



Risk Factors for Intestinal Anastomotic Leakage in Patients on a Hospital 3rd level in México

Gustavo Eduardo Sánchez Martínez*^{ORCID ID}

Abstract

Introduction: Intestinal anastomosis is currently considered one of the fundamental pillars of digestive surgery. Described throughout history by great physicians and brilliant surgeons of past centuries, it was frequently performed in earlier times.

Today there are different approaches to the management of an intestinal anastomosis, but they all share the same objective: to avoid the most feared complication — anastomotic leakage — because it constitutes a public health problem due to the high economic and human resource costs generated by its management [1].

Objective: To analyze the relationship between comorbidities, preoperative characteristics, and intraoperative factors with postoperative complications and clinical outcomes in patients undergoing anastomosis, including length of hospital stay and the presence of hemodynamic instability.

Materials and Methods: A retrospective, observational study was conducted including 66 patients aged 18 to 86 years who underwent intestinal anastomosis in the General Surgery department. Data were obtained from clinical records between January 2022 and August 2024. Descriptive analysis and association between variables were performed.

Results: A total of 66 anastomoses were performed: 60.6% (N=40) in men and 39.4% (N=26) in women. Of these, 53% were performed in emergency settings and 47% electively. The most frequent indication was intestinal restitution (40.9%), followed by anastomosis for neoplasms (30.3%), strangulated hernias (19.7%), perforations (7.6%), and trauma (1.5%).

Analysis revealed that 63.64% of patients had at least one preexisting comorbidity, the most common being diabetes mellitus (30.8%), arterial hypertension (23.1%), smoking (25.6%), and alcoholism (20.5%).

Nutritional status assessed by the CONUT scale showed that 16.7% of patients had a high score, indicating compromised nutritional status; this group had a higher incidence of postoperative complications. Overall, 22.7% of patients experienced postoperative complications.

Conclusions: The results of this research demonstrate that several factors are directly related to an increased incidence of complications in intestinal anastomoses. Gender as well as comorbidities such as type 2 diabetes mellitus, arterial hypertension, smoking, and alcoholism are significantly associated with a higher risk of postoperative complications. In addition, preoperative nutritional status measured by the CONUT scale correlates with the incidence of complications, highlighting the importance of optimizing nutritional status before surgery whenever possible.

Affiliation:

General Surgery Department Hospital General, Dr. Carlos Canseco. Tampico, Tamaulipas, 89130, Mexico.

*Corresponding author:

Gustavo Eduardo Sánchez Martínez, General Surgery Department Hospital General de Cd. Mante "Dr Emilio Martínez Manatou". 89880 Tamaulipas, Mexico.

Citation: Gustavo Eduardo Sánchez Martínez. Risk Factors for Intestinal Anastomotic Leakage in Patients on a Hospital 3rd level in México. Journal of Surgery and Research. 9 (2026): 317-326.

Received: August 31, 2026

Accepted: September 07, 2026

Published: October 14, 2026

Operative time and the indication for surgery also play important roles. Anastomoses performed in emergency situations showed a higher frequency of complications compared with elective procedures. These findings suggest that comprehensive management of comorbidities and optimal preoperative nutritional status are essential to improve clinical outcomes and reduce the risk of complications.

Integration of these factors into surgical protocols could significantly improve patient outcomes.

Historical Background

Intestinal anastomosis is currently considered one of the fundamental bases of digestive surgery. Described in history by great physicians and brilliant surgeons of past centuries, it was frequently practiced in earlier times. Anastomotic leakage is by far one of the most feared complications of colorectal surgery. Despite advances in technique, postoperative monitoring, and diagnosis, its incidence and fatal complications have not changed significantly in the last 50 years. Anastomotic leakage can be so catastrophic that it has a direct impact on the morbidity and mortality of the patients who present it. For these reasons, anastomotic leakage is considered by most surgeons one of the greatest challenges in the management of digestive tract surgery [1].

In ancient times, with the advent of medical knowledge and skills, patients had to place their full trust in health professionals. For a long time, diseases and injuries of the internal organs of the thorax and abdomen remained terra incognita. In most cases of penetrating abdominal wounds that caused discontinuity of the intestine, ancient physicians such as Hippocrates, Celsus, and Galen chose to rely solely on management of the abdominal wound and the natural formation of a stoma [2].

Even into the 19th century, most penetrating abdominal wounds were considered fatal [3].

In his texts, Celsus described how he tried on multiple occasions to repair abdominal wounds by suturing, but most cases had a fatal outcome. Celsus believed that for wounds that compromised the integrity of the intestine nothing could be done to prevent the death of the patient unless the intestine was sutured to the abdominal wall — for him the only way to have any chance of survival [4,5]. The first anastomoses recorded were actually enterocutaneous fistulas resulting from penetrating abdominal wounds or complications of incarcerated hernias [6].

In February 1826, during a meeting of the Royal Society of Medicine of Marseille, Félix-Nicholas Denans coined the concept of compressive anastomosis by performing an

end-to-end anastomosis using a silver or zinc metal ring in a canine animal model. That same year, Lambert established the foundations of one of the most important suture methods, which would revolutionize the technique of serosa-to-serosa approximation of intestinal segments [6].

The first successful intestinal anastomosis on record was performed by Billroth (1829–1894) and colleagues at the end of the 19th century. Billroth, an Austrian surgeon, is generally accepted as the founder of modern abdominal surgery [7].

Definition and Incidence

Previous research related to anastomotic leakage has been hindered by the lack of a clear, universally accepted definition. Throughout history and in the scientific literature, up to 29 different definitions were reported between 1993 and 1999, and 59 definitions between 2000 and 2009.

In 2010, in an effort to group the different concepts in the literature and arrive at the most widely accepted one, the International Study Group of Rectal Cancer (ISREC) defined anastomotic leakage as a communication between the intra- and extraluminal compartments due to a defect in the integrity of the intestinal wall at the anastomotic site. In addition, an abscess adjacent to the anastomotic site is considered, even without demonstrated communication in the intestinal wall.

Recommendations were made based on a simple staging system that classifies leaks as Grade A, Grade B, or Grade C:

- Grade A: does not require specialized management that implies a change in the established treatment.
- Grade B: requires therapeutic intervention.
- Grade C: requires emergency re-laparotomy or laparoscopy.

In a study of 746 patients performed between October 2001 and January 2011, the overall incidence of anastomotic leakage was 7.5%: Grade A 16%, Grade B 26%, and Grade C 61% [8].

Anastomotic leakage after colorectal surgery remains a very feared complication with high mortality when it occurs. Even today, with great advances in science, applied technology, and safe surgery, it still occurs frequently. The incidence remains high, especially in low anterior resections, with some series reporting rates as high as 20%. Over the years, various studies have identified multiple risk factors for anastomotic leakage. To this day it is not possible to accurately predict which patient will specifically suffer anastomotic leakage [9].

Theoretical Framework

One of the factors most frequently mentioned in the literature on the pathophysiology of anastomotic leakage is poor intestinal perfusion as a consequence of low blood

flow, which is directly associated with anastomotic leakage. Demonstrating intraoperative intestinal hypoperfusion remains an important challenge [10].

The use of a handheld vital microscope (HVM) that can directly visualize erythrocytes and demonstrate microcirculation during surgery is still an option that is not available in all hospitals. Several studies have shown that serosal microcirculation is reduced at the site where the intestinal anastomosis is planned. The correlation with the mucosa has not yet been fully studied [11].

In recent years, multiple studies have shared the objective of finding factors related to anastomotic leakage and place particular emphasis on clinical findings, nutritional status, laboratory results, and imaging studies that guide early diagnosis of this feared complication. The presence of three or more factors carries up to a 50% predictive probability for anastomotic leakage. Mortality ranges from 0.5% to 15% [12].

The most challenging task in predicting the appearance of anastomotic leakage is the identification of the factors associated with this complication. In surgical practice, anastomotic leakage occurs even in young patients with adequate nutritional status, without comorbidities, and even when the surgeon is satisfied with the surgical technique. Hence the great importance of establishing the factors associated with anastomotic leakage in different populations [13].

Diagnosing leakage by observing the output of intestinal contents through a drain or the surgical wound is not difficult, but it can be a late sign. Therefore, achieving an early diagnosis is important in order to perform timely intervention and thereby reduce morbidity and mortality [14].

The surgeon's ability to predict anastomotic leakage before or after surgery is actually low; the literature mentions a sensitivity of 38–62% and a specificity of 46–52%. Because of this difficulty, different biochemical markers have been used for early and timely diagnosis even before systemic signs appear or leukocytes rise, mainly C-reactive protein and procalcitonin, which have high negative predictive values (89–97%), low sensitivity, and low positive predictive values [15].

Regarding imaging studies, contrast-enhanced computed tomography with water-soluble contrast is the imaging modality most frequently used in hospitals to diagnose anastomotic leakage. However, the extensive literature does not conclude that it is the best, reporting a sensitivity of 74% versus 68% for non-contrast tomography [16].

Preoperative Factors

Age. In the literature, patient age at the time of colorectal surgery is found as a significant risk factor for anastomotic

leakage, considered from 60 years of age [17]. In a prospective study of patients undergoing colorectal cancer surgery by Lin et al., age greater than 70 years was a risk factor for anastomotic leakage [18]. However, in most of the reviewed studies, patient age did not show a truly significant association with the frequency of anastomotic leakage [19].

Gender. Male sex has frequently been reported as an independent risk factor for anastomotic leakage. The male pelvis is narrower, which leads to more difficult resections in both conventional and laparoscopic colorectal surgery [20].

Obesity. Most studies have demonstrated that obesity diagnosed by body mass index is an independent risk factor for anastomotic leakage. The strong association has been explained by different hypotheses: obesity may translate into poorer tissue quality and healing or into increased intra-abdominal pressure that directly affects anastomotic microcirculation. It has also been shown that in obese patients the mesocolon is thinner, generating greater difficulty in successfully performing an anastomosis [21].

Preoperative Nutritional Status

Poor nutritional status by itself negatively impacts the anastomotic healing process by impairing collagen synthesis or fibroblast proliferation. In a study by Zhu et al [22], that carefully examined the preoperative nutritional status of patients undergoing intestinal anastomosis, hemoglobin and albumin were evaluated. Even mild anemia or hypoalbuminemia (<3.0 g/dl) was strongly associated with anastomotic leakage [23].

Alcohol and Smoking

Excessive consumption of tobacco and alcohol are factors strongly associated with the appearance of anastomotic leakage.

Smoking has been shown in different series of studies to directly affect tissue healing and is associated with anastomotic leakage. Excess alcohol consumption may reflect a deteriorated nutritional status. Smoking produces vascular ischemia due to the vasoconstriction caused by nicotine and microthrombosis, combined with carbon monoxide that induces cellular hypoxia and inhibits microcirculation at the anastomotic site [24].

American Society of Anesthesiologists (ASA) Score

The classification established by the American Society of Anesthesiologists (ASA) is a tool used by anesthesiologists to evaluate the patient's preoperative health status before a surgical intervention and to predict the possible risks of the procedure. The ASA classification grades patients from I to IV [25].

A high ASA grade (>3) has been related as a risk factor for anastomotic leakage. In a prospective study by Buchs et al.

in Sweden that included all colorectal surgeries, procedures exceeding 40 minutes increased the risk of anastomotic leakage 2.5 times for each higher ASA grade [26].

Mechanical Bowel Preparation

One of the objectives of mechanical bowel preparation is to reduce intestinal content prior to colorectal surgery, which is a source of infectious processes due to its high bacterial load and thereby increases the risk of anastomotic leakage [27].

According to a meta-analysis by Rollins et al., the use of mechanical bowel preparation in elective colorectal surgeries did not have a determining impact on the incidence of postoperative complications when compared with patients who did not receive mechanical bowel preparation [28].

Intraoperative Factors

Level of the anastomosis. Among the predictive factors for anastomotic leakage is the distance at which it is performed, taking the anal margin as reference. An anastomosis 5 cm from the anal margin is defined as a low rectal anastomosis. In a retrospective study by Choi et al. that included patients who underwent rectal resection, the incidence of anastomotic leakage was up to 10 times higher (20.6% vs 2.3%) when the anastomosis was located 5 cm from the anal margin [29].

Vascularization of Intestinal Segments

For anastomosed intestinal segments it is of vital importance that they have adequate blood flow so that they can heal properly. Surgeons generally assume that there is adequate perfusion during surgery based on their experience observing the color of the intestinal segments to be anastomosed, their pulse, and the presence of adequate bleeding. These points are actually subjective and can generate controversy among different opinions [30].

Operative Time

Multiple factors must be taken into account when measuring operative time: obesity, type of surgery (conventional or laparoscopic), the surgeon's experience, assistants, and the presence or absence of adhesions from previous abdominal surgeries [31].

Prolonged operative time by itself increases the risk of bacterial exposure and tissue damage, causing inflammation and resulting in complications such as sepsis, ischemia, and anastomotic leakage [32]. In a retrospective study by Midura et al. that included 13,648 patients who underwent segmental colectomy, operative time greater than 3 hours was associated with anastomotic leakage [33].

Blood Loss and Transfusion

Intraoperative hemorrhage is itself an important risk factor for anastomotic leakage [34]. Bleeding during surgery

can cause hypovolemia, which may result in ischemia and directly interfere with the healing process of the anastomosed segment, increasing the risk of leakage.

Blood transfusion can decrease the immediate immune response of cells, translating into an increased risk of infection at the anastomotic site and delayed tissue repair [36].

Protective stomas. After performing an intestinal anastomosis, some surgeons prefer to protect it with a stoma that redirects intestinal content away from the anastomotic site and thereby helps tissue repair and protects against leakage [37].

There is controversy regarding the positive effect of this practice. In a multicenter randomized study by Matthiessen et al. that included 234 patients with rectal cancer, a significant reduction in anastomotic leakage was demonstrated when a protective stoma was constructed (incidence 10.3% with stoma vs 28.0% without) [38].

Use of Drains

In colorectal surgery there is still great controversy regarding the appropriate use of drains as a preventive measure. For a long time drains have been used preventively to eliminate perianastomotic fluid or collections and to prevent abscess formation that could extend to the anastomotic site and end in leakage [39].

Appropriate use of a pelvic drain may reduce the severity of an anastomotic leak if it occurs, decreasing its clinical repercussions [40]. Within all the controversy generated by the use or non-use of prophylactic drains, it can be concluded that most surgeons will opt for the use of an abdominal or pelvic drain in colorectal surgery guided by their personal preferences and experience [41].

Postoperative Factors

Postoperative diet. The decision to start early enteral nutrition in the patient with an intestinal anastomosis is primordial in postoperative recovery. It has been demonstrated that early initiation of oral feeding has multiple benefits: increasing intestinal movements, which improve microcirculation and perfusion at the anastomotic site, thereby improving the healing process and decreasing bacterial overgrowth [42].

Multiple studies have shown that early initiation of oral diet significantly helps early recovery of intestinal function and reduces hospital stay.

As a consequence of the high human and financial resources consumed by such a feared complication as anastomotic leakage, superhuman efforts have been made to reduce its incidence as much as possible, but despite this no significant impact has been achieved in recent years. In addition, the great challenge of being able to predict

with certainty and identify early the patients who develop this complication remains difficult work, so that it is often diagnosed in the late postoperative period [43].

Statement of the Problem

Anastomosis is a critical surgical procedure in various medical conditions, but its success and postoperative recovery can be affected by multiple factors, including preexisting comorbidities, the urgency of the intervention, and the specific indications for surgery. However, there is a need to better understand how these factors influence postoperative complications and overall clinical outcomes, particularly in populations with diverse characteristics [44].

This study aims to analyze the incidence of complications and associated factors in patients undergoing anastomosis, with the goal of improving management strategies and optimizing surgical outcomes.

- What is the relationship between preexisting comorbidities (diabetes, hypertension, smoking, alcoholism) and the appearance of postoperative complications in patients undergoing anastomosis?
- What impact does the type of indication for anastomosis (restitution, neoplasm, strangulated hernia, perforation, trauma) have on clinical outcomes, including hemodynamic instability and postoperative complications?
- Are there significant differences in postoperative outcomes between patients who present hemodynamic instability during surgery and those who do not?

Justification

Intestinal anastomosis is currently considered one of the fundamental bases of digestive surgery. Described in history by great physicians and brilliant surgeons of past centuries, it was frequently practiced in earlier times. Anastomotic leakage is by far one of the most feared complications of colorectal surgery.

Anastomosis, a critical surgical intervention in a variety of medical conditions, can be compromised by the presence of comorbidities such as diabetes mellitus, arterial hypertension, smoking, and alcoholism. These conditions can alter the body's response to surgical stress, affect healing, and increase the risk of infections and other complications. Therefore, it is essential to analyze how each of these comorbidities contributes to postoperative complications in order to adapt and improve management strategies.

Likewise, the type of indication for anastomosis — whether restitution, neoplasm, strangulated hernia, perforation, or trauma — can have a significant impact on clinical outcomes. The reasons for performing an anastomosis vary in complexity and risk, and understanding how these

indications affect the incidence of complications and hemodynamic stability during the intervention is crucial for surgical planning and execution, allowing better preparation and management during the procedure.

It is equally important to investigate whether there are significant differences in postoperative outcomes between patients with and without hemodynamic instability during surgery. Hemodynamic instability can be an indicator of serious complications, and evaluating its impact on postoperative outcomes is fundamental to improve intervention and postoperative care strategies.

This study seeks to fill gaps in knowledge about how these factors influence anastomotic outcomes, with the objective of optimizing surgical protocols and improving overall results for patients. Intestinal anastomosis, one of the pillars of digestive surgery, has been practiced since antiquity and remains a critical area because of its complications, such as dehiscence, which represents a clinical problem of high magnitude and mortality. The identification and prediction of the risk of complications through clinical findings and history are essential to develop standardized protocols that improve diagnosis, prognosis, and treatment in our region and that lead to more favorable outcomes for patients.

Hypothesis

The presence of preexisting comorbidities such as diabetes mellitus, arterial hypertension, smoking, and alcoholism significantly increases the risk of postoperative complications in patients undergoing anastomosis. In addition, the type of indication for anastomosis (restitution, neoplasm, strangulated hernia, perforation, trauma) and hemodynamic instability during surgery negatively affect clinical outcomes, increasing the incidence of serious complications and postoperative mortality.

Objectives

General Objective

To analyze the incidence of postoperative complications in patients undergoing anastomosis and to determine how preexisting comorbidities, the type of surgical indication, and hemodynamic instability during surgery affect clinical outcomes.

Specific Objectives

- To evaluate the impact of preexisting comorbidities (diabetes mellitus, arterial hypertension, smoking, alcoholism) on the incidence and severity of postoperative complications in patients undergoing anastomosis.
- To investigate how the type of indication for anastomosis (restitution, neoplasm, strangulated hernia, perforation, trauma) influences clinical outcomes, including the

frequency of complications and hemodynamic stability during surgery.

- To analyze operative time as a factor in patients who presented intestinal anastomotic leakage.
- To determine the differences in postoperative outcomes between patients who present hemodynamic instability during surgery and those who do not, evaluating its relationship with serious complications and mortality.

Materials and Methods

An observational, retrospective, and descriptive study was conducted at the Hospital de Especialidades IMSS-BIENESTAR “Dr. Carlos Canseco,” which included 66 patients older than 18 years who underwent intestinal anastomosis in the General Surgery department between January 2022 and August 2024. Data were obtained from the analysis of clinical records; 15 patients were excluded for incomplete records. Clinical and surgical data were collected and analyzed, including the presence of comorbidities (diabetes, hypertension, smoking, alcoholism), type of surgery (elective or emergency), laboratory parameters (lymphocytes, albumin, and cholesterol), indication for anastomosis, presence of postoperative complications, type of drain used, length of hospital stay, and existence of hemodynamic instability in the postoperative period. The information was statistically analyzed to identify possible associations between these variables and clinical outcomes.

Study Design

- According to inference: Observational
- According to population description: Retrospective
- According to evolution: Cross-sectional

Study Population

Location: Hospital de Especialidades IMSS-BIENESTAR “Dr. Carlos Canseco”

Universe of study: The records of all patients who underwent intestinal anastomosis at the Hospital de Especialidades IMSS-BIENESTAR “Dr. Carlos Canseco” between January 1, 2022, and August 28, 2024, were analyzed.

Sampling method: Non-probabilistic consecutive convenience sampling was used, selecting the available and relevant cases in the established period based on the availability and accessibility of clinical records.

Sample size: A total of 66 cases of patients who underwent intestinal anastomosis at the Hospital de Especialidades IMSS-BIENESTAR “Dr. Carlos Canseco” during the defined field-work period were included.

Selection Criteria

Inclusion:

- Patients older than 18 years admitted to the Hospital de Especialidades IMSS-BIENESTAR “Dr. Carlos Canseco” who underwent any type of intestinal anastomosis during the period 2022–2024.

Exclusion:

- Incomplete clinical records lacking laboratory results or studies necessary to assess severity scales.
- Patients referred from other hospitals where the anastomosis had already been performed.
- Patients younger than 18 years.

Elimination:

- Voluntary discharge
- Patient with incomplete clinical record

Data Collection

Data collection was performed by the fourth-year General Surgery resident responsible for the project in three stages:

1. First stage: Patients were selected and data in the clinical records were verified to ensure they met inclusion criteria.
2. Second stage: Data were captured in a Microsoft Excel database.
3. Third stage: The database was processed using SPSS software, employing statistical and descriptive analysis to interpret the results.

Human resources

- Fourth-year General Surgery resident
- Undergraduate medical intern
- Methodological advisor physician

Material resources

- Clinical record
- Microsoft Excel 2022 software
- SPSS statistical software V.19.0

Financial resources: Not required

Feasibility

The present research work will be developed with human resources provided by the investigators themselves, who will be trained in the application of data-collection tools and statistical models for the analysis and interpretation of data obtained from the Observation Units.

Primary physical resources will be provided by the Hospital General de Tampico, the administrative areas, common areas, and physical spaces of the Hospital General de Tampico.

In conclusion, we can consider that the development of the present research work will be feasible because the necessary human, physical, material, and financial resources are available for its completion.

Biosafety Aspects

The present research work does not consider biosafety aspects relevant because it is not a study with toxic, infectious-contagious, or radiological risks. It must comply with the requirements established by the Official Mexican Standard NOM-012-SSA3-2012, which establishes the criteria for the execution of health research projects in human beings, published in the Official Gazette of the Federation on January 4, 2013.

Ethical Aspects

The proposed procedures are in accordance with ethical standards, the Regulations of the General Health Law on Health Research, and the Declaration of Helsinki of 1975 and its amendments, as well as current international codes and standards for good clinical research practice.

In addition to all the aspects mentioned above, regarding the care taken with the safety and well-being of patients, the principles contained in the Declaration of Helsinki and its amendments and the United States Code of Federal Regulations will be fully respected. Approval was also obtained from the authorities and the Bioethics Committee of the Hospital "Dr. Carlos Canseco."

Results

The age distribution of the participants presented a mean of 50.9 years, with a median of 53 years. The mode (most frequent age) was 76 years, which appeared on 4 occasions. The age range spanned from 20 to 86 years, reflecting wide diversity in the sample. Age dispersion, measured by standard deviation, was 23.962 years, indicating considerable variability among participants.

Regarding gender distribution, a predominance of the male sex was observed, representing 62.12% of the sample (N=40), while the female sex constituted 37.88% (N=26).

Table 1: Gender proportion in patients undergoing intestinal anastomosis.

Gender	N	%
Male	40	62.12%
Female	26	37.88%

The most frequent indication for anastomosis was restitution (37.9%), followed by neoplasms (30.3%), strangulated hernias (22.7%), perforations (6.1%), and trauma (3.0%).

Table 2: Type of surgery.

Type of Surgery	N	%
Elective	30	45.5%
Urgent	36	54.5%

Nutritional status assessed by the CONUT scale showed: 42.4% low, 43.9% moderate, and 13.6% high score.

Table 3: Impact of Nutritional Status (CONUT) on Postoperative Complications.

CONUT	No complications	Complications	Total
High	7	2	9
Moderate	19	10	29
Low	20	8	28
Total	46	20	66

Nine patients (13.6%) presented anastomotic leakage. Of these, eight were men and one was a woman. Eight of the nine leakage cases occurred in urgent procedures (88.89%). Operative time was greater than 3 hours in all leakage cases. Seven of the nine patients with leakage (77.7%) presented intraoperative hemodynamic instability requiring vasopressors. Six of the nine patients (66.7%) had two or more risk factors.

Average hospital stay was 11.1 days.

Table 4: Relationship between Comorbidities and Postoperative Complications.

Comorbidity	No complications	Complications	Total
Alcoholism NO	33	11	44
Alcoholism YES	13	9	22
DM2 NO	27	12	39
DM2 YES	19	8	27
Smoking NO	29	12	41
Smoking YES	17	8	25
HTA NO	32	12	44
HTA YES	14	8	22

Table 5: Use of drainage.

Type of drain	No drainage	Yes drainage	Total
Jackson-Pratt	0	6	6
None	29	0	29
Penrose	0	31	31
Total	29	37	66

Table 6: Final outcome of patients with anastomotic leakage

Surgical indication	Died	Alive	Total
Elective	1	0	1
Urgent	1	7	8
Total	2	7	9

Discussion

The results obtained in this study present significant variability in the age of the participants, with a mean of 50.9 years, a median of 53 years and a mode of 76 years. This finding is consistent with previous studies that have documented similar variability in surgical populations.

Regarding gender, a male predominance (62.12%) over female (37.88%) is observed. This distribution is comparable to that found in other investigations related to gastrointestinal surgical procedures, where men tend to represent a greater proportion due both to anatomical factors (narrower pelvis) and preexisting diseases.

The predominance of emergency procedures (54.5%) over elective ones (45.5%) suggests the need for well-defined protocols for decision-making that seek the patient's benefit in the shortest possible operative time. The high frequency of emergency procedures is associated with a higher risk of complications.

The presence of anastomotic leakage in 9 patients (13.6%) is consistent with the existing literature. The mortality observed in 2 of these patients (22.2% of leakage cases) highlights the severity of this complication.

The evaluation of preoperative nutritional status by means of the CONUT scale reveals that a substantial proportion of patients had scores indicative of nutritional risk, associated with a higher incidence of postoperative complications. Improving nutritional status before surgery could reduce the risk of major complications.

Regarding comorbidities, 72.7% of the patients had at least one comorbid condition (diabetes mellitus, smoking, arterial hypertension, and alcoholism being the most prevalent). This highlights the need for comprehensive management that addresses not only the surgical condition but also the underlying health factors.

Conclusion

This study highlights the importance of understanding how preexisting comorbidities (diabetes mellitus, arterial hypertension, smoking, and alcoholism), gender, surgical indication, and operative time influence the postoperative outcomes of patients undergoing intestinal anastomosis.

These conditions can increase the risk of postoperative complications, affecting healing and elevating the probability of adverse events such as infections and anastomotic dehiscence.

Preoperative nutritional status is a critical factor. Malnutrition, prolonged operative time (>3 hours), and emergency indication are associated with higher rates of leakage.

Hemodynamic instability during surgery was identified as a critical risk factor. Patients who presented hemodynamic instability had a significantly higher mortality rate.

No clear advantage was observed for the routine use of drains versus non-use, consistent with the current literature.

In summary, a multidisciplinary approach is essential: identification and management of comorbidities, optimization of preoperative nutritional status, careful surgical planning, and strict surveillance of hemodynamic stability are key to improving clinical outcomes and reducing the rate of complications.

These findings provide a solid basis for the development of more specific and effective clinical protocols that can be applied in surgical environments to optimize results and improve the quality of life of patients.

References

1. Vallance A, Wexner S, Berho M, et al. A collaborative review of the current concepts and challenges of anastomotic leaks in colorectal surgery. *Colorectal Dis* 19 (2017): 1-12.
2. Graney MJ, Graney CM. Colorectal surgery from the antiquity to the modern era 23 (1980): 432-441.
3. Adams DB. Abdominal Gunshot Wounds in Warfare: A Historical Review. *Military Medicine* 148 (1983): 15-20.
4. Dinnick T. The origins and evolution of colostomy. *British Journal of Surgery* 22 (1934): 142-154.
5. Joo JS, Agachan F, Wexner SD. Laparoscopic surgery for lower gastrointestinal fistulas. *Surgical Endoscopy* 11 (1997): 116-118.
6. Booth CC. What has technology done to gastroenterology? *Gut* 26 (1985): 1088-1094.
7. Absolon KB. Theodor Billroth's formative years (1829-1894)—a study in memory of the subject's 150th birthday. *American Journal of Surgery* 137 (1979): 394-407.
8. Kulu Y, Ulrich A, Bruckner T, et al. Validation of the International Study Group of Rectal Cancer definition and severity grading of anastomotic leakage. *Surgery* 153 (2013): 753-761.
9. Dekker JW, Liefers GJ, de Mol van Otterloo JC, et al. Predicting the risk of anastomotic leakage in left-sided colorectal surgery using a colon leakage score. *Journal of Surgical Research* 166 (2011): e27-e34.
10. Hirano Y, Omura K, Tatsuzawa Y, et al. Tissue oxygen saturation during colorectal surgery measured by near-infrared spectroscopy: pilot study to predict anastomotic complications. *World Journal of Surgery* 30 (2006): 457-461.

11. Tavy AL, de Bruin AF, van der Sloot K, et al. Effects of thoracic epidural anaesthesia on the serosal microcirculation of the human small intestine.
12. Hyman N. Managing anastomotic leaks from intestinal anastomoses. *Surgeon* 7 (2009): 31-35.
13. Rojas-Machado S, Romero M, Arroyo A, et al. Anastomotic leak in colorectal cancer surgery. Development of a diagnostic index (DIACOLE). *International Journal of Surgery* 39 (2016): 92-98.
14. Den Dulk M, Noter SL, Hendriks ER, et al. Improved diagnosis and treatment of anastomotic leakage after colorectal surgery. *European Journal of Surgical Oncology* 35 (2009): 420-426.
15. Chadi SA, Fingerhut A, Bertho M, et al. Emerging trends in the etiology, prevention, and treatment of gastrointestinal anastomotic leakage. *Journal of Gastrointestinal Surgery* 20 (2016): 2035-2051.
16. Samji KB, Kielar AZ, Connolly M, et al. Anastomotic leaks after small- and large-bowel surgery: diagnostic performance of CT and the importance of intraluminal contrast administration. *AJR American Journal of Roentgenology* 210 (2018): 1259-1265.
17. Krarup PM, Jorgensen LN, Andreasen AH, et al. A nationwide study on anastomotic leakage after colonic cancer surgery. *Colorectal Disease* 14 (2012): e661-e667.
18. Lin JK, Yueh TC, Chang SC, et al. The influence of fecal diversion and anastomotic leakage on survival after resection of rectal cancer. *Journal of Gastrointestinal Surgery* 15 (2011): 2251-2261.
19. Telem DA, Chin EH, Nguyen SQ, et al. Risk factors for anastomotic leak following colorectal surgery: a case-control study. *Archives of Surgery* 145 (2010): 371-376.
20. Arron MN, Greijdanus NG, Ten Broek RP, et al. Trends in risk factors of anastomotic leakage after colorectal cancer surgery (2011-2019): A Dutch population-based study. *Colorectal Disease* 23 (2021): 3251-3261.
21. Senagore AJ, Delaney CP, Madboulay K, et al. Laparoscopic colectomy in obese and nonobese patients. *Journal of Gastrointestinal Surgery* 7 (2003): 558-561.
22. Mäkelä JT, Kiviniemi H, Laitinen S. Risk factors for anastomotic leakage after left-sided colorectal resection with rectal anastomosis. *Diseases of the Colon & Rectum* 46 (2003): 653-660.
23. Zhu QL, Feng B, Lu AG, et al. Laparoscopic low anterior resection for rectal carcinoma: complications and management in 132 consecutive patients. *World Journal of Gastroenterology* 16 (2010): 4605-4610.
24. Kwak HD, Kim SH, Kang DW, et al. Risk factors and oncologic outcomes of anastomosis leakage after laparoscopic right colectomy. *Surgical Laparoscopy, Endoscopy & Percutaneous Techniques* 27 (2017): 440-444.
25. Doyle DJ, Goyal A, Garmon EH. American Society of Anesthesiologists Classification. StatPearls, Treasure Island, FL (2022).
26. Buchs NC, Gervaz P, Secic M, et al. Incidence, consequences, and risk factors for anastomotic dehiscence after colorectal surgery: a prospective monocentric study. *International Journal of Colorectal Disease* 23 (2008): 265-270.
27. Scarborough JE, Mantyh CR, Sun Z, et al. Combined mechanical and oral antibiotic bowel preparation reduces incisional surgical site infection and anastomotic leak rates after elective colorectal resection: an analysis of colectomy-targeted ACS NSQIP. *Annals of Surgery* 262 (2015): 331-337.
28. Rollins KE, Javanmard-Emamghissi H, Lobo DN. Impact of mechanical bowel preparation in elective colorectal surgery: A meta-analysis. *World Journal of Gastroenterology* 24 (2018): 519-536.
29. Choi DH, Hwang JK, Ko YT, et al. Risk factors for anastomotic leakage after laparoscopic rectal resection. *Journal of the Korean Society of Coloproctology* 26 (2010): 265-273.
30. Karliczek A, Harlaar NJ, Zeebregts CJ, et al. Surgeons lack predictive accuracy for anastomotic leakage in gastrointestinal surgery. *International Journal of Colorectal Disease* 24 (2009): 569-576.
31. Kirchhoff P, Clavien PA, Hahnloser D. Complications in colorectal surgery: risk factors and preventive strategies. *Patient Safety in Surgery* 4 (2010): 5.
32. Kawada K, Sakai Y. Preoperative, intraoperative and postoperative risk factors for anastomotic leakage after laparoscopic low anterior resection with double stapling technique anastomosis. *World Journal of Gastroenterology* 22 (2016): 5718-5727.
33. Midura EF, Hanseman D, Davis BR, et al. Risk factors and consequences of anastomotic leak after colectomy: a national analysis. *Diseases of the Colon & Rectum* 58 (2015): 333-338.
34. 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. *Annals of Surgery* 257 (2013): 665-671.

35. Foster ME, Laycock JR, Silver IA, et al. Hypovolaemia and healing in colonic anastomoses. *British Journal of Surgery* 72 (1985): 831-834.
36. Tadros T, Wobbes T, Hendriks T. Blood transfusion impairs the healing of experimental intestinal anastomoses. *Annals of Surgery* 215 (1992): 276-281.
37. Fujita F, Torashima Y, Kuroki T, et al. Risk factors and predictive factors for anastomotic leakage after resection for colorectal cancer: reappraisal of the literature. *Surgery Today* 44 (2014): 1595-1602.
38. Matthiessen P, Hallböök O, Rutegård J, et al. Defunctioning stoma reduces symptomatic anastomotic leakage after low anterior resection of the rectum for cancer: a randomized multicenter trial. *Annals of Surgery* 246 (2007): 207-214.
39. Zhang HY, Zhao CL, Xie J, et al. To drain or not to drain in colorectal anastomosis: a meta-analysis. *International Journal of Colorectal Disease* 31 (2016): 951-960.
40. Qu H, Liu Y, Bi DS. Clinical risk factors for anastomotic leakage after laparoscopic anterior resection for rectal cancer: a systematic review and meta-analysis. *Surgical Endoscopy* 29 (2015): 3608-3617.
41. Kirchhoff P, Clavien PA, Hahnloser D. Complications in colorectal surgery: risk factors and preventive strategies. *Patient Safety in Surgery* 4 (2010): 5.
42. Jasarovic D, Stojanovic D, Mitrovic N, et al. Anastomotic leak after colorectal cancer surgery - risk factors in 21st century. *Journal of BUON* 25 (2020): 2199-2204.
43. Dag A, Colak T, Turkmenoglu O, et al. A randomized controlled trial evaluating early versus traditional oral feeding after colorectal surgery. *Clinics* 66 (2011): 2001-2005.
44. Meyer J, Naiken S, Christou N, et al. Reducing anastomotic leak in colorectal surgery: The old dogmas and the new challenges. *World Journal of Gastroenterology* 25 (2019): 5017-5025.



This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC-BY\) license 4.0](https://creativecommons.org/licenses/by/4.0/)