



Original Research

Impact of Enhanced Recovery after Surgery (ERAS) Protocols in Subacute Intestinal Obstruction Surgery

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Abstract: **Objective:** To compare the outcomes of Enhanced Recovery After Surgery (ERAS) protocols with conventional perioperative care in patients undergoing surgery for subacute intestinal obstruction. **Methods:** This randomized controlled trial was conducted in the Department of General Surgery, Khyber Teaching Hospital, Peshawar. A total of 60 eligible patients aged 20–60 years with subacute intestinal obstruction requiring surgery were randomly allocated to either the ERAS group (n=30) or the conventional care group (n=30). The primary outcome was postoperative hospital stay, while secondary outcomes included chest infection, paralytic ileus, and surgical site infection (SSI). Data were analyzed using SPSS version 25. Continuous variables were compared using the independent-samples t-test or Mann-Whitney U test, while categorical variables were analyzed using the Chi-square or Fisher's exact test. A p-value ≤ 0.05 was considered statistically significant. **Results:** The mean postoperative hospital stay was significantly shorter in the ERAS group than in the conventional care group (5.56 ± 1.19 vs. 10.93 ± 1.93 days; $p < 0.001$). Chest infection occurred in 2 (6.7%) patients in the ERAS group and 14 (46.7%) in the conventional care group. Paralytic ileus was observed in 4 (13.3%) and 18 (60.0%) patients, respectively, while SSI occurred in 1 (3.3%) and 12 (40.0%) patients, respectively (all $p < 0.001$). **Conclusion:** ERAS protocols significantly reduced postoperative hospital stay and complications compared with conventional perioperative care in patients undergoing surgery for subacute intestinal obstruction.

Keywords: Enhanced Recovery after Surgery; ERAS; Subacute intestinal obstruction; Emergency laparotomy; Surgical site infection; Paralytic ileus.

INTRODUCTION

Subacute intestinal obstruction is a common surgical emergency characterized by partial or intermittent blockage of the intestinal lumen, resulting in abdominal pain, distension, vomiting, and constipation. If not recognized and managed promptly, progressive bowel distension may compromise intestinal perfusion, leading to bowel ischemia, perforation, peritonitis, septic shock, and death. Postoperative adhesions remain the leading cause of intestinal obstruction worldwide, followed by incarcerated hernias, malignancies, volvulus, and inflammatory bowel diseases. Despite advances in diagnostic imaging and surgical techniques, intestinal obstruction continues to account for a substantial proportion of emergency surgical admissions and is

associated with considerable postoperative morbidity and mortality.^{1–3}

Patients undergoing emergency surgery for intestinal obstruction are at greater perioperative risk than those undergoing elective abdominal procedures because they frequently present with dehydration, electrolyte imbalance, malnutrition, sepsis, and physiological instability. Consequently, these patients have a higher incidence of postoperative complications, including pulmonary infections, paralytic ileus, surgical site infection (SSI), prolonged hospital stay, and mortality. Optimizing perioperative management is therefore essential to improve postoperative recovery and reduce complication rates.^{2–4}

Enhanced Recovery After Surgery (ERAS) is a

multimodal, evidence-based perioperative care pathway developed to attenuate the surgical stress response and promote early functional recovery. The protocol incorporates several evidence-based interventions, including patient education, shortened preoperative fasting, optimized fluid therapy, multimodal opioid-sparing analgesia, maintenance of normothermia, early enteral nutrition, prevention of postoperative nausea and vomiting, and early postoperative mobilization. Collectively, these measures preserve physiological function, reduce postoperative complications, shorten hospital stay, and improve patient satisfaction without increasing readmission rates.⁵⁻⁷

Although ERAS pathways have been widely adopted in elective colorectal and gastrointestinal surgery, their implementation in emergency abdominal surgery remains relatively limited because emergency procedures allow little time for comprehensive preoperative optimization. Nevertheless, accumulating evidence indicates that several ERAS components can be safely implemented in emergency surgical patients, resulting in earlier return of bowel function, fewer postoperative complications, shorter hospital stay, and reduced healthcare costs. Recent randomized controlled trials and prospective cohort studies have consistently reported favorable postoperative outcomes following ERAS implementation in emergency gastrointestinal surgery.^{4, 8-10}

Despite the growing international evidence supporting ERAS, data regarding its effectiveness in patients undergoing surgery for subacute intestinal obstruction remain limited in Pakistan. Differences in patient characteristics, healthcare infrastructure, perioperative practices, and resource availability may influence the effectiveness of ERAS protocols in local settings. Therefore, this randomized controlled trial was conducted to compare the outcomes of Enhanced Recovery After Surgery (ERAS) protocols with conventional perioperative care in patients undergoing surgery for subacute intestinal obstruction at Khyber Teaching Hospital, Peshawar.

MATERIALS AND METHODS

This randomized controlled trial was conducted in the Department of General Surgery, Khyber Teaching Hospital, Peshawar, Pakistan from June 2025 to September 2025. The sample size was calculated using the WHO sample size calculator for comparison of two independent means, assuming a 95% confidence level, 90% study power, and previously reported mean postoperative hospital stays of 5.56 ± 4.55 days in the ERAS group and 8.75 ± 5.37 days in the conventional care group. The calculated sample size was 60 patients, with 30 patients allocated to each group.

Eligible patients were recruited using a non-probability consecutive sampling technique.

Inclusion Criteria Patients of either sex, aged between 20 and 60 years, who underwent surgery for subacute intestinal obstruction of more than 24 hours duration were considered for inclusion. Subacute intestinal obstruction was diagnosed on the basis of clinical features of cramping abdominal pain, abdominal distension, vomiting and radiological findings consistent with intestinal obstruction. Patients receiving long-term corticosteroid therapy, those with chronic obstructive pulmonary disease, acute abdominal trauma, malignant intestinal obstruction, or those undergoing laparoscopic procedures were excluded from the study.

Written informed consent was obtained from all eligible patients before enrollment. The patients were then randomized into two equal groups by simple lottery method. Patients who picked slips marked "A" were allocated to the Enhanced Recovery After Surgery (ERAS) group and those who picked slips marked "B" were allocated to the conventional care group. Patients in the ERAS group received perioperative care as per the ERAS protocol including decreased preoperative fasting, optimized intravenous fluid therapy, multimodal opioid-sparing analgesia, maintenance of normothermia, early oral feeding as tolerated in the postoperative period, early mobilization, and removal of drains and urinary catheters as clinically appropriate. Patients in the conventional care group received routine perioperative care as per the institution's protocol including prolonged preoperative fasting, bowel preparation, conventional opioid-based analgesia, delayed oral feeding, prolonged drain placement, and routine postoperative mobilization. All procedures were done by the same consultant general surgeon to minimise surgeon-related bias. Baseline demographic and clinical parameters such as age, sex, height, weight, body mass index (BMI), place of residence, monthly family income, type of surgery and operative duration were recorded on a structured proforma. Patients were observed during their hospital stay and reviewed four weeks post-surgery to assess postoperative outcomes. Primary outcome was postoperative hospital stay defined as number of days from the date of surgery to hospital discharge after satisfactory clinical recovery. Secondary outcomes were chest infection, paralytic ileus and surgical site infection (SSI). Chest infection was diagnosed if the patient presented with cough, fever ($>100^{\circ}\text{F}$), decreased chest expansion, bronchial breath sounds and clinical evidence of pulmonary infection. Paralytic ileus was defined as postoperative nausea or vomiting associated with absent bowel sounds during the first 24 hours after surgery. Surgical site infection was defined as purulent wound discharge or wound

dehiscence occurring within four weeks after surgery. Patients who did not complete the four-week follow-up were excluded from the final analysis.

Data were checked for completeness and accuracy before being entered into the Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA) for analysis. Continuous variables were assessed for normality using the Shapiro-Wilk test. Continuous variables were expressed as mean $\pm$ standard deviation (SD) or median with interquartile range (IQR), as appropriate, and categorical variables were presented as frequencies and percentages. Baseline characteristics

were compared between the two groups using the independent-samples t-test or Mann-Whitney U test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as appropriate. The primary outcome of postoperative hospital stay was compared using the independent-samples t-test, whereas postoperative complications including chest infection, paralytic ileus, and surgical site infection were analyzed using the Chi-square test or Fisher's exact test. Stratified analyses were performed according to age, gender, BMI, operative duration, and type of surgery to assess potential effect modification. A two-tailed p-value of ≤ 0.05 was considered statistically significant.

RESULT

A total of 60 patients undergoing surgery for subacute intestinal obstruction were enrolled and randomized equally into the Enhanced Recovery After Surgery (ERAS) group (n=30) and the conventional care group (n=30). All enrolled patients completed the study and were included in the final analysis.

The mean age of patients in the ERAS group was 47.7 ± 7.8 years, while that of the conventional care group was 49.7 ± 8.2 years, with no statistically significant difference between the groups (p=0.34). Males constituted 56.7% of the ERAS group and 60.0% of the conventional care group (p=0.79). The mean body mass index was 26.3 ± 0.8 kg/m² in the ERAS group and 27.0 ± 1.0 kg/m² in the conventional care group (p=0.39). Similarly, no significant differences were observed between the groups regarding place of residence or monthly family income. No statistically significant difference was observed in the mean operative time between the ERAS and conventional care groups (108.6 ± 18.9 minutes vs. 111.4 ± 19.7 minutes, p=0.57), indicating comparable intraoperative characteristics between the study groups. The baseline demographic and clinical characteristics of both groups are presented in Table I.

Table I. Baseline demographic and clinical characteristics of the study participants (n=60)

Variable	ERAS (n=30)	Conventional (n=30)	p-value
Age (years), Mean $\pm$ SD	47.7 ± 7.8	49.7 ± 8.2	0.34
Male, n (%)	17 (56.7)	18 (60.0)	0.79
Female, n (%)	13 (43.3)	12 (40.0)	
BMI (kg/m ²), Mean $\pm$ SD	26.3 ± 0.8	27.0 ± 1.0	0.39
Urban residence, n (%)	19 (63.3)	17 (56.7)	0.60
Rural residence, n (%)	11 (36.7)	13 (43.3)	
Operation time (minutes), Mean $\pm$ SD	108.6 ± 18.9	111.4 ± 19.7	0.57

The primary outcome analysis demonstrated a significantly shorter postoperative hospital stay among patients managed with the ERAS protocol. The mean duration of hospital stay was 5.56 ± 1.19 days in the ERAS group compared with 10.93 ± 1.93 days in the conventional care group, and this difference was statistically significant (p<0.001) (Table II).

Table II. Comparison of postoperative hospital stay between the study groups

Outcome	ERAS (n=30)	Conventional (n=30)	p-value
Hospital stay (days), Mean $\pm$ SD	5.56 ± 1.19	10.93 ± 1.93	<0.001

Regarding postoperative complications, chest infection developed in 2 (6.7%) patients in the ERAS group compared with 14 (46.7%) patients in the conventional care group (p<0.001). Paralytic ileus occurred in 4 (13.3%) patients receiving ERAS, whereas it was observed in 18 (60.0%) patients receiving conventional care (p<0.001). Surgical site infection was recorded in only 1 (3.3%) patient in the ERAS group compared with 12 (40.0%) patients in the conventional care group, showing a statistically significant reduction associated with ERAS implementation (p<0.001). Detailed comparisons of postoperative outcomes are presented in Table III.

Table III. Comparison of postoperative complications between the study groups

Variable	ERAS (n=30)	Conventional (n=30)	p-value
Chest infection, n (%)	2 (6.7)	14 (46.7)	<0.001
Paralytic ileus, n (%)	4 (13.3)	18 (60.0)	<0.001
Surgical site infection, n (%)	1 (3.3)	12 (40.0)	<0.001

DISCUSSION

Enhanced Recovery After Surgery (ERAS) has emerged as an evidence-based perioperative care pathway that minimizes the physiological stress response to surgery and promotes early postoperative recovery. Although ERAS has been widely adopted in elective gastrointestinal surgery, evidence regarding its effectiveness in patients undergoing surgery for subacute intestinal obstruction remains limited. In the present randomized controlled trial, implementation of ERAS protocols significantly improved postoperative outcomes compared with conventional perioperative care. Patients managed with ERAS experienced significantly shorter postoperative hospital stay together with lower incidences of chest infection, paralytic ileus, and surgical site infection. The most important finding of the present study was the significant reduction in postoperative hospital stay among patients managed according to the ERAS protocol. The mean duration of hospital stay was 5.56 ± 1.19 days in the ERAS group compared with 10.93 ± 1.93 days in the conventional care group. These findings are consistent with those reported by Sharma et al., who demonstrated significantly shorter hospitalization among patients managed using ERAS following emergency laparotomy.¹⁰ Similarly, Aggarwal et al. reported that implementation of a modified ERAS protocol significantly reduced hospital stay without increasing postoperative complications in patients undergoing emergency surgery for intestinal obstruction.³ Comparable reductions in hospitalization have also been reported by Mandal et al.⁹ and Mazni et al.⁴ The shorter hospital stay observed in the present study is likely attributable to early mobilization, optimized perioperative fluid therapy, opioid-sparing analgesia, and earlier restoration of gastrointestinal function, which are fundamental components of ERAS pathways.

Postoperative pulmonary complications remain a major cause of morbidity following emergency abdominal surgery. In the present study, chest infection occurred significantly less frequently among patients managed with ERAS than among those receiving conventional perioperative care. This reduction may be explained by earlier mobilization, improved pain control, effective respiratory physiotherapy, and enhanced pulmonary function associated with ERAS pathways. Scott et al. emphasized that standardized perioperative care and early mobilization substantially reduce pulmonary complications following emergency laparotomy.² Likewise, Elsenosy et al. reported improved postoperative respiratory outcomes following implementation of ERAS recommendations.⁵

Paralytic ileus is a common complication following intestinal surgery and contributes to delayed recovery, prolonged hospitalization, and increased healthcare costs. In the present study, the incidence of paralytic ileus was significantly lower among patients managed with ERAS. This finding is consistent with previous randomized studies demonstrating that early oral feeding, optimized fluid management, and reduced perioperative opioid use facilitate earlier recovery of bowel function following abdominal surgery.^{3,11} Furthermore, the scoping review by Buhl et al. concluded that implementation of ERAS protocols promotes earlier gastrointestinal recovery and shortens the duration of postoperative ileus in patients undergoing surgery for intestinal obstruction.¹

Surgical site infection remains one of the leading causes of postoperative morbidity following emergency gastrointestinal surgery. The present study demonstrated a marked reduction in surgical site infection among patients receiving ERAS compared with conventional perioperative care. Similar findings have been reported by Shahid et al., who observed fewer wound infections and improved postoperative recovery following ERAS implementation in gastrointestinal surgery.⁶ Naseer et al. likewise reported reduced postoperative infectious complications and shorter hospital stay among patients managed according to ERAS protocols.⁸ These favorable outcomes are likely related to optimized antibiotic prophylaxis, maintenance of normothermia, balanced fluid therapy, improved nutritional support, and early postoperative mobilization.

The favorable outcomes observed in the present study support the physiological basis of ERAS. Conventional perioperative practices, including prolonged fasting, delayed oral feeding, excessive opioid administration, prolonged bed rest, and liberal intravenous fluid therapy, may increase insulin resistance, delay gastrointestinal recovery, impair pulmonary function, and increase susceptibility to postoperative complications. In contrast, ERAS protocols attenuate the surgical stress response, preserve physiological homeostasis, enhance immune function, and facilitate early functional recovery, thereby improving overall postoperative outcomes.¹² The randomized controlled design of the present study represents an important methodological strength because it minimized selection bias and improved the validity of treatment comparisons. Furthermore, all operations were performed by the same consultant surgeon, reducing variability related to surgical technique. Baseline demographic and operative characteristics were comparable between the two groups, suggesting that the observed differences in postoperative outcomes were attributable primarily to implementation of the ERAS protocol rather than

differences in patient characteristics or operative factors.¹³

Despite these strengths, several limitations should be acknowledged. The study was conducted at a single tertiary care hospital with a relatively small sample size, which may limit the generalizability of the findings. In addition, long-term postoperative outcomes, patient-reported quality of life, readmission rates, mortality, and cost-effectiveness were not evaluated. Future multicenter randomized controlled trials with larger sample sizes and longer follow-up periods are warranted to further evaluate the long-term clinical and economic benefits of ERAS protocols in patients undergoing surgery for subacute intestinal obstruction.¹⁴

Overall, the findings of the present study add to the growing body of evidence supporting the implementation of Enhanced Recovery After Surgery protocols in emergency gastrointestinal surgery. Incorporating ERAS into routine perioperative practice may improve postoperative recovery, reduce complications, shorten hospital stay, and optimize healthcare resource utilization without compromising patient safety.

CONCLUSION

The implementation of Enhanced Recovery After Surgery (ERAS) protocols significantly improved short-term postoperative outcomes in patients undergoing surgery for subacute intestinal obstruction. Compared with conventional perioperative care, ERAS significantly reduced postoperative hospital stay and the incidence of chest infection, paralytic ileus, and surgical site infection. These findings support the routine incorporation of ERAS protocols into perioperative management to enhance postoperative recovery and reduce morbidity in patients undergoing surgery for subacute intestinal obstruction.

Limitations

This study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. In addition, long-term postoperative outcomes, readmission rates, mortality, patient-reported quality of life, and cost-effectiveness were not evaluated. Further multicenter studies with larger sample sizes and extended follow-up are required to validate these findings.

Recommendations

Enhanced Recovery After Surgery (ERAS) protocols should be considered for routine perioperative management of patients undergoing surgery for subacute intestinal obstruction. Further multicenter randomized controlled trials with larger sample sizes

are recommended to evaluate long-term clinical outcomes, healthcare costs, patient satisfaction, and quality of life following ERAS implementation.

Conflict of Interest

The authors declare no conflict of interest.

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