RESEARCH PAPER

The Role of Enhanced Recovery After Surgery (ERAS) Protocols in Improving Postoperative Outcomes in Gastrointestinal Surgery

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ABSTRACT
Background: Enhanced Recovery After Surgery (ERAS) protocols are evidence-based perioperative care pathways designed to reduce surgical stress, accelerate recovery, and improve clinical outcomes following major surgery. Objective: To evaluate the role of ERAS protocols in improving postoperative outcomes among patients undergoing gastrointestinal surgery. Methods: This comparative cross-sectional study was conducted at Hayatabad Medical Complex MTI Peshawar from august 2024 to august 2025 and included 220 patients undergoing elective gastrointestinal surgery. Patients were divided into ERAS (n=110) and conventional care (n=110) groups. Results: The mean age of patients was 52.6 ± 13.4 years, and 60.0% were male. Patients managed with ERAS protocols demonstrated significantly earlier oral intake (18.6 ± 5.4 vs. 42.3 ± 9.8 hours; $p<0.001$), earlier bowel movement (2.1 ± 0.8 vs. 3.7 ± 1.1 days; $p<0.001$), shorter hospital stay (5.2 ± 1.7 vs. 8.6 ± 2.4 days; $p<0.001$), lower pain scores (3.8 ± 1.3 vs. 5.9 ± 1.8; $p<0.001$), and higher rates of early mobilization (85.5% vs. 46.4%; $p<0.001$). Overall postoperative complications were significantly lower in the ERAS group (17.3% vs. 34.5%; $p=0.004$), including reduced surgical site infections, pulmonary complications, and postoperative ileus. ERAS adherence was strongly associated with improved postoperative outcomes ($p<0.001$). Conclusion: ERAS protocols significantly enhance postoperative recovery and reduce complications following gastrointestinal surgery..

Keywords: Enhanced Recovery After Surgery; ERAS; gastrointestinal surgery; postoperative recovery
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INTRODUCTION

Enhanced Recovery After Surgery (ERAS) is an evidence-based, multidisciplinary perioperative pathway to optimize recovery, minimize surgical stress and surgical complications, and improve overall patient outcomes after major surgery [1]. ERAS protocols were introduced in the late 1990s and have revolutionised the way of peri-operative care in a number of surgical specialties, including gastrointestinal surgery, where postoperative morbidity, prolonged hospital stay, and delayed functional recovery are important considerations [3]. ERAS programs combine multiple interventions pre-, intra, and post-surgery to enhance the patient's physiology and to aid him or her in getting back to normal function [2]. Performing gastrointestinal surgery is a very stressful procedure because of manipulation of the bowel, trauma to the tissues, inflammatory response and changes in fluid, and the postoperative pain associated with it [4]. All these factors may lead to a delayed bowel recovery, prolonged immobilization, higher risk of infection, pulmonary problems, thromboembolic complications and longer hospital stay [6]. Older practices around the peri-operative period, including long periods of fasting, routine

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nasogastric tube placement, over-infusions, delayed oral feeding and bed rest may also be factors that contribute to delayed recovery and cost of care [5]. To overcome these limitations, standardized perioperative care pathways based on the current scientific evidence, the ERAS protocols were developed. Preoperative counselling, nutritional optimisation, avoiding prolonged fasting, carbohydrate loading, minimally invasive surgical techniques if possible, multimodal analgesia, goal-directed fluid therapy, avoidance of nausea and vomiting and early mobilisation and oral feeding are all part of ERAS [8]. In combination, these interventions should aim to reduce the physiological stress response to surgery, whilst maintaining normal organ function throughout the perioperative period [10].

Many studies have shown that ERAS can be associated with a marked reduction in postoperative complications, hospital stay, healthcare costs and patient satisfaction without increasing length of hospital stay or readmission rates [9]. The ERAS has been linked to earlier return of bowel function and reduced postoperative morbidity in colorectal surgery [11]. The same advantages have been also observed in other major abdominal surgeries, such as the upper gastrointestinal surgery, hepatobiliary surgery, pancreatic surgery, etc. [12]. Early mobilization and early enteral nutrition are among the most crucial elements of ERAS pathways. These measures maintain muscle mass, enhance pulmonary function, decrease insulin resistance and support gastrointestinal healing [13]. In addition, multimodal pain management decreases the amount of opioids needed and affects side effects, leading to more rapid ambulation and recovery [15]. This has led to the ever-expanding use of ERAS protocols in contemporary gastrointestinal surgery. Although international acceptance has increased over time, implementation of ERAS pathways is not uniform within healthcare institutions, especially in developing countries where limited resources, institutional practices, and compliance issues can impact results in the process [14]. In addition, there is limited local evidence to assess the effectiveness of ERAS protocols in gastrointestinal surgery [16]. Study of the outcomes after implementation of ERAS is therefore crucial to inform future perioperative care and practice.

Objective

To evaluate the role of ERAS protocols in improving postoperative outcomes among patients undergoing gastrointestinal surgery.

Methodology

This was a comparative cross-sectional study conducted at Hayatabad Medical Complex MTI Peshawar from august 2024 to august 2025, including 220 patients who underwent gastrointestinal surgery to evaluate the role of Enhanced Recovery After Surgery (ERAS) protocols in improving postoperative outcomes. Adult patients aged 18 years and above who underwent elective gastrointestinal surgery, including colorectal, gastric, small bowel, hepatobiliary, and other major gastrointestinal procedures, were included. Patients managed according to ERAS protocols as well as those receiving conventional perioperative care with complete clinical records and postoperative follow-up data were considered eligible. Patients undergoing emergency surgery, trauma-related gastrointestinal procedures, reoperations during the same admission, severe preoperative organ failure, American Society of Anesthesiologists (ASA) class IV or V status, pregnancy, inability to participate in ERAS interventions, or incomplete clinical records were excluded.

Data Collection

After obtaining ethical approval, data were collected using a structured proforma from hospital records and perioperative databases. Demographic variables included age, gender, body mass index (BMI), comorbidities, smoking status, and ASA classification. Surgical variables included type of gastrointestinal procedure, operative duration, surgical approach, and estimated blood loss. Patients were categorized into ERAS and conventional care groups based on perioperative management protocols. ERAS components assessed included preoperative counseling, carbohydrate loading, avoidance of prolonged fasting, multimodal analgesia, early oral feeding, early mobilization, and goal-directed fluid therapy. Postoperative outcomes included time to first bowel movement, time to oral intake, length of hospital stay, postoperative pain scores, postoperative complications, surgical site infection, pulmonary complications, readmission, and mortality. Overall recovery outcomes were compared between both groups.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Independent t-tests were used to compare continuous variables between ERAS and conventional care groups, while chi-square tests were used for categorical variables. Multivariable logistic regression analysis was performed to identify factors independently associated with improved postoperative outcomes. A p-value ≤ 0.05 was considered statistically significant.

Results

The mean age of patients was 52.6 ± 13.4 years, with male predominance (132, 60.0%) compared with females (88, 40.0%). The mean BMI was 27.3 ± 4.6 kg/m². Hypertension was present in 71 (32.3%), diabetes mellitus in 54 (24.5%), and smoking in 47 (21.4%) patients. Most patients were ASA class I–II (156, 70.9%), while 64 (29.1%) were ASA class III.

Table 1: Baseline Demographic and Clinical Characteristics of Patients Undergoing Gastrointestinal Surgery (N = 220)

Variable	n (%) / Mean ± SD
Age (years)	52.6 ± 13.4
Male	132 (60.0)
Female	88 (40.0)

BMI (kg/m²)	27.3 ± 4.6
Diabetes mellitus	54 (24.5)
Hypertension	71 (32.3)
Current smokers	47 (21.4)
ASA Class I–II	156 (70.9)
ASA Class III	64 (29.1)

Both groups were comparable at baseline. Mean age was similar between ERAS and conventional care groups (51.9 ± 13.2 vs. 53.3 ± 13.6 years; p=0.44), as was male gender distribution (68, 61.8% vs. 64, 58.2%; p=0.59). Operative duration was also comparable (165.8 ± 42.5 vs. 170.3 ± 45.1 minutes; p=0.45). Types of surgery, including colorectal, gastric, hepatobiliary, and other GI procedures, showed no significant group differences.

Table 2: Surgical Characteristics and Comparison Between Study Groups

Variable	ERAS Group (n=110)	Conventional Care (n=110)	p-value
Age (years), Mean ± SD	51.9 ± 13.2	53.3 ± 13.6	0.44
Male gender, n (%)	68 (61.8)	64 (58.2)	0.59
Operative duration (minutes), Mean ± SD	165.8 ± 42.5	170.3 ± 45.1	0.45
Colorectal surgery, n (%)	48 (43.6)	45 (40.9)	0.69
Gastric surgery, n (%)	27 (24.5)	30 (27.3)	0.64
Hepatobiliary surgery, n (%)	21 (19.1)	18 (16.4)	0.60
Other GI procedures, n (%)	14 (12.7)	17 (15.4)	0.56

Postoperative recovery was significantly better in the ERAS group. Time to first oral intake was shorter in ERAS patients (18.6 ± 5.4 vs. 42.3 ± 9.8 hours; p<0.001), and bowel movement occurred earlier (2.1 ± 0.8 vs. 3.7 ± 1.1 days; p<0.001). Hospital stay was reduced in the ERAS group (5.2 ± 1.7 vs. 8.6 ± 2.4 days; p<0.001), pain scores were lower (3.8 ± 1.3 vs. 5.9 ± 1.8; p<0.001), and early mobilization was higher (94, 85.5% vs. 51, 46.4%; p<0.001).

Table 3: Postoperative Recovery Outcomes

Variable	ERAS Group (n=110)	Conventional Care (n=110)	p-value
Time to first oral intake (hours), Mean ± SD	18.6 ± 5.4	42.3 ± 9.8	<0.001
Time to first bowel movement (days), Mean ± SD	2.1 ± 0.8	3.7 ± 1.1	<0.001
Length of hospital stay (days), Mean ± SD	5.2 ± 1.7	8.6 ± 2.4	<0.001
Pain score (VAS), Mean ± SD	3.8 ± 1.3	5.9 ± 1.8	<0.001
Early mobilization within 24 hours, n (%)	94 (85.5)	51 (46.4)	<0.001

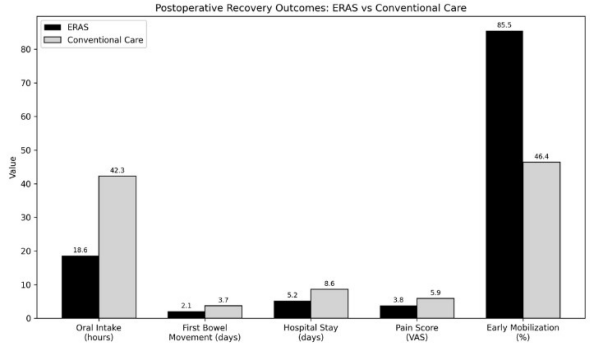

Figure 1. Comparison of Postoperative Recovery Outcomes Between ERAS and Conventional Care Groups

Postoperative complications were lower in the ERAS group compared with conventional care. Any complication occurred in 19 (17.3%) ERAS patients versus 38 (34.5%) conventional care patients (p=0.004). Surgical site infection was lower in

ERAS patients (7, 6.4% vs. 16, 14.5%; p=0.04), as were pulmonary complications (5, 4.5% vs. 13, 11.8%; p=0.05) and postoperative ileus (6, 5.5% vs. 15, 13.6%; p=0.04). Readmission and mortality were lower in ERAS but not statistically significant.

Table 4: Postoperative Complications and Clinical Outcomes

Variable	ERAS Group (n=110)	Conventional Care (n=110)	p-value
Any postoperative complication, n (%)	19 (17.3)	38 (34.5)	0.004
Surgical site infection, n (%)	7 (6.4)	16 (14.5)	0.04
Pulmonary complications, n (%)	5 (4.5)	13 (11.8)	0.05
Postoperative ileus, n (%)	6 (5.5)	15 (13.6)	0.04
Readmission within 30 days, n (%)	4 (3.6)	7 (6.4)	0.35
Mortality, n (%)	2 (1.8)	4 (3.6)	0.41

Improved postoperative outcome was associated with younger age (50.4 ± 12.8 vs. 58.2 ± 13.9 years; p<0.001), ERAS adherence (102, 64.6% vs. 8, 12.9%; p<0.001), and ASA class I–II status (124, 78.5% vs. 32, 51.6%; p<0.001). Poor outcomes were more common among diabetic patients (25, 40.3% vs. 29, 18.4%; p=0.001), longer surgeries (188.5 ± 48.7 vs. 158.6 ± 39.4 minutes; p<0.001), and those with postoperative complications (39, 62.9% vs. 18, 11.4%; p<0.001).

Table 5: Factors Associated with Improved Postoperative Outcome

Variable	Improved Outcome (n=158)	Poor Outcome (n=62)	p-value
Age (years), Mean ± SD	50.4 ± 12.8	58.2 ± 13.9	<0.001
ERAS protocol adherence, n (%)	102 (64.6)	8 (12.9)	<0.001
ASA Class I–II, n (%)	124 (78.5)	32 (51.6)	<0.001
Diabetes mellitus, n (%)	29 (18.4)	25 (40.3)	0.001
Length of surgery (minutes), Mean ± SD	158.6 ± 39.4	188.5 ± 48.7	<0.001
Postoperative complications, n (%)	18 (11.4)	39 (62.9)	<0.001

Discussion

This study assessed the effects of ERAS regimen on postoperative outcomes in patients who underwent gastrointestinal surgery. The results showed that using ERAS protocols led to significantly better recovery parameters, fewer postoperative complications, a shorter hospital admission time and better overall clinical outcomes than traditional perioperative management. These findings complement the growing body of evidence that ERAS pathways contribute to optimized peri-operative management and improve postoperative recovery. The mean age of the study population was 52.6 ± 13.4 years and 60.0% of the patients were males. Hypertension and diabetes mellitus were common comorbidities, affecting 32.3% and 24.5% of patients, respectively. The results of this study are similar to the previous studies which found that gastrointestinal surgical patients are mainly middle-aged to older patients with significant cardiovascular and metabolic comorbidities. These are known to affect postoperative recovery and complication rates [17]. The baseline surgical characteristics were comparable between the ERAS and conventional care groups, suggesting that it is unlikely that the differences in outcomes were related to variations in patient characteristics or surgical complexity. In past studies, comparable baseline characteristics were also highlighted as key factors when assessing ERAS pathway effectiveness and the benefits were found to be robust, even after adjusting for patient and procedural factors [18]. One of the most significant results was that the ERAS group started oral intake much earlier (18.6 ± 5.4 hours) than the conventional care group (42.3 ± 9.8 hours). Early feeding is a critical aspect of ERAS and is important to ensure gastrointestinal mucosal integrity, limit catabolism and speed up bowel recovery. Few previous studies have demonstrated that early feeding is linked to quicker recovery, decreased infection rates, and patient satisfaction without an increase of the anastomosis complications. Early returned bowel function was also achieved among patients who received management according to ERAS protocols, who had a mean time of 2.1 ± 0.8 days before their first bowel movement versus 3.7 ± 1.1 days for conventional care. Early gastrointestinal recovery could be explained by the decrease in opioid use, early mobilization, optimized fluid therapy, and early enteral nutrition. Other studies have also found that those who underwent ERAS pathways had significantly better bowel recovery and postoperative ileus [19].

The ERAS group had significantly shorter hospital stay than the conventional group (5.2 ± 1.7 days vs 8.6 ± 2.4 days). One of the greatest advantages of ERAS implementation is its effect on shorter hospital stays thus better use of resources, lower hospital-acquired infection complications, and lower costs of healthcare. Reductions in hospital stay of 2 to 4 days after ERAS implementation have been consistently shown by previous studies in different gastrointestinal surgical procedures [20]. In addition, postoperative pain control was better in the ERAS group, as the pain scores were significantly lower (3.8 ± 1.3 vs. 5.9 ± 1.8). The central principle of ERAS is effective multimodal

analgesia which decreases the need for opioid drugs which are linked to delayed bowel recovery, nausea, sedation, and prolonged recovery. In line with this finding, previous studies have also reported reduced pain scores and less opioid consumption in ERAS patients, leading to improved patient recovery and comfort following surgery [21]. Among patients who received care in the ERAS group early mobilization was achieved in 85.5% patients while it was done in 46.4% in the conventional group. Early mobilization benefits pulmonary function, decreases the risk of venous thromboembolism, helps to maintain muscle strength and supports gastrointestinal recovery.

Limitations

This study has several limitations. As a comparative cross-sectional study, it could identify associations between ERAS implementation and postoperative outcomes but could not establish definitive causal relationships. The study was conducted at a single center, which may limit the generalizability of the findings to other healthcare settings. Variations in surgeon experience, procedure complexity, and adherence to individual ERAS components may have influenced outcomes despite standardized protocols. The study did not assess long-term outcomes, patient-reported quality of life, or cost-effectiveness beyond the immediate postoperative period. Additionally, unmeasured confounding factors such as nutritional status, frailty, and socioeconomic conditions may have affected recovery outcomes.

Conclusion

Enhanced Recovery After Surgery (ERAS) protocols significantly improved postoperative outcomes in patients undergoing gastrointestinal surgery. ERAS implementation was associated with earlier oral intake, faster return of bowel function, shorter hospital stay, lower pain scores, increased early mobilization, and reduced postoperative complications compared with conventional perioperative care. Patients managed through ERAS pathways experienced superior recovery without increased readmission or mortality rates..

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