital, Dahod, Gujarat.
Dr. Rahul Parmar*	Assistant Professor, Department of General Surgery, Zydus medical college and hospital, Dahod, Gujarat*Corresponding Author
Dr. Dishank Modhia	Assistant Professor, Department of General Surgery, Zydus medical college and hospital, Dahod, Gujarat
Dr. Shailesh Rathod	Professor and Head of Dept., Department of General Surgery, Zydus medical college and Hospital, Dahod, Gujarat

ABSTRACT

Background: Intestinal anastomosis is one of the most frequently performed procedures in gastrointestinal surgery. Despite advances in surgical techniques, anastomotic leakage remains a serious and potentially life-threatening complication, contributing to significant morbidity, mortality, and increased healthcare costs. **Objective:** To study and evaluate the patient-related, disease-related, and surgical factors affecting the outcome of intestinal anastomosis. **Methods:** This prospective observational study was conducted at a tertiary care teaching hospital from April 2024 to March 2026, following Institutional Review Board (IRB) approval. 56 patients who underwent intestinal resection with primary anastomosis were included. Data on demographics, hemoglobin, serum albumin, comorbidities, surgical urgency, site of anastomosis, and postoperative complications were recorded and analyzed using descriptive statistics and Chi-square test. **Results:** The mean patient age was 52.2 years, with 58.93% males. The overall abdominal complication rate was 26.79%. Anastomotic leak was the most common complication (26.79%), followed by wound infection (21.43%) and wound dehiscence (17.86%). Hypoalbuminemia was strongly associated with complications (48% vs 9.68%; $p = 0.002$). Anemia ($Hb < 10$ g/dL) was also significantly associated with higher complication rates (44.44% vs 18.42%; $p = 0.04$). The overall mortality rate was 30.36%. **Conclusion:** Serum albumin and hemoglobin are strong independent predictors of postoperative complications following intestinal anastomosis. Preoperative optimization of nutritional and hematological parameters represents a simple, cost-effective strategy to improve anastomotic outcomes.

KEYWORDS

Intestinal Anastomosis, Anastomotic Leak, Hypoalbuminemia, Anemia, Postoperative Complications, Gastrointestinal Surgery

INTRODUCTION

Intestinal anastomosis is defined as the surgical connection of two bowel segments following resection or injury. It is a fundamental technique in the management of intestinal obstruction, malignancy, inflammatory bowel disease, trauma, and ischemic bowel disease. Its success is critical for restoring gastrointestinal continuity and maintaining normal digestive function.

Despite significant advances in suture materials, stapling devices, and perioperative care, complications related to intestinal anastomosis remains a major concern. Anastomotic leakage is among the most serious, leading to peritonitis, sepsis, prolonged hospitalization, and increased mortality. The reported incidence of anastomotic leakage ranges from 2% to 15%, depending on the site of anastomosis, underlying pathology, and patient condition.

Factors influencing anastomotic outcome may be broadly classified into three categories: patient-related factors (age, nutritional status, anemia, diabetes mellitus, immunosuppression), disease-related factors (peritonitis, obstruction, malignancy, ischemia), and surgical/technical factors (technique, blood supply, tension, surgeon experience). Proper healing requires adequate perfusion, tension-free approximation, precise technique, and good nutritional and physiological reserve.

Early identification and preoperative optimization of modifiable risk factors is essential for improving surgical outcomes. This study was undertaken to prospectively evaluate the various factors affecting the outcome of intestinal anastomosis in patients undergoing intestinal surgery at a tertiary care center.

AIMS AND OBJECTIVES

Aim

To study and evaluate the various factors affecting the outcome of intestinal anastomosis in patients undergoing intestinal surgery.

Objectives

Primary objectives

1. To assess postoperative outcomes of intestinal anastomosis.

2. To identify patient-related factors (age, nutritional status, anemia, diabetes mellitus, comorbidities) influencing anastomotic outcome.
3. To evaluate disease-related factors (indication for surgery, peritonitis, obstruction, malignancy, ischemia) affecting anastomotic healing.

Secondary objectives

1. To analyze surgical and technical factors (type of anastomosis, tension, blood supply) associated with postoperative outcomes.
2. To determine the incidence of complications including anastomotic leak, wound infection, stricture, and postoperative mortality.
3. To identify risk factors associated with poor outcomes to improve surgical management and patient care.

REVIEW OF LITERATURE

Historical Background

Intestinal anastomosis has evolved over nearly two centuries. Theodor Billroth performed the first successful gastric resection with anastomosis in 1881, establishing the foundation of modern gastrointestinal surgery. Subsequent contributions by Mikulicz-Radecki and Halsted emphasized meticulous tissue handling, adequate blood supply, and tension-free construction. Various hand-sewn techniques—including Lembert, Connell, and Gambee sutures—were introduced to improve healing and reduce complications. The mid-twentieth century saw the introduction of surgical stapling devices, followed by laparoscopic and robotic approaches that further refined this field.

Pathophysiology of Anastomotic Healing

Normal intestinal anastomotic healing proceeds through three overlapping phases:

- Inflammatory phase (Days 1–4): Platelet aggregation, fibrin deposition, and recruitment of inflammatory cells establish the initial wound environment.
- Proliferative phase (Days 3–14): Fibroblasts synthesize type III collagen, angiogenesis occurs, and granulation tissue is formed. This period corresponds to the vulnerable "lag phase" (Days 3–7) when tensile strength is at its nadir.

- Remodeling phase (>Day 14): Type III collagen is replaced by type I collagen, progressively increasing tensile strength.

Mechanisms of Anastomotic Failure

Anastomotic leakage results from disruption of the healing cascade. Key mechanisms include tissue ischemia (impairing collagen synthesis and immune response), excessive tension (reducing blood flow), bacterial contamination (increasing collagenase activity), and increased intraluminal pressure. Consequences include peritonitis, abscess formation, septic shock, and multi-organ failure, with reported mortality of 6–22% in severe cases.

Risk Factors: Published Evidence

Multiple patient-related, disease-related, and surgical factors influence anastomotic outcomes. Advanced age, malnutrition, hypoalbuminemia, anemia, diabetes mellitus, and immunosuppression adversely affect wound healing. Disease states including peritonitis, bowel obstruction, ischemia, and malignancy impair local perfusion and increase infection risk. Surgical factors—blood supply adequacy, tension at the anastomotic site, technique (hand-sewn vs. stapled), and surgeon experience—are equally determinant. The published literature broadly supports that hand-sewn and stapled anastomoses yield comparable outcomes when fundamental principles are respected.

METHODOLOGY :

Study Design and Setting

This was a prospective observational study conducted at the Department of General Surgery, Zydus Medical College and Hospital, Dahod, Gujarat.

Study Time Period - . April 2024 (after IRB/NHLIRB approval) to March 2026.

Study Population

56 consecutive patients fulfilling the inclusion criteria who underwent intestinal resection with primary anastomosis during the study period were enrolled.

Inclusion Criteria

- Patients who underwent intestinal resection with primary anastomosis.
- Age 18 years and above.
- Patients who gave written and informed consent.
- Emergency and Elective both surgeries included.
- Both male and female patients included.

Exclusion Criteria

- Patients undergoing stoma formation without intestinal anastomosis.
- Patients who refused consent.
- Pregnant patients.

Data Collection

A predesigned proforma captured personal and demographic details, presenting symptoms, physical examination findings, laboratory investigations (CBC, serum albumin, RBS, renal function, coagulation profile), radiological findings, operative details, and postoperative course. Data were entered into Microsoft Excel.

Variables Studied

Patient-related: Age, sex, BMI, hemoglobin level, serum albumin, diabetes mellitus, immunocompromised state.

Disease-related: Indication for surgery, presence of peritonitis, site of intestinal pathology.

Surgical: Emergency vs. elective, site of anastomosis (small bowel, large bowel, or combined).

Postoperative outcomes: Anastomotic leak, wound infection, wound dehiscence, intraperitoneal collection, re-laparotomy, and mortality.

Statistical Analysis

Descriptive statistics (mean, percentage, standard deviation) were calculated. Associations between categorical factors and outcomes were evaluated using the Chi-square test. A p-value < 0.05 was considered statistically significant.

RESULTS :

Demographic Profile

The study enrolled 56 patients with a mean age of 52.2 years (range 18–83 years). The majority (44.64%) were above 60 years, and 58.93% were male, yielding a male-to-female ratio of 1.43:1.

Table 1. Age Distribution of Patients (n = 56)

Age Group (Years)	Number of Patients	Percentage (%)
18–30	8	14.29
31–40	5	8.93
41–50	7	12.50
51–60	11	19.64
>60	25	44.64
Total	56	100

Presenting Symptoms

Abdominal pain was the most common symptom (92.86%), followed by nausea (78.57%), vomiting (73.21%), abdominal distension (67.86%), and constipation/obstipation (60.71%). Fever was present in 19.64% and diarrhoea in 7.14% of patients.

Abdominal distension was the predominant examination finding (71.43%), followed by tenderness (17.86%). Signs of peritonitis (guarding, rigidity) were each present in 5.36% of patients. History of previous abdominal surgery was recorded in 53.57% of patients, consistent with postoperative adhesions as the primary etiology of small bowel obstruction.

Diagnosis and Surgical Urgency

Table 2. Diagnosis Based on Imaging (n = 56)

Diagnosis	n	%
Small bowel obstruction	34	60.72
Hollow viscus perforation	11	19.64
Intussusception	5	8.92
Obstructed hernia	3	5.36
SMA thrombosis	2	3.57
Large bowel obstruction	1	1.79

The majority of patients (71.43%, n = 40) underwent emergency laparotomy, while 28.57% (n = 16) had elective surgery. All 56 patients underwent hand-sewn anastomosis; 55 received end-to-end anastomosis and 1 received Roux-en-Y gastrojejunostomy.

Procedures Performed

Table 3. Anastomotic Procedures Performed (n = 56)

Procedure	n	%
Ileo-colic anastomosis	20	35.71
Ileo-ileal anastomosis	20	35.71
Jejuno-jejunal anastomosis	6	10.71
Colo-colic anastomosis	6	10.71
Jejuno-ileal anastomosis	3	5.37
Roux-en-Y gastrojejunostomy	1	1.79

Postoperative Complications

Table 4. Abdominal Complications (n = 56)

Complication	n	%
Anastomotic leak	15	26.79
Wound infection	12	21.43
Wound dehiscence	10	17.86
Intraperitoneal collection	6	10.71
Re-obstruction	0	0

Among 56 patients, 43 developed at least one abdominal complication. Seven patients had more than one concurrent complication. No cases of re-obstruction were observed. Seven patients (12.5%) required re-laparotomy, of whom 6 (85.71%) died, indicating a very high mortality in the re-laparotomy subgroup.

Anemia and Complications

Eighteen patients (32.14%) had a hemoglobin level below 10 g/dL. The complication rate in this anemic group was 44.44%, compared to 18.42% in the non-anemic group. This difference was statistically significant (p = 0.04).

Table 5. Hemoglobin Level and Abdominal Complications

Hb Level	Total (n=56)	Complications	p value
<10 g/dL	18	8 (44.44%)	0.04*
>10 g/dL	38	7 (18.42%)	

*Statistically significant ($p < 0.05$)

Hypoalbuminemia and Complications

Twenty-five patients (44.64%) had hypoalbuminemia (serum albumin < 3.5 g/dL). Of the 15 patients who developed abdominal complications, 12 had low albumin levels and only 3 had normal albumin. The complication rate in the hypoalbuminemic group was 48%, compared to 9.68% in the normoalbuminemic group. This association was highly statistically significant ($p = 0.002$).

Table 6. Hypoalbuminemia and Abdominal Complications

Albumin	Total (n=56)	Complications	p value
Low (<3.5 g/dL)	25 (44.64%)	12 (48.00%)	0.002**
Normal	31 (55.36%)	3 (9.68%)	

**Highly statistically significant ($p < 0.01$)

Diabetes, Site of Anastomosis, and Timing of Surgery

History of diabetes mellitus was present in 5 patients (8.93%). Diabetic patients showed a higher complication rate (40%) compared to non-diabetic patients (25.49%), but this did not reach statistical significance ($p = 0.27$). Large bowel anastomoses demonstrated a higher complication proportion (66.66%, 2/3 patients) compared to small bowel anastomoses (27.58%) and small-large bowel anastomoses (22.72%), though the difference was not statistically significant owing to the small sample size in the large bowel group. Comparison of emergency vs. elective surgery revealed complication rates of 20.00% vs. 43.75% respectively; however, this difference was not statistically significant ($p = 0.18$).

Outcomes

Table 7. Overall Patient Outcomes (n = 56)

Outcome	n	%
Discharged	37	66.07
Discharged Against Medical Advice (DAMA)	2	3.57
Death	17	30.36

DISCUSSION :

Demographics

The predominance of patients above 60 years (44.64%) was consistent with epidemiological data showing higher rates of intestinal obstruction and related surgical conditions in the elderly, reflecting associated comorbidities, delayed presentation, and reduced physiological reserve. The male predominance (M:F = 1.43:1) was comparable to the 1.25:1 ratio reported by Prakash et al., suggesting higher exposure to underlying risk factors in males.

Nutritional Status

Hypoalbuminemia emerged as the single most significant independent predictor of postoperative abdominal complications in this study ($p = 0.002$). This is consistent with findings by Jina and Singh ($p = 0.005$) and Vikas et al. ($p = 0.005$). Albumin is a critical substrate for collagen synthesis and immune function; low levels impair fibroblasts proliferation and anastomotic integrity. These data strongly support routine preoperative albumin measurement and nutritional supplementation before elective anastomosis.

Anemia

Anemia (Hb < 10 g/dL) was significantly associated with higher complication rates (44.44% vs 18.42%; $p = 0.04$). Tissue hypoxia secondary to anemia impairs collagen synthesis, reduces leukocyte bactericidal capacity, and delays wound healing. Preoperative correction of hemoglobin—through iron supplementation, erythropoietin, or transfusion in selected cases—is therefore a critical optimization strategy.

Site of Anastomosis

Large bowel anastomoses had a notably higher complication proportion (66.66%) compared to small bowel (27.58%) and small-to-large bowel anastomoses (22.72%). This aligns with the well-established greater complication risk of colonic anastomoses, attributable to higher bacterial load, comparatively reduced vascularity of the left colon, and the presence of solid stool. The small number of large bowel cases ($n = 3$) in this series precludes statistical inference, but the trend warrants clinical attention.

Emergency vs. Elective Surgery

Contrary to expectation, elective surgeries showed a higher

complication rate (43.75%) than emergency surgeries (20.00%), though the difference was not statistically significant ($p = 0.18$). This may reflect the complexity and comorbidity burden of elective cases (including malignancies and inflammatory bowel disease), as well as the referral bias at a tertiary center. These findings suggests that patient condition and intraoperative factors are more important determinants of outcome than timing of surgery alone.

Diabetes and Other Factors

Diabetes mellitus showed a trend toward higher complication rates (40% vs 25.49%) that did not reach significance ($p = 0.27$), likely due to the small number of diabetic patients ($n = 5$). Diabetes is known to impair microvascular perfusion, leukocyte function, and collagen synthesis; larger studies consistently demonstrate its role as an independent risk factor. None of the enrolled patients were HIV-positive or on long-term corticosteroid therapy.

Mortality

The overall mortality of 30.36% is high, reflecting the severity of underlying pathology (predominantly emergency presentations with small bowel obstruction and perforation), patient age, and comorbidity burden at this tertiary referral center. The re-laparotomy subgroup carried a particularly poor prognosis (mortality 85.71%), underscoring the gravity of major postoperative complications.

CONCLUSIONS :

Anastomotic leakage remains the most significant determinant of postoperative morbidity and mortality following intestinal surgery. In this prospective study of 56 patients, the overall abdominal complication rate was 26.79%, with an overall mortality of 30.36%.

Serum albumin and hemoglobin levels were identified as strong, statistically significant independent predictors of postoperative anastomotic complications. Preoperative measurement of these parameters provides a simple, cost-effective, and reliable method for surgical risk stratification.

Although advanced age, emergency surgery, diabetes, and site of anastomosis demonstrated higher complication rates, they did not achieve statistical significance in this series, likely reflecting sample size limitations. Larger, multi-center studies are warranted to further define these relationships.

These findings highlights the critical importance of nutritional and hematological optimization prior to intestinal anastomosis. Systematic preoperative correction of hypoalbuminemia and anemia, combined with sound surgical technique, can meaningfully improve anastomotic healing and reduce postoperative complications.

REFERENCES :

- Bailey & Love's Short Practice of Surgery. 28th ed. CRC Press; 2018.
- Schwartz's Principles of Surgery. 11th ed. McGraw-Hill; 2019.
- Sabiston Textbook of Surgery. 21st ed. Elsevier; 2022.
- Billroth T. First successful gastric resection with anastomosis. 1881.
- Halsted WS, Mikulicz-Radecki J. Principles of surgical technique and tissue handling.
- Bruce J, Krukowski ZH, Al-Khairi G, et al. Definition and measurement of anastomotic leak. Br J Surg. 2001;88:1157–1168.
- Kingham TP, Pachter HL. Colonic anastomotic leak: risk factors and management. J Am Coll Surg. 2009;208:269–278.
- McDermott FD, Heeney A, Kelly ME, et al. Risk factors for colorectal anastomotic leak. Br J Surg. 2015;102:462–479.
- Trencheva K, Morrissey KP, Wells M, et al. Predictors of anastomotic leak. Ann Surg. 2013;257:108–113.
- Alves A, Panis Y, Trancart D, et al. Factors associated with anastomotic leakage. Ann Surg. 2002;235:499–507.
- Prakash DS, Naniwadekar DG. A clinical study on resection and anastomosis of bowel in our surgical practice. South Eastern European Journal of Public Health. 2025; 3575–3582.
- Jina A, Singh UC. Factors influencing intestinal anastomotic leak and their predictive value. ISJ. 2019;6(12).
- Meena V, Bajpai G, Kumar D, Meena S. Factors affecting the outcome of intestinal resection and anastomosis: a prospective observational study. J Popul Ther Clin Pharmacol. 2025;32(4):616–620.
- Rohit DK, Sahu SK, et al. A prospective clinical study to understand the factors affecting healing of intestinal primary repair anastomosis. J Contemp Clin Pract. 2025;11(5):590–595.
- Yamamoto T, Allan RN, Keighley MRB. Risk factors for intra-abdominal sepsis after surgery in Crohn's disease. Dis Colon Rectum. 2000;43(8):1141–5.
- Makela JT, Kiviniemi H, Laitinen S. Risk factors for anastomotic leakage after left-sided colorectal resection with rectal anastomosis. Dis Colon Rectum. 2003;46(5):653–60.