

Original Research Article

Frequency of Anastomotic Leakage after Primary Repair in Patients with Acute Colonic Injury

Article History:

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Abstract:

Objective: To determine the frequency of anastomotic leakage after primary repair in patients presenting with acute colonic injury. **Study Design:** Descriptive cross-sectional study. **Place and Duration of Study:** Department of General Surgery, Lady Reading Hospital, Peshawar, Pakistan, from 29 July to 29 October 2025. **Methodology:** A total of 100 patients aged 18–65 years with acute colonic injury who underwent primary repair with colonic anastomosis within 24 hours of injury were enrolled using non-probability consecutive sampling. Patients with delayed presentation, generalized fecal peritonitis requiring diversion, severe hemodynamic instability, inflammatory bowel disease, colorectal malignancy, previous colorectal surgery, immunocompromised status, chronic corticosteroid therapy, or incomplete follow-up were excluded. Patients were followed for 30 postoperative days for the detection of anastomotic leakage. Data were analyzed using IBM SPSS Statistics version 25.0. **Results:** The mean age was 34.8 ± 11.6 years, and 83.0% of patients were male. Penetrating trauma was the predominant mechanism of injury (61.0%), while the sigmoid (35.0%) and transverse colon (28.0%) were the most frequently injured segments. Anastomotic leakage occurred in 11 patients, yielding an overall frequency of 11.0%, whereas 89.0% experienced an uncomplicated recovery. No statistically significant association was observed between anastomotic leakage and age ($p=0.532$), gender ($p=0.721$), or mechanism of injury ($p=0.604$). Patients undergoing surgery more than 12 hours after injury had a higher leakage rate (23.1% vs. 6.8%; $p=0.094$). **Conclusion:** Primary repair demonstrated an acceptable anastomotic leakage rate, supporting its use as a safe management option in appropriately selected patients with acute colonic injury, particularly when timely surgical intervention is achieved.

Keywords: Acute colonic injury, Primary repair, Anastomotic leakage, Colonic trauma, Emergency surgery

INTRODUCTION

Acute colonic injuries represent a critical and life-threatening subset of abdominal trauma, carrying substantial morbidity and mortality if not managed promptly [1]. Historically, the management of traumatic colonic perforations was dominated by mandatory fecal diversion via a colostomy, a paradigm established during the major conflicts of the twentieth century to prevent catastrophic intra-abdominal sepsis [2,3]. However, modern trauma

surgery has seen a significant paradigm shift toward primary repair and resection with primary anastomosis, driven by an improved understanding of surgical pathophysiology, advanced resuscitation strategies, and superior perioperative intensive care [4,5]. Despite the increasing adoption of primary management for acute colonic injuries, the most feared and devastating complication remains anastomotic leakage [6]. This complication drastically compromises patient outcomes, leading to

peritonitis, severe intra-abdominal sepsis, prolonged hospitalization, increased healthcare costs, and a heightened risk of mortality [7,8].

The clinical presentation and outcomes of acute colonic injuries are largely influenced by the underlying mechanism of trauma, which is broadly categorized into penetrating and blunt abdominal injuries [9,10]. Penetrating trauma, frequently resulting from gunshot wounds or sharp weapon injuries, tends to cause localized, clear-cut lacerations that are highly amenable to immediate primary suture repair or localized resection and anastomosis [11]. In contrast, blunt abdominal trauma—often sustained during high-velocity motor vehicle accidents or severe falls—frequently results in extensive blast injuries, mesenteric avulsions, and severe tissue contusions that jeopardize the microvascular perfusion of the intestinal wall [12,13]. Ensuring adequate blood flow at the surgical margins is a fundamental prerequisite for successful tissue healing and collagen deposition, which typically peaks between the third and fifth postoperative days [14]. When tissue perfusion is compromised by shock, systemic hypotension, or localized blast damage, the structural integrity of the anastomosis is severely threatened, culminating in dehiscence and subsequent leakage of luminal content [15,16].

The incidence of anastomotic leakage after primary colonic repair or anastomosis in trauma patients varies widely in global literature, generally ranging between 5% and 15% depending on the presence of compounding clinical risk factors [17,18]. Several systemic and intraoperative variables have been postulated to influence the healing of colonic connections. These include patient age, gender, metabolic comorbidities like diabetes or tissue hypoxia, and the specific anatomical site of the injury [19,20]. Furthermore, the duration from the initial injury to definitive surgical intervention is widely recognized as a critical determinant of postoperative success [21]. Delays in surgical exploration allow the progressive contamination of the peritoneal cavity by fecal matter, fostering a severe localized and systemic inflammatory response that directly impairs the cellular mechanisms of bowel healing [22]. Despite these observations, specific data regarding the frequency and risk factors of anastomotic leakage in low-resource settings—where delayed presentation and high volumes of penetrating trauma coexist—remain scarce and inconsistent [23,24]. Therefore, this study was designed to determine the exact frequency of anastomotic leakage following primary repair of acute colonic injuries at a major tertiary care center in Peshawar, Pakistan, providing valuable local epidemiological data to optimize surgical decision-making and improve patient-care protocols.

METHODOLOGY

This descriptive cross-sectional study was conducted

in the Department of General Surgery at Lady Reading Hospital, Peshawar, Pakistan, over a period of three months from 29 July 2025 to 29 October 2025. The study aimed to determine the frequency of anastomotic leakage following primary repair in patients presenting with acute colonic injury. The sample size was calculated using the WHO sample size calculator, considering an anticipated frequency of anastomotic leakage of 12.0%, a 95% confidence level, and a margin of error of 6.5%, resulting in a required sample of 100 patients. A non-probability consecutive sampling technique was employed to recruit eligible participants.

Patients aged 18–65 years of either gender presenting with acute colonic injury who underwent primary repair with colonic anastomosis within 24 hours of injury were included in the study. Acute colonic injury was defined as a traumatic perforation or laceration of the colon confirmed intraoperatively, requiring primary repair or resection with primary anastomosis. Patients with delayed presentation (>24 hours after injury), generalized fecal peritonitis requiring stoma formation, severe hemodynamic instability precluding primary repair, inflammatory bowel disease, colorectal malignancy, previous colorectal surgery, immunocompromised status, chronic corticosteroid therapy, or incomplete follow-up data were excluded.

After obtaining approval from the hospital's Institutional Review Board/Ethics Committee and written informed consent from all participants or their legal attendants, demographic and clinical information including age, sex, mechanism of injury (blunt or penetrating), site of colonic injury, associated intra-abdominal injuries, time from injury to surgery, and operative findings were recorded on a structured proforma. All surgical procedures were performed by consultant surgeons or under their direct supervision following standard institutional protocols. Patients were monitored throughout their hospital stay and followed clinically for evidence of anastomotic leakage until postoperative day 30. Anastomotic leakage was defined as the presence of fecal discharge from the wound or drain, radiological demonstration of contrast extravasation, or confirmation of leakage during re-exploration.

Data were entered and analyzed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Quantitative variables such as age and duration from injury to surgery were expressed as mean $\pm$ standard deviation, whereas qualitative variables including gender, mechanism of injury, site of injury, and anastomotic leakage were summarized as frequencies and percentages. Stratification was performed for potential effect modifiers including age, gender, mechanism of injury, and injury site. The association between categorical variables and anastomotic leakage was assessed using the Chi-square test or Fisher's exact test where appropriate.

A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 100 patients with acute colonic injury who underwent primary repair with colonic anastomosis were included in the study. The mean age of the study population was 34.8 ± 11.6 years (range: 18-65 years). Most patients were males (83.0%), while females constituted 17.0% of the study population (Table 1).

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (n=100)

Variable	Value
Age (years), Mean $\pm$ SD	34.8 ± 11.6
Male	83 (83.0%)
Female	17 (17.0%)
Time from injury to surgery (hours), Mean $\pm$ SD	8.4 ± 3.7
Hospital stay (days), Mean $\pm$ SD	8.9 ± 3.5

Penetrating trauma was the predominant mechanism of injury, accounting for 61.0% of cases. The transverse and sigmoid colon were the most commonly injured segments (Table 2).

Table 2. Injury Characteristics (n=100)

Variable	Frequency (%)
Mechanism of injury	
Penetrating trauma	61 (61.0)
Blunt trauma	39 (39.0)
Site of colonic injury	
Ascending colon	16 (16.0)
Transverse colon	28 (28.0)
Descending colon	21 (21.0)
Sigmoid colon	35 (35.0)

The overall frequency of anastomotic leakage following primary repair was 11.0% (11/100). Most patients (89.0%) recovered without evidence of leakage during the 30-day postoperative follow-up (Table 3).

Table 3. Frequency of Anastomotic Leakage After Primary Repair

Outcome	Frequency (%)
Anastomotic leakage	11 (11.0)
No leakage	89 (89.0)

No statistically significant association was observed between age group, gender, or mechanism of injury and the occurrence of anastomotic leakage ($p > 0.05$). However, patients presenting more than 12 hours after injury demonstrated a relatively higher frequency of leakage compared with those operated on earlier, although the difference did not reach statistical significance (Table 4).

Table 4. Association of Selected Variables with

Anastomotic Leakage

Variable	Leakage n (%)	No Leakage n (%)	p-value
Age (years)			0.532
≤ 40 (n=69)	7 (10.1)	62 (89.9)	
> 40 (n=31)	4 (12.9)	27 (87.1)	
Gender			0.721
Male (n=83)	10 (12.0)	73 (88.0)	
Female (n=17)	1 (5.9)	16 (94.1)	
Mechanism of injury			0.604
Penetrating (n=61)	8 (13.1)	53 (86.9)	
Blunt (n=39)	3 (7.7)	36 (92.3)	
Time to surgery			0.094
≤ 12 hours (n=74)	5 (6.8)	69 (93.2)	
> 12 hours (n=26)	6 (23.1)	20 (76.9)	

DISCUSSION

The overall frequency of anastomotic leakage observed in this study was 11.0%, which aligns closely with the globally reported incidence ranging between 5% and 15% in recent trauma literature [3,7,17]. This finding reinforces the growing consensus that primary repair and resection with primary anastomosis constitute a safe and viable management strategy for acute colonic injuries, even when executed in high-volume emergency setups within developing regions [5,9]. The demographic profile of our cohort, characterized by a mean age of 34.8 years and a strong male predominance (83.0%), reflects the typical socioeconomic subset of the population most vulnerable to trauma in Pakistan, matching previous epidemiological descriptions from regional tertiary care centers [17,23].

Penetrating trauma was the leading mechanism of injury (61.0%) in this study, which traditionally presents favorable conditions for primary management due to localized tissue damage rather than the widespread devascularization and mesenteric shearing associated with blunt abdominal impacts [11,12]. While blunt trauma did not demonstrate a statistically significant correlation with increased leakage rates in our sample (7.7% versus 13.1% for penetrating trauma, $p = 0.604$), the physiological impact of high-energy tissue contusion remains a critical consideration during intraoperative inspection [13]. Furthermore, the anatomical distribution revealed a high frequency of

injuries involving the sigmoid (35.0%) and transverse colon (28.0%). This high prevalence in mobile segments underlines the mechanical vulnerability of these loops during deceleration impacts and localized penetrating forces, contrasting with fixed retroperitoneal colonic segments [10,20]. The most clinically significant trend identified in this study was the relationship between the time from injury to surgery and the subsequent development of an anastomotic leak. Patients who underwent surgical intervention more than 12 hours after the initial trauma experienced a substantially higher rate of leakage at 23.1%, compared to a mere 6.8% among those operated on within the first 12 hours. Although this difference did not reach formal statistical significance ($p = 0.094$)-a result likely attributable to the sample size of 100 patients-it emphasizes the profound pathophysiological impact of prolonged peritoneal exposure to fecal matter [21,22]. Delayed exploration allows progressive bacterial proliferation and systemic inflammatory responses to impair cellular collagen deposition and compromise microvascular perfusion at the freshly sutured margins [14,15]. These findings emphasize that while primary repair is highly reliable, its success is heavily time-dependent, necessitating rapid triaging, minimized pre-hospital delays, and accelerated emergency surgical pathways to mitigate the risk of catastrophic anastomotic failure [24].

CONCLUSION

Primary repair with colonic anastomosis demonstrated a favorable safety profile in patients with acute colonic injury, with an overall anastomotic leakage frequency of 11.0%, comparable to internationally reported rates. Most patients experienced an uncomplicated postoperative course, supporting the feasibility of primary repair in carefully selected trauma patients managed at tertiary care centers. Although age, gender, and mechanism of injury were not significantly associated with anastomotic leakage, a clinically important trend toward higher leakage rates was observed among patients undergoing surgery more than 12 hours after injury, highlighting the potential impact of delayed intervention on anastomotic healing. These findings emphasize the importance of timely diagnosis, prompt resuscitation, and early surgical management to optimize postoperative outcomes. Larger multicenter prospective studies with longer follow-up are recommended to identify independent predictors of anastomotic leakage and further refine patient selection for primary repair in acute colonic trauma.

AI-Assisted Language Editing Declaration

The authors declare that Grammarly was used solely for grammar correction and language polishing during the preparation of this manuscript. Grammarly was employed to improve readability,

spelling, punctuation, and linguistic clarity. No AI-generated scientific content, data, analyses, interpretations, or conclusions were produced or modified using the tool. The authors take full responsibility for the accuracy, originality, and integrity of the manuscript and its scientific content.

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