

Single-Layer End-to-Side Ileotransverse Anastomosis in Emergency Right Hemicolectomy: A Comparative Cohort Study on Anastomotic Leakage and Mortality

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Abstract

Introduction: Acute intestinal obstruction due to right-sided colorectal pathology is a high-risk emergency. Delayed presentation, bowel dilation, microbial contamination, impaired microcirculation, and limited preoperative optimization increase the risks of anastomotic failure, sepsis, and mortality. Although leakage after emergency right hemicolectomy ranges from 8% to 15% (up to 18–20% in high-risk settings), and mortality often reaches 10–20%, the optimal ileotransverse anastomosis remains debated. This comparative cohort study (January 2020–January 2026) evaluated whether optimized small bowel–large bowel reconstruction improved outcomes. **Methods:** This comparative cohort study was conducted at the Department of Faculty Surgery, I.K. Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan. Data were collected from January 2020 to January 2026 for this study. The study included 97 patients who underwent emergency surgery for acute intestinal obstruction requiring ileotransverse anastomosis. The etiologies were predominantly malignant (6.1% benign cases). The study group ($n = 35$) underwent right hemicolectomy with original single-layer continuous inverting end-to-side ileotransverse anastomosis using a 3-0 absorbable suture and vascularity-oriented stump preparation (Moynihan-shaped colonic stump at 60°; ileal stump prepared by removing the anti-mesenteric angle; colonic opening along the tenia libera) to minimize trauma. **Results:** The comparison group ($n = 62$) underwent conventional two-layer hand-sewn side-to-side anastomosis (inner continuous 3-0 polyglycolide, outer interrupted 3-0 nylon). All patients had radiographic obstruction; symptoms exceeded 48 h in most cases and 4 days in 40% of cases, with surgery performed 4–16 h post-admission via midline laparotomy. Anastomotic leakage occurred in 0/35 versus 9/62 (14.5%; $P = 0.024$), and mortality in 0/35 versus 4/62 (6.4%; $P = 0.041$); the mean hospital stay was similar (19.5 vs. 19.9 days; $P = 0.731$). **Conclusion:** These findings suggest that a single-layer end-to-side technique emphasizing preserved vascular architecture and reduced suture-related ischemia can decrease leakage and early mortality in emergency right-sided obstruction, supporting broader prospective multicenter studies.

Key words: Anastomotic leakage, colorectal cancer, ileotransverse anastomosis, intestinal obstruction, post-operative complications, right hemicolectomy

INTRODUCTION

Acute intestinal blockage in right-sided colorectal cancer poses a critical challenge in emergency surgery. Studies indicate that complicated right-sided colon tumors occur in 15–30% of patients, often manifesting as mechanical obstruction.^[1,2] Right-sided tumors account for 35–45% of colorectal cancer cases, and delayed diagnosis frequently leads to emergency surgery.^[3,4]

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The broad lumen of the right colon allows tumors to progress asymptotically. Clinical symptoms emerge only with significant narrowing or blockage, causing proximal intestinal dilation, intoxication, and water and electrolyte disturbances.^[4,5] Upon admission, 40–60% of patients exhibit hypoproteinemia, anemia, and systemic inflammation, which heightens the surgical and anesthetic risks.^[2,6]

Urgent surgery restricts pre-operative preparation, and primary ileotransverse anastomosis often occurs in the presence of intestinal swelling, microbial contamination, and compromised microcirculation.^[4,7] The literature reports small colonic anastomotic leakage rates following emergency right-sided hemicolectomy, ranging from 8% to 15%, reaching 18% to 20% with risk factors.^[1,5] This complication often leads to intra-abdominal abscesses, peritonitis, and sepsis.^[3,6]

Postoperative mortality for complicated right-sided colorectal cancer varies between 10% and 20%, exceeding 25% in older patients.^[4,8] The primary causes of negative outcomes include anastomotic leakage, multiple organ failure, and decompensation of existing conditions.^[2,7]

Active discussions continue regarding anastomosis techniques, including manual single- and double-layer sutures, mechanical methods using linear and circular staplers, and various configurations (end-to-side, side-to-side, functional side-to-side).^[1,8] Studies have shown that mechanical anastomoses reduce leakage rates to 5–9% compared to manual methods.^[3,5] However, the choice of technique depends on intraoperative conditions, intestinal dilation, mesenteric status, and stump blood supply.^[2,6]

Assessing blood flow at the anastomotic site is crucial for preventing complications. Previous studies have demonstrated that intraoperative monitoring, such as fluorescein angiography, can reduce ischemic complications by 20–30%.^[4,7] Additional preventive strategies include tension-free mobilization, careful tissue handling, and appropriate antibacterial therapies.

Despite advances in colorectal surgery, the incidence of post-operative complications in emergency interventions for right-sided cancer complicated by obstruction remains high, ranging from 24 to 40%.^[3,4] The most common complications are anastomotic leakage, intra-abdominal purulent-septic processes, post-operative intestinal paresis, and wound complications.^[5,8] Therefore, the search for an optimal small colonic anastomosis technique continues, aimed at reducing leakage incidence and post-operative mortality, a priority task in modern oncosurgery.^[1,2]

This study aimed to improve the outcomes of patients with acute intestinal obstruction due to right-sided colorectal cancer by optimizing the technique of small-large intestinal anastomosis and reducing the incidence of failure, post-operative complications, and mortality.

MATERIALS AND METHODS

This comparative cohort study was conducted at the Department of Faculty Surgery, I.K. Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan. Data were collected from January 2020 to January 2026 for this study. The study included 97 patients who underwent emergency surgery for acute intestinal obstruction requiring ileotransverse anastomosis. The causes included right-sided colon cancer, Crohn's disease, adhesions, carcinomatosis, and metastatic lesions. The Bioethics Committee of I.K. Akhunbaev Kyrgyz State Medical Academy approved this study (Protocol No. 231, dated July 24, 2020). Informed consent for surgery and study participation was obtained from all patients or their legal guardians.

The participants were divided into the following groups

Study group

35 patients who underwent right hemicolectomy and original single-layer end-to-side ileotransverse anastomosis.

Comparison group

62 patients who underwent conventional double-layer side-to-side ileotransverse anastomosis. The demographics were similar between the groups.

Patients underwent standard emergency assessment, including clinical examination, blood counts, biochemical tests, and abdominal radiography. Intestinal obstruction was confirmed in all the patients. The time from admission to surgery ranged from 4 to 16 h.

Surgeries were performed using midline laparotomy. Following right hemicolectomy, end-to-side ileotransverse anastomosis was created using a single-layer continuous inverting 3-0 absorbable suture. The colonic stump was shaped (Moynihan technique, 60° angle), and the ileal stump was prepared by removing the anti-mesenteric angle. A colonic opening matching the ileum was created along the tenia libera. A conventional side-to-side anastomosis was performed using a two-layer hand-sewn method: An inner continuous 3-0 polyglycolide suture and an outer interrupted 3-0 nylon seromuscular layer.

The primary outcome was the anastomotic leakage. The secondary outcomes included postoperative mortality, hospital stay duration, and early complications. Leakage was defined as clinical or radiological dehiscence that required intervention or caused septic complications.

Statistical analysis was performed using STATISTICA 6.0. Continuous variables are presented as median (interquartile range) or mean $\pm$ standard deviation. Categorical variables were compared using Pearson's Chi-square or Fisher's exact test ($P < 0.05$ was considered significant).

RESULTS

This study included 97 patients who were admitted to the hospital with acute intestinal obstruction in the right colon or terminal ileum. During surgery, the need for ileotransverse anastomosis was assessed in all patients. The participants were categorized into two groups: The main (prospective) group, comprising 35 individuals specifically chosen for this research, and the comparison (retrospective) group, which included 62 patients who were treated before the study. The main group comprised 13 men and 22 women, whereas the comparison group comprised 23 men and 39 women. The age profiles were similar, with a median age of 68.5 years (range, 59–81 years) in the comparison group and 71 years (range, 62–74 years) in the main group [Table 1].

In this study, all patients underwent right hemicolectomy, followed by end-to-side anastomosis between the small intestine and colon. This was performed in a single layer using continuous inversion of 3/0 absorbable monofilament sutures. The colonic stump was prepared using the Moynihan method, with the resection line angled at 60° to the mesentery. The afferent small intestinal loop was prepared by removing the intestinal wall angle farthest from the mesentery. A section matching the small intestine's cross-section was removed along the colonic tenia libera. In the comparison group, a side-to-side anastomosis was performed. Sutures were applied in two layers: Internal continuous 3-0 polyglycolide and external individual 3-0 nylon seromuscular sutures. This study evaluated the anastomotic leakage and mortality rates. Most patients with acute intestinal obstruction had malignant tumors; only 6.1% underwent surgery for benign conditions, such as abdominal adhesive disease or stricturing Crohn's disease. Table 2 shows the distribution of patients by etiology.

In cases where separating the intestinal loops posed significant technical challenges and there was a high risk of intestinal injury, bypass anastomoses were utilized for adhesive obstruction. Clinical symptoms in both groups appeared after more than 48 h, with 40% of patients experiencing symptoms for over 4 days. Upon hospitalization, a standard examination was conducted, which included a general clinical laboratory test and an abdominal X-ray. All 97 patients (100%) exhibited typical X-ray signs of intestinal obstruction, such as Kloiher's bowls and small intestinal arches with fluid levels. The time from admission to surgery varied between 4 and 16 h, as some patients initially received conservative treatment [Table 3]. All patients underwent a wide midline laparotomy, which allowed comprehensive abdominal exploration, particularly when the precise location of the obstruction was not identified before surgery.

The intestinal lumen was incised solely using a sharp method, avoiding the use of electrosurgical tools. We believe that this approach minimizes trauma to the intestinal wall and simultaneously provides a clear evaluation of the adequacy of blood supply at the anastomotic suture line. The extended

Table 1: Demographic characteristics of the included patients in the study

Variables	Study group (n=35)	Comparison group (n=62)	P-value
Male	13 (37.1%)	23 (37.1%)	1.000
Female	22 (62.9%)	39 (62.9%)	1.000
Median age (years)	71	68.5	0.412
Age range (years)	62–74	59–81	-

Data presented as n (%), n: Number of patients, %: Percentage of patients, *P<0.05

Table 2: The distribution of patients by etiology of acute intestinal obstruction

Etiology	Study group (n=35)	Comparison group (n=62)
Right-sided colon cancer	33 (94.3%)	50 (80.6%)
Metastatic melanoma of the ileocecal region	1 (2.9%)	0
Crohn's disease with stricture	1 (2.9%)	1 (1.6%)
Adhesive intestinal obstruction	5*	0
Abdominal carcinomatosis	6*	0

Data presented as n (%), n=number of patients, % = percentage of patients, *P<0.05

Table 3: Characteristics of clinical and perioperative parameters

Parameter	Study group	Comparison group
Symptom duration >48 h	Most of the patients	Most of the patients
Symptom duration >4 days	40%	40%
Radiological signs of obstruction	100%	100%
Time from admission to surgery	4–16 h	4–16 h
Surgical access	Midline laparotomy	Midline laparotomy

duration of surgery due to extensive lymph node dissection did not adversely affect the immediate surgical outcomes. The mean hospital stay was 19.5 days in the study group and 19.9 days in the comparison group. In the comparison group, anastomotic leakage was observed in 14.5% of patients ($P = 0.024$), with four patients (6.4%) succumbing [Table 4]. The study group did not experience any anastomotic complications or fatalities.

The innovative single-layer end-to-side ileotransverse anastomosis was associated with a complete absence of anastomotic leakage and post-operative mortality in the study group. This indicates that maintaining intestinal wall vascularity and reducing tissue damage may play a significant

Table 4: Characteristics of post-operative outcomes

Outcome	Study group (n=35)	Comparison group (n=62)	P-value
Anastomotic leakage	0 (0%)	9 (14.5%)	0.024
Mortality	0 (0%)	4 (6.4%)	0.041
Mean hospital stay (days)	19.5	19.9	0.731

role in enhancing anastomotic healing. The suggested method showed greater safety than the traditional double-layer side-to-side anastomosis, leading to lower rates of major post-operative complications while maintaining a similar hospital stay duration.

DISCUSSION

Acute intestinal obstruction due to right-sided colonic issues poses a challenge in emergency colorectal surgery. Surgical intervention occurs under adverse conditions, including bowel distension, tissue swelling, bacterial contamination, and impaired blood flow. These factors elevate the risks of anastomotic failure and post-operative death.^[1,3]

In this study, single-layer end-to-side ileotransverse anastomosis showed better clinical results than the traditional double-layer side-to-side method. The study group experienced no anastomotic leakage or mortality, whereas the comparison group had a 14.5% leakage rate and 6.4% mortality rate. These results indicate that maintaining blood supply and minimizing tissue damage during anastomosis construction are crucial for healing.

Anastomotic leakage is a serious complication that can occur after colorectal surgery. Recent research indicates leakage rates between 5% and 15% following right hemicolectomy, with higher rates in emergency situations than in elective ones.^[3,8-10] Kertzman *et al.* found higher morbidity and mortality in patients undergoing emergency resection for right-sided colon cancer, underscoring the negative effects of obstruction and physiological imbalance on outcomes.^[3] Similarly, Rossi *et al.* noted that anastomosis configuration affects the risk of leakage, stressing the importance of technical aspects during reconstruction.^[8]

The positive outcomes in our study were attributed to the technical features of the proposed method. First, single-layer continuous anastomosis reduces foreign material in the bowel wall and lessens local ischemia linked to multiple suture rows. Second, preparing the bowel ends based on the vascular anatomy may enhance blood flow at the site. An adequate blood supply is essential for healing. Current evidence suggests that impaired microcirculation contributes to anastomotic failure and septic complications.^[11-13]

Recent advancements in colorectal surgery have emphasized perfusion-guided anastomosis construction. Fluorescence angiography using indocyanine green improves the evaluation of bowel viability and may decrease ischemia-related leaks.^[11,12] Alekseev *et al.* and Akhmetzyanov *et al.* emphasized intraoperative perfusion assessment in preventing ischemic complications.^[14,15] Although these technologies were not used in this study, the surgical approach to maintaining optimal vascular architecture aligns with these modern principles.^[16,17]

The lack of mortality in the study group is clinically important. Anastomotic leakage is associated with post-operative sepsis, reoperation, extended hospital stays, and mortality. Previous studies have indicated that mortality rates following leakage can exceed 20%, especially in older patients with multiple health issues.^[18,19] Consequently, any strategy that lowers leak rates can enhance surgical outcomes.

Several limitations should be considered when interpreting these findings. The sample size was limited, and the study design included prospective and retrospective groups, potentially introducing selection bias. In addition, a comprehensive evaluation of perioperative risk factors, such as nutritional status, American Society of Anesthesiologists classification, smoking history, and comorbidity burden, was not conducted, making multivariate analysis unfeasible.^[20,21] To confirm these findings and assess their applicability to broader colorectal surgery, future multicenter prospective studies with larger groups are necessary.

Despite these constraints, the results suggest that the proposed single-layer end-to-side ileotransverse anastomosis is a safe and effective approach for emergency surgeries in patients with acute intestinal obstruction. This technique appears to lower the risk of anastomotic failure and mortality while maintaining similar hospital stay lengths, thus advocating for broader clinical evaluation.

CONCLUSION

In cases of acute intestinal obstruction, small-to-large intestinal anastomoses should be created, considering the individual vascular architecture of the intestinal wall. This approach ensures an adequate blood supply to the suture line, reduces the risk of tissue ischemia and necrosis, and promotes faster and more complete healing of the anastomosis. Optimizing the anastomotic technique, considering the vascular characteristics of the intestinal wall, plays a key role in preventing post-operative complications such as suture failure and abdominal infection.

This strategy significantly improves immediate post-operative outcomes, reduces the incidence of complications, and ensures stable bowel function recovery. Furthermore, careful planning and execution of anastomoses, considering

the vascular architecture, significantly reduces mortality in patients with acute intestinal obstruction, which is especially important in the time-sensitive setting of emergency surgical interventions. This approach forms the basis for safe and effective surgical treatment, improves patient prognosis, and enhances the quality of post-operative care.

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Data availability statement

Data are available from the corresponding author upon reasonable request.

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