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Assessing Postoperative Complications in Emergency Bowel Resection and Anastomosis

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ABSTRACT

Objective: To evaluate postoperative Complications in Emergency Bowel Resection and Anastomosis

Study Design: Cross-sectional Analytical Study

Place and Duration of Study: General Surgical Ward, Combined Military Hospital and Pakistan Emirates Military Hospital, Rawalpindi, Pakistan, from Mar to Aug 2023.

Methodology: A total of 110 participants, both genders, who underwent emergency bowel resection and anastomosis for various diseases were selected using a non-probability consecutive sampling technique. The participants were divided into three groups, A, B, and C, according to Clavien-Dindo classification system. Data on clinical characteristics, postoperative results, intraoperative variables, and demographics were gathered and analyzed.

Results: Of the 110 patients, 79.1% (n=87) were male and 20.9% (n=23) were female. The mean age was 53.83±9.76 years. Surgical site infections (28.2%), anastomotic leaks (9.1%), post-op ileus (34.5%), and sepsis (21.8%) were among the most frequent postoperative sequelae. Group-B had the most anastomotic leak rate (18.1%), Group-C had the highest surgical site infection rate (43.4%). Group-C was predominantly affected by post-operative ileus (44.8%), and Group-B had the highest sepsis incidence (39.3%). A hospital stay of 7.3±2.7 days was average. Group-B had the greatest death rate of 24.2%, accounting for 12.7% of the total thirty-day mortality.

Conclusion: Recognizing the potential complications following an emergency intestinal resection is vital for enhancing surgical outcomes and improving patient care. By employing a multidisciplinary approach, timely detection and effective treatment of these challenges can be ensured, ultimately leading to better recovery and overall patient well-being.

Keywords: Acute intestinal obstruction, Bowel ischemia, Emergency Resection and anastomosis, Intestine perforation.

How to Cite This Article: *Anwar F, Ullah JS, Maqbool A, Umer W, Khan WA, Bashir S. Assessing Postoperative Complications in Emergency Bowel Resection and Anastomosis. Pak Armed Forces Med J 2025; 75(3): 578-582. DOI: https://doi.org/10.51253/pafmj.v75i3.11709*

INTRODUCTION

A large proportion of general surgical emergencies involve bowel surgery, out of which 15-20% of patients with large bowel cancer present with acute obstruction requiring emergency surgery.[1,2] Acute intestinal conditions, including perforation, obstruction, and ischemia, are treated surgically by emergency bowel resection and anastomosis. Although the procedure is relatively common, it is associated with a range of postoperative complications, including wound infection, anastomotic leakage, ileus, and sepsis.[3] Following emergency surgery, older individuals experience higher morbidity and fatality rates.[5] 14.3% of emergency bowel procedures result in complications that lead to death, according to Mealy *et al*.[6]

The small intestine is an intricate organ that performs vital functions like digesting, absorbing, secreting, hormone production, and defending the internal environment against toxins produced by luminal bacteria and hazardous compounds that are ingested. Its intricate anatomical structure, which includes villus mucosal architecture, circular mucosal folds, and microvilli on the epithelial surface, enables its extraordinary efficiency in digesting nutrients. These anatomical modifications increase the surface area available for digestion and absorption by a remarkable 600 times, underscoring the complexity of its function in preserving vital physiological functions.[5] Literature on emergency small intestinal procedures has shown mortality and morbidity rates between 15 and 30 percent; the underlying disease, the time of presentation, and related comorbidities all affect the prognosis. When compared to elective colorectal procedures, major problems necessitating reoperation happen over twice as frequently following emergency surgery. These results highlight how difficult it is to manage these procedures and how important it is to have a comprehensive strategy that takes into account each patient's unique circumstances.[7,8] Understanding the various risks associated with emergency bowel resection and

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Received: 26 Feb 2024; revision received: 20 May 2024; accepted: 21 May 2024

anastomosis is essential for providing optimal treatment and achieving the best outcomes.

This cross-sectional analytical study aims to describe the prevalence of postoperative complications in patients undergoing emergency bowel resection and anastomosis and to identify risk factors associated with these complications. Identifying the risk factors associated with these adverse outcomes can guide clinicians in risk detection, inform decision-making, and support the development of preventive strategies to improve surgical outcomes and patient safety.

METHODOLOGY

This cross-sectional analytical study was conducted for 06 months starting from Mar to Aug 2023 at the General Surgical Ward, Combined Military Hospital and Pakistan Emirates Military Hospital in Rawalpindi, Pakistan, after obtaining approval from ethical research committees (ERC) of the institute; ERC No. 539/23.

A total of 110 patients were included using a non-probability consecutive sampling technique. The WHO sample size calculator, using a confidence level of 90% and a margin of error of 6%, indicates that with a reported morbidity and mortality rate of 14.3% after emergency bowel resection, the estimated sample size required will be 92.[6]

Inclusion Criteria: The study included patients above 12 years of age, who underwent emergency bowel resection and anastomosis between Mar to Aug 2023 for acute intestinal obstruction, bowel ischemia, intestine perforation, regardless of gender. Patients were diagnosed using clinical assessments and laboratory testing such complete blood counts, C-reactive protein, serum lactate, abdomen x-rays, ultrasound and CT scan.

Exclusion Criteria: Patients under the age of 12 of either gender, pregnant females, immune-compromised patients, those who underwent elective bowel resection and anastomosis, and those patients who underwent emergency bowel resection and exteriorization without anastomosis were all excluded.

Data on the patient's demographics, clinical traits, intraoperative factors, and postoperative results were gathered and examined. To enable comparisons and clinical decision-making, the problems were categorized based on recognized grading systems. Each patient's data included the following factors: Age and gender were given as demographic information. Primary surgical indications (bowel obstruction, perforation, and ischemia) and underlying medical disorders (comorbidities) were among the clinical characteristics. Intraoperative factors included the kind of anastomosis employed, the surgical method (open or laparoscopic), and the length of the procedure. Postoperative results included 30-day mortality, length of hospital stay, requirement for intensive care unit (ICU) admission, and incidence and kinds of postoperative complications. For categorical factors like complications and surgical methods, frequencies and percentages were determined. For continuous variables such as age and operation time, the mean and standard deviation (or median and interquartile range) were employed. Based on well-established grading schemes, such as the Clavien-Dindo classification, postoperative problems were categorized. This approach divides problems into five classes, from minor issues that don't need any attention (Grade-I) to major issues that might cause death (Grade-V). Comparing the intensity of complications and their effect on patient outcomes is made easier by categorization.

The patients were divided into three groups based on Primary Surgical Indication: Bowel Obstruction (Group-A), Bowel Ischemia (Group-B), and Bowel Perforation (Group-C).

Descriptive statistics like mean, standard deviation, and frequency distribution were used to analyze the data. The study population's overall incidence of postoperative complications was estimated. The frequency of each distinct kind of complication, such as surgical site infections and anastomotic leaks, was calculated as a proportion of all cases. The Clavien-Dindo classification system was used to group problems according to their severity. The frequency of complications was determined for each grade (Grade I to Grade V). Chi-square test was applied to assess associations between categorical variables, while t-tests were used for continuous variables. Statistical significance is defined as a *p*-value of less than 0.05. The data were examined using IBM's Statistical Package for the Social Sciences (SPSS) version 26:00.

RESULTS

A total of 110 patients were admitted to the General Surgical Ward of both Combined Military Hospital and Pak Emirates Military Hospital Rawalpindi, with presentation of acute abdominal bowel obstruction, perforation, or ischemia, who

underwent emergency laparotomy with resection and anastomosis, were enrolled in the study.

The study included 110 patients who underwent emergency bowel resection and anastomosis. The mean age was 53.83+9.76 years, with a range of 12 years to 70 years. 87(79.1%) patients were male, and 23(20.9%) were female patients. Patients were distributed into three categories, depending on the primary surgical indication for emergency bowel resection and anastomosis. Of a total of 110 cases, n-54(49%) were in Group-A, n-33(30%) were in Group-B, and n-23(20.9%) were in Group-C. As shown in Table-I.

Table-I: Demographic Details, Comorbid, Surgical Technique Employed (n-110)

Category	Details	Group-A n-54	Group-B n-33	Group-C n-23	*p*-value
Age	Years (Mean+SD)	53.89+8.22	52.09+13.15	56.22+6.87	<0.001
Gender	Male n(%)	40(74.1%)	26(78.8%)	21(91.3%)	0.235
	Female n(%)	14(25.9%)	7(21.2%)	2(8.7%)	0.235
Comorbid	Diabetes Mellitus n(%)	12(22.22%)	5(15.15%)	12(52.17%)	0.005
	Hypertension n(%)	18(33.33%)	11(33.33%)	16(69.56%)	0.007
	Ischemic Heart Disease n(%)	5(9.25%)	2(5.88%)	22(95.65%	<0.001
Surgical Technique	Open Surgery	48(88.9%)	33(100%)	23(100%)	0.037
	Lap Assisted	6(11.1%)	0	0	0.037
Length of Procedure	Mean+Time (hours)	3.43+0.51	2.58+0.54	4.02+0.41	<0.001

The distribution of surgical techniques used was as follows: open surgery, n=104 (94.5%), and laparoscopic-assisted surgery was done n = 6(5.5%). The mean operative time in Group-A was 3.43+0.51 hours, while it was 2.58+0.54 and 4.02+0.41 hrs in groups B and C, respectively.

Postoperative complications occurred in patients who underwent emergency bowel resection and anastomosis. The most prevalent complications were surgical site infections 31(28.2%) with *p*-value of 0.117 making it statistically insignificant, anastomotic leaks 10(9.1%) with *p*-value of 0.093 making it statistically insignificant, Post Op Ileus 38(34.5%) *p*- value of 0.230 making it statistically insignificant, and Sepsis 24(21.8%) *p*-value of 0.001 making it statistically significant variable. Surgical site infection was most prevalent in Group-C, occurring in 10(43.4%) of the patients who underwent Emergency Laparotomy for Bowel ischemia. Anastomotic leakage was most common in cases of Group-B, occurring in 6(18.1%) of patients. While patients of Group-C experienced post op ileus, occurring in 11(47.8%) of patients. Most patients of Group-B, 13(39.3%), remained septic post-operatively and required Post-operative ICU admission. Mean Hospital stay after emergency resection and anastomosis was 7.3+2.7 Days. 30-day Mortality was seen in 14(12.7%) of cases, with maximum mortality in Group-B, 8(24.2%). There was a significant association with the occurrence of complications ($p<0.05$).

As shown in Table-III, complications were categorized based on the Clavien-Dindo classification system: Grade I 5(4.55%), Grade II 21(19.09%), Grade III 0, Grade IV 10(9.09%), Grade V 14(12.72%). The majority of complications fell into Grade II 21(19.09%) and Grade V 14(12.72%) categories.

No statistically significant associations were found between patient characteristics (age, gender, BMI) and the occurrence of postoperative complications.

Table-II: Post-Operative Assessment (n=110)

Category	Group-A n-54	Group-B n-33	Group-C n-23	Overall n-110	*p*-value
Wound Infection	15(27.7%)	6(18.1%)	10(43.4%)	31(28.2%)	0.117
Anastomotic Leakage	3(5.5%)	6(18.1%)	1(4.3%)	10(9.1%)	0.093
Ileus	15(27.7%)	12(36.2%)	11(47.8%)	38(34.5%)	0.230
Sepsis	4(7.4%)	13(39.3%)	7(30.4%)	24(21.8%)	0.001
ICU Admission	4(7.4%)	13(39.3%)	7(30.4%)	24(21.8%)	0.001
Hospital Stay (Mean+SD Days)	6.91+2.63	7.15+2.87	8.00+2.94	7.21+2.77	<0.001
30 Days Mortality	2(3.7%)	8(24.2%)	4(17.4%)	14(12.7%)	0.015

Table-III: Complications Categorized based on the Clavien-Dindo Classification System (n=110)

Classification	Group-A n-54	Group-B n-33	Group-C n-23	Overall n-110	*p*-value
Grade I	4(7.41%)	1(3.03%)	0	5(4.55%)	0.318
Grade II	14(25.92%)	3(9.09%)	4(17.39%)	21(19.09%)	0.148
Grade III	0	0	0	0	-
Grade IV	3(5.55%)	5(15.15%)	2(8.69%)	10(9.09%)	0.318
Grade V	1(1.85%)	8(24.24%)	5(21.74%)	14(12.72%)	0.003

DISCUSSION

The study's findings highlighted that ileus and wound infection had the highest prevalence for emergency bowel resection and anastomosis, which may affect the course of the patient's recovery. Around 12% of the participants faced mortality within the first 30 days postoperatively. Acute intestinal conditions, including perforation, obstruction, and ischemia, are treated surgically by emergency bowel resection and anastomosis with or without the formation covering a stoma. Although the procedure is relatively common, it is associated with a range of postoperative complications, including wound infection, anastomotic leakage, ileus, and sepsis.[3]

Alkaaki *et al* found that wound infection occurs in 35% of the patients undergoing emergency abdominal surgery, which is consistent with the findings of our study, i.e., 28% of the cases.[9] One of

the most serious side effects of bowel repair or anastomosis is anastomotic leak. An enteric leak was described as "leakage of luminal contents from a surgical join between two hollow viscera" by the United Kingdom Surgical Infection Study Group.[10] Malnutrition, steroids, tobacco use, leukocytosis, cardiovascular disease, alcohol use, lower Gastro-intestinal (GI) anastomoses, suboptimal anastomotic blood supply, longer than two-hour operations, bowel obstruction, perioperative blood transfusion, and intra-operative septic conditions not conducive to a primary anastomosis are a few factors that have been linked to anastomotic leaks.[11] Calin MD *et al.,* have demonstrated that people who have anastomoses in the lower GI tract are more vulnerable to leaks than those who have anastomoses in the upper GI tract, particularly following urgent surgery.[12,13] Rai *et al.,* also stated an anastomotic leakage rate of 0-36% after emergency laparotomy, while our study showed the anastomotic leakage rate of 9.1%. [14]

A study by HB S *et al.,* showed the rate of post op ileus to be 12.8% after emergency laparotomy, which is not comparable to our study, which has shown a rate of 34.5%. The same study showed the rate of Surgical site infection to be 47.2%, which is also not comparable to the results of our study, i.e., 28%.[15]

A study by Cellan *et al.,* has shown results coherent with findings of the current study, showing the rate of septicemia to be 25% in emergency laparotomy cases. The mortality rate of 12.7% is also supported by reporting 14.2% mortality following emergency laparotomy within 30 days postoperatively. [16] The study by Pedan *et al.,* reported an overall 30-day mortality incidence of 11.1% following emergency laparotomy in 2023. The study also showed that Grade II and IV complications were more common, as validated by literature.[17]

The high rate of postoperative complications in this study highlights the challenges of performing emergency intestinal resection and anastomosis. Increased morbidity, extended hospital stays, and even fatality are all possible consequences of these problems, as endorsed by Thomson *et al.*[18] To enhance patient outcomes, strategies for managing and preventing problems should be put into practice. Complications with emergency bowel resection and anastomosis might happen for several reasons. These include aspects of the patient (such as comorbidities and malnutrition), aspects of the operation itself (such as surgical technique and intraoperative problems), and aspects of the recovery period (such as wound care and antibiotic prophylaxis).[19] It may be possible to lessen problems and improve recovery by addressing these factors using multidisciplinary methods like enhanced recovery after surgery (ERAS) protocols and standardized perioperative care routes explained by Bhardwaj *et al*.[20] An important concern after bowel resection and anastomosis is anastomotic leakage. Early detection and treatment are essential to preventing severe sepsis or the requirement for further surgery. Furthermore, excellent outcomes depend on careful patient selection, precision surgical technique, and a sufficient blood supply to the anastomotic site.[21]

LIMITATION OF STUDY

The study was a bi-center study, yet the limited duration of the study restricted the generalizability of the findings. The study highlighted various postoperative complications, yet their correlation cannot be evaluated for a more in-depth analysis to understand the prevalence of these common complications. Future research should consider prospective designs, larger patient cohorts, and multi-center partnerships to verify the findings and uncover long-term risk factors. Furthermore, investigating surgery volume, expertise levels of surgeons, and perioperative care practices affecting complication rates may provide insightful information. For emergency bowel resection and anastomosis, future research should concentrate on creating standardized methods and standards to reduce complications and enhance patient outcomes.

CONCLUSION

The study concluded that ileus and wound infection had the highest prevalence for emergency bowel resection and anastomosis, which may affect the course of the patient's recovery. For optimized patient care and surgical results to be improved, it is important to comprehend the incidence, risk factors, treatment techniques, and outcomes related to these complications. For the quick identification and treatment of problems, a multidisciplinary strategy is essential.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

FA & JSU: Data acquisition, data analysis, critical review, approval of the final version to be published.

AM & WU: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

WAK & SB Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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