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Original Research Article

Effect of Enhanced Recovery after Surgery (ERAS) Protocol on Postoperative Recovery Following Elective Major Abdominal Surgery: A Prospective Cohort Study

Pratheek Devappa[1], Shilpa Wali[2], Harshita Muralidhar[3]

[1]Assistant Professor, Department of Anaesthesiology, Mahadevappa Rampure Medical College and Basaveshwar Teaching and General Hospital, Kalaburagi, Karnataka, India.
[2]Senior Resident, Department of Anaesthesiology, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India.
[3]Senior Resident, Department of Anaesthesiology, Gulbarga Institute of Medical Sciences, Kalaburagi, Karnataka, India.

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Corresponding author: Dr. Harshita Muralidhar
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Abstract

Background: Enhanced Recovery after Surgery (ERAS) is an evidence-based multidisciplinary perioperative care pathway designed to reduce surgical stress, accelerate postoperative recovery, and improve clinical outcomes. The present study evaluated the impact of ERAS on postoperative outcomes in patients undergoing major abdominal surgery.

Methods: This prospective cohort study included 120 patients undergoing elective major abdominal surgery. Sixty patients received perioperative care according to the ERAS protocol (Group E), while sixty patients received conventional perioperative care (Group C). Baseline demographic characteristics were comparable between the groups. Postoperative recovery parameters, pain scores, opioid consumption, gastrointestinal recovery, postoperative complications, duration of hospital stay, and patient satisfaction were compared between the two groups.

Results: Patients managed under the ERAS protocol demonstrated significantly improved postoperative recovery compared with conventional care. The ERAS group showed earlier ambulation (13.8 ± 2.9 vs. 22.1 ± 4.3 hours; $p<0.001$), faster return of bowel sounds (20.4 ± 4.8 vs. 30.8 ± 5.6 hours; $p<0.001$), earlier oral intake (22.6 ± 5.1 vs. 34.5 ± 6.8 hours; $p<0.001$), and shorter hospital stay (5.1 ± 1.2 vs. 7.3 ± 1.7 days; $p<0.001$). Postoperative pain scores and opioid consumption were significantly lower in the ERAS group, with prolonged time to first rescue analgesia (9.6 ± 2.1 vs. 5.4 ± 1.8 hours; $p<0.001$). The incidence of postoperative nausea and vomiting, postoperative ileus, and pulmonary complications was also significantly reduced. Patient satisfaction scores were significantly higher among ERAS patients (9.1 ± 0.8 vs. 7.8 ± 1.0; $p<0.001$). Readmission, reoperation, ICU admission, and mortality rates were comparable between the groups.

Conclusion: ERAS significantly enhanced postoperative recovery, reduced complications and opioid requirements, shortened hospitalization, and improved patient satisfaction without compromising patient safety. Routine implementation of ERAS protocols should be encouraged for patients undergoing major abdominal surgery to optimize perioperative outcomes.

Introduction

Major abdominal surgery is associated with a significant physiological stress response and remains an important contributor to postoperative morbidity, delayed recovery, prolonged hospitalization, and increased healthcare expenditure [1]. Despite advances in surgical techniques, anesthesia, and perioperative care, patients continue to experience complications such as postoperative pain, ileus, nausea and vomiting, pulmonary complications, surgical site infections, venous thromboembolism, delayed mobilization, and impaired gastrointestinal recovery, which negatively affect quality of life and patient satisfaction [2].Traditional perioperative practices, including prolonged fasting, liberal fluid administration, delayed oral feeding, prolonged use of drains and catheters, opioid-based analgesia, and delayed mobilization, were historically adopted to improve safety [3]. However, evidence suggests that several of these approaches may contribute to

delayed recovery by increasing insulin resistance, protein catabolism, inflammatory response, impaired gastrointestinal function, and postoperative complications. Excessive opioid use further increases the risk of nausea, sedation, respiratory depression, constipation, urinary retention, and delayed bowel recovery [4].

Enhanced Recovery after Surgery (ERAS) represents a multidisciplinary, evidence-based approach designed to reduce surgical stress, preserve physiological function, and accelerate postoperative recovery. Initially introduced for colorectal surgery, ERAS has now been implemented across various surgical specialties, including major abdominal, hepatobiliary, gynecological, urological, and orthopedic procedures [5,6].

ERAS focuses on a combination of coordinated interventions rather than a single treatment modality, aiming to minimize metabolic disturbances and facilitate early functional recovery. Surgical trauma triggers a neuroendocrine and inflammatory response characterized by increased catecholamine and cortisol secretion, cytokine release, insulin resistance, fluid retention, impaired immunity, and delayed gastrointestinal motility [5]. These changes contribute to postoperative pain, ileus, muscle weakness, delayed wound healing, and prolonged hospitalization. ERAS protocols aim to attenuate this response through optimized perioperative management, including patient counseling, nutritional optimization, avoidance of prolonged fasting, carbohydrate loading when appropriate, standardized anesthesia, multimodal opioid-sparing analgesia, goal-directed fluid therapy, maintenance of normothermia, early feeding, early mobilization, and timely removal of drains and catheters [7,8]. Multiple randomized trials and systematic reviews have demonstrated that ERAS pathways reduce postoperative pain, opioid consumption, complications, time to gastrointestinal recovery, and length of hospital stay while improving patient satisfaction without increasing readmission or mortality rates [9,10].

Successful recovery after major abdominal surgery depends not only on surgical expertise but also on effective perioperative optimization, including adequate analgesia, nutritional support, fluid management, preservation of bowel function, and early mobilization [11].

The application of ERAS is particularly relevant in developing healthcare systems such as India, where high surgical volume and limited healthcare resources require strategies that improve recovery while reducing costs and hospital stay. However, institutional variations in ERAS implementation and limited evidence from Indian healthcare settings highlight the need for prospective studies evaluating its effectiveness in routine clinical practice [12].Therefore, the present prospective cohort study was undertaken to assess the impact of the ERAS protocol on postoperative outcomes in patients undergoing major abdominal surgery.

The study compared postoperative pain, gastrointestinal recovery, time to ambulation, postoperative complications, length of hospital stay, and overall recovery between patients managed with ERAS pathways and those receiving conventional perioperative care.

Materials and Methods

This prospective cohort study was conducted in the Department of Anaesthesia at a tertiary care teaching hospital over a period of 18 months

Study Population: Adult patients scheduled to undergo elective major abdominal surgery were screened for eligibility. Patients who met the predefined inclusion criteria were enrolled consecutively during the study period. A total of 120 patients were included in the study. Based on the perioperative care protocol followed, patients were allocated into two cohorts:

- **ERAS Group (Group E):** 60 patients managed according to the Enhanced Recovery after Surgery (ERAS) protocol.
- **Conventional Care Group (Group C):** 60 patients managed according to the standard perioperative care protocol.

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

- Age between 18 and 75 years.
- Scheduled for elective major abdominal surgery.
- American Society of Anesthesiologists (ASA) physical status I–III.
- Ability to provide written informed consent.

Exclusion Criteria

Patients were excluded if they had:

- Emergency abdominal surgery.
- ASA physical status IV or V.
- Pregnancy.
- Severe hepatic or renal dysfunction.
- Uncontrolled cardiovascular or respiratory disease.
- Cognitive impairment or inability to comply with the ERAS protocol.
- Re-exploration surgery or conversion to damage-control procedures.
- Refusal to participate in the study.

Study Groups

Group E (ERAS Protocol): Patients in the ERAS group received perioperative care according to the institutional ERAS pathway, which included evidence-based interventions during the preoperative, intraoperative, and postoperative periods.

Group C (Conventional Care): Patients in the conventional care group received routine perioperative management as practiced in the institution without implementation of the ERAS pathway.

ERAS Protocol

Preoperative Care: Patients in the ERAS group underwent structured preoperative counseling regarding the surgical procedure and postoperative recovery. Nutritional status was assessed and optimized whenever required. Prolonged fasting was avoided, and patients were allowed clear fluids until 2 hours before anesthesia and solid food up to 6 hours before surgery. Preoperative carbohydrate loading was administered according to institutional protocol in eligible patients. Mechanical bowel preparation was avoided unless specifically indicated. Appropriate thromboembolism prophylaxis and antibiotic prophylaxis were administered according to institutional guidelines.

Intraoperative Care: Standardized anesthetic techniques were used for all patients. Multimodal opioid-sparing analgesia was administered whenever feasible. Goal-directed intravenous fluid therapy was employed to maintain euvolemia while avoiding fluid overload. Normothermia was maintained throughout surgery using active warming devices. Prophylaxis against postoperative nausea and vomiting was provided according to individual patient risk. Surgical drains and nasogastric tubes were used only when clinically indicated.

Postoperative Care: Early oral feeding was initiated as soon as clinically appropriate. Patients were encouraged to mobilize on the day of surgery or within 24 hours postoperatively. Urinary catheters, intravenous lines, and surgical drains were removed at the earliest appropriate opportunity. Multimodal analgesia was continued with minimization of opioid use. Respiratory physiotherapy and venous thromboembolism prophylaxis were continued according to institutional protocol.

Conventional Perioperative Care: Patients in the conventional care group received routine perioperative management, which generally included overnight fasting, delayed postoperative oral feeding until return of bowel function, liberal intravenous fluid administration, opioid-based analgesia, prolonged use of urinary catheters and surgical drains as clinically indicated, and delayed postoperative mobilization according to the treating surgical team's standard practice.

Data Collection: Baseline demographic and clinical characteristics including age, sex, body mass index (BMI), ASA physical status, diagnosis, type of surgery, duration of surgery, and relevant comorbidities were recorded. Perioperative data were collected using a standardized case record form by trained investigators.

Outcome Measures

Primary Outcome: The primary outcome was overall postoperative recovery, assessed by:

- Length of hospital stay (days)
- Time to first ambulation (hours)
- Time to recovery of bowel sounds (hours)
- Time to first oral intake (hours)

Secondary Outcomes: Secondary outcome measures included:

- Postoperative pain scores assessed using the Visual Analogue Scale (VAS) at predefined postoperative intervals.
- Total postoperative opioid consumption during the first 48 hours.
- Time to first rescue analgesia.
- Incidence of postoperative nausea and vomiting.
- Postoperative ileus.
- Surgical site infection.
- Pulmonary complications.
- Urinary retention.
- Venous thromboembolism.
- Overall postoperative complications.
- Patient satisfaction score at discharge.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Normality of data distribution was assessed using the Shapiro–Wilk test. Normally distributed continuous variables were compared using the independent Student's t-test, while non-normally distributed variables were analyzed using the Mann–Whitney U test. Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. A two-tailed p value <0.05 was considered statistically significant.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants prior to enrollment, and confidentiality of patient information was maintained throughout the study. All procedures were performed in

accordance with the ethical standards of the institutional research committee and the principles of the Declaration of Helsinki.

Results

A total of 120 patients undergoing elective colorectal surgery were included in the study and were equally allocated into two groups: Group E (ERAS protocol, n=60) and Group C (conventional perioperative care, n=60). All patients completed the study follow-up period and were included in the final analysis. Baseline demographic and perioperative characteristics were comparable between the two groups, with no statistically significant differences observed in age, sex distribution, BMI, ASA physical status, or duration of surgery (Table 1). Patients managed according to the ERAS protocol demonstrated significantly improved postoperative recovery parameters compared with conventional care.

The mean time to first ambulation was significantly shorter in Group E compared with Group C (13.8 ± 2.9 vs 22.1 ± 4.3 hours, p<0.001). Similarly, recovery of bowel sounds (20.4 ± 4.8 vs 30.8 ± 5.6 hours), time to first oral intake (22.6 ± 5.1 vs 34.5 ± 6.8 hours), and length of hospital stay (5.1 ± 1.2 vs 7.3 ± 1.7 days) were significantly reduced in the ERAS group. Patient satisfaction scores were also significantly higher among patients receiving ERAS care (9.1 ± 0.8 vs 7.8 ± 1.0, p<0.001) (Table 2). The comparative improvement in postoperative recovery outcomes between both groups is illustrated in Figure 1.Postoperative pain management outcomes showed significant advantages with the ERAS protocol. Patients in Group E had a prolonged time to first rescue analgesia compared with Group C (9.6 ± 2.1 vs 5.4 ± 1.8 hours, p<0.001). Total opioid consumption over 48 hours was significantly lower in the ERAS group (18.4 ± 5.2 vs 33.7 ± 7.1 mg morphine equivalents, p<0.001). Furthermore, postoperative VAS pain scores were significantly lower in Group E at all assessed time points, including recovery room, 6 hours, 12 hours, and 24 hours after surgery (Table 3). The trends in postoperative pain scores and analgesic requirements are presented in Figure 2.Comparison of postoperative complications revealed that patients managed with ERAS experienced fewer adverse events.

The incidence of postoperative nausea and vomiting was significantly lower in Group E compared with Group C (13.3% vs 33.3%, p=0.010). Postoperative ileus (5.0% vs 18.3%, p=0.026) and pulmonary complications (5.0% vs 16.7%, p=0.041) were also significantly reduced in the ERAS group. Although lower rates of surgical site infection, urinary retention, deep vein thrombosis, and 30-day readmission were observed in Group E, these differences did not reach statistical significance (Table 4). The distribution of postoperative complications between the two groups is depicted in Figure 3.Evaluation of gastrointestinal recovery demonstrated significantly earlier return of bowel function among ERAS patients. Time to first flatus was significantly shorter in Group E compared with Group C (26.7 ± 5.8 vs 38.9 ± 7.3 hours, p<0.001), as was time to first bowel movement (39.6 ± 8.2 vs 55.8 ± 9.6 hours, p<0.001). A significantly greater proportion of patients in the ERAS group tolerated oral diet within the first 24 hours (78.3% vs 31.7%, p<0.001). Additionally, nasogastric tube reinsertion was required less frequently in the ERAS group (3.3% vs 13.3%, p=0.047) (Table 5).

Overall clinical outcomes were superior in patients receiving ERAS-based care. Uneventful postoperative recovery occurred in significantly more patients in Group E compared with Group C (86.7% vs 68.3%, p=0.017). Rates of ICU admission, reoperation, and mortality were lower in the ERAS group; however, these differences were not statistically significant (Table 6). These findings indicate that implementation of an ERAS pathway was associated with enhanced recovery, reduced opioid requirement, fewer postoperative complications, and improved overall clinical outcomes following colorectal surgery.

Table 1: Baseline Demographic and Perioperative Characteristics

Variable	Group E (ERAS) (n=60)	Group C (Conventional) (n=60)	p-value
Age (years), Mean ± SD	54.2 ± 11.3	55.1 ± 10.8	0.671
Male, n (%)	36 (60.0)	35 (58.3)	0.852
Female, n (%)	24 (40.0)	25 (41.7)	
BMI (kg/m²), Mean ± SD	24.9 ± 3.1	25.2 ± 3.4	0.612
ASA I, n (%)	14 (23.3)	13 (21.7)	0.948
ASA II, n (%)	33 (55.0)	34 (56.7)	
ASA III, n (%)	13 (21.7)	13 (21.6)	
Duration of surgery (minutes), Mean ± SD	158.6 ± 31.8	160.9 ± 33.1	0.694

Table 2: Comparison of Postoperative Recovery Outcomes

Parameter	Group E	Group C	p-value
Time to first ambulation (hours)	13.8 ± 2.9	22.1 ± 4.3	<0.001
Recovery of bowel sounds (hours)	20.4 ± 4.8	30.8 ± 5.6	<0.001
Time to first oral intake (hours)	22.6 ± 5.1	34.5 ± 6.8	<0.001
Length of hospital stay (days)	5.1 ± 1.2	7.3 ± 1.7	<0.001
Patient satisfaction score (0–10)	9.1 ± 0.8	7.8 ± 1.0	<0.001

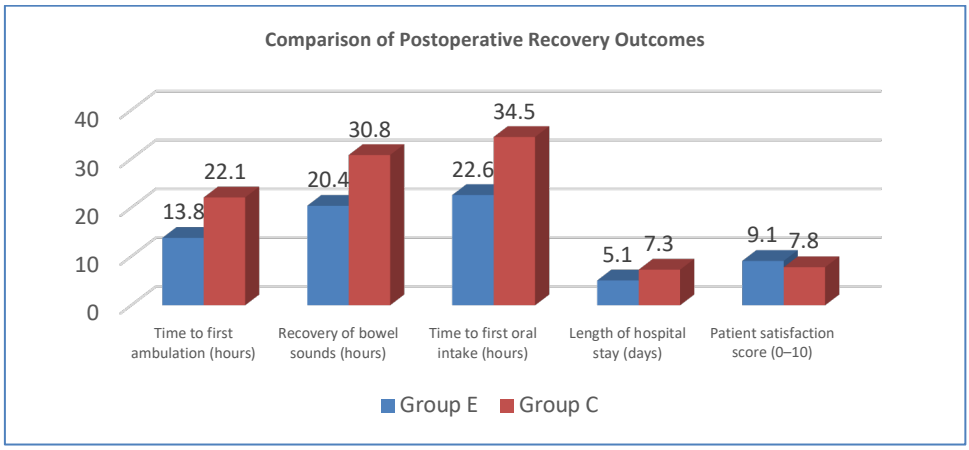

Figure 1: Comparison of Postoperative Recovery Outcomes

Table 3: Comparison of Postoperative Pain and Analgesic Outcomes

Parameter	Group E	Group C	p-value
Time to first rescue analgesia (hours)	9.6 ± 2.1	5.4 ± 1.8	<0.001
Total opioid consumption (Morphine equivalent, mg/48 h)	18.4 ± 5.2	33.7 ± 7.1	<0.001
VAS Pain Score (Recovery Room)	3.2 ± 0.8	4.6 ± 0.9	<0.001
VAS Pain Score (6 hours)	2.9 ± 0.7	4.3 ± 0.8	<0.001
VAS Pain Score (12 hours)	2.6 ± 0.8	3.8 ± 0.9	<0.001
VAS Pain Score (24 hours)	2.3 ± 0.7	3.2 ± 0.8	<0.001

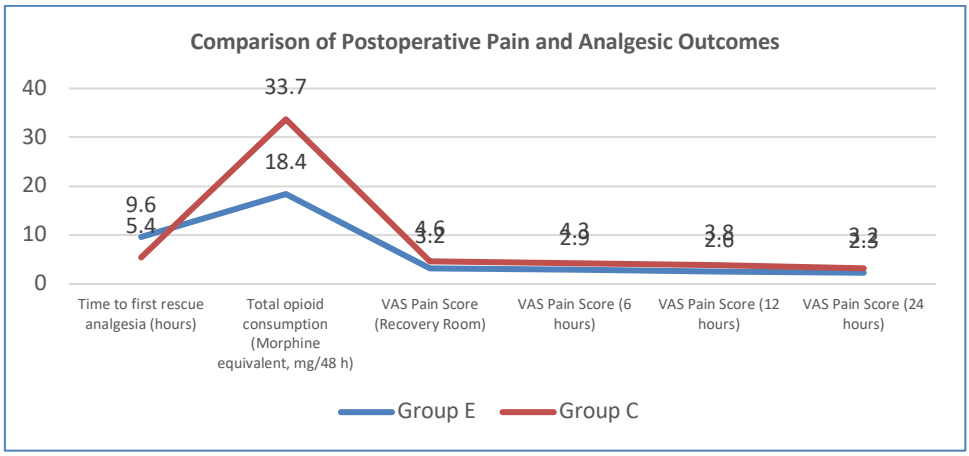

Figure 2: Comparison of Postoperative Pain and Analgesic Outcomes

Table 4: Comparison of Postoperative Complications

Complication	Group E n (%)	Group C n (%)	p-value
Postoperative nausea and vomiting	8 (13.3)	20 (33.3)	0.010
Postoperative ileus	3 (5.0)	11 (18.3)	0.026
Surgical site infection	4 (6.7)	8 (13.3)	0.224
Pulmonary complications	3 (5.0)	10 (16.7)	0.041
Urinary retention	3 (5.0)	9 (15.0)	0.072
Deep vein thrombosis	1 (1.7)	4 (6.7)	0.170
Readmission within 30 days	2 (3.3)	4 (6.7)	0.401

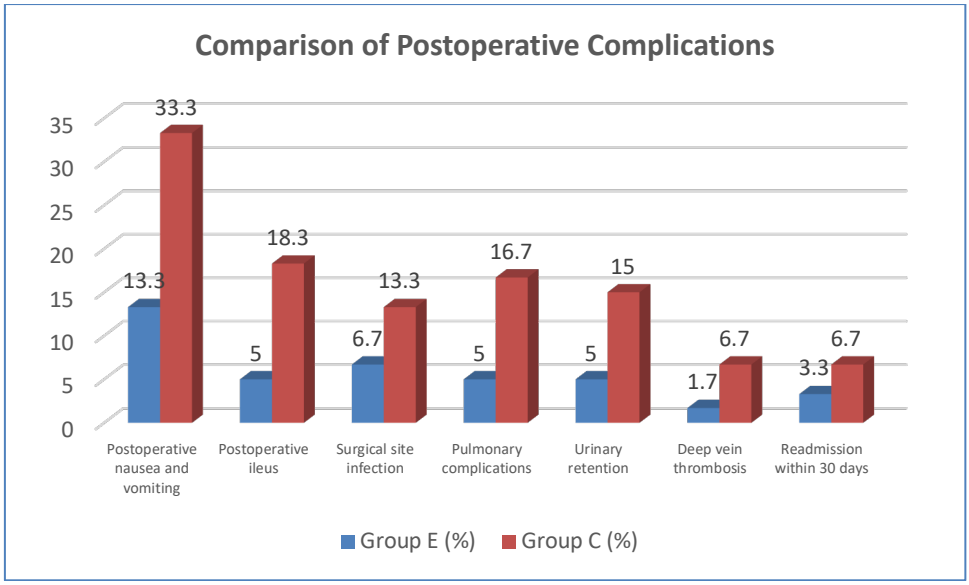

Figure 3: Comparison of Postoperative Complications

Table 5: Gastrointestinal Recovery Outcomes

Parameter	Group E	Group C	p-value
Time to first flatus (hours)	26.7 ± 5.8	38.9 ± 7.3	<0.001
Time to first bowel movement (hours)	39.6 ± 8.2	55.8 ± 9.6	<0.001
Patients tolerating oral diet within 24 h, n (%)	47 (78.3)	19 (31.7)	<0.001
Need for nasogastric tube reinsertion, n (%)	2 (3.3)	8 (13.3)	0.047

Table 6: Overall Clinical Outcomes

Outcome	Group E n (%)	Group C n (%)	p-value
Uneventful postoperative recovery	52 (86.7)	41 (68.3)	0.017
ICU admission	3 (5.0)	8 (13.3)	0.116
Reoperation	1 (1.7)	3 (5.0)	0.309
Mortality	0 (0.0)	1 (1.7)	0.315

Discussion

The present prospective cohort study demonstrated that implementation of an Enhanced Recovery after Surgery (ERAS) protocol in patients undergoing major abdominal surgery resulted in significantly improved postoperative recovery compared with conventional perioperative care. Patients managed with ERAS experienced earlier mobilization, faster gastrointestinal recovery, improved pain control, and reduced opioid consumption, fewer postoperative complications, shorter hospital stay, and higher patient satisfaction without an increase in readmission, reoperation, ICU admission, or mortality.

These findings support the effectiveness and safety of ERAS as a structured perioperative care pathway. Baseline demographic and operative characteristics were comparable between the two groups, including age, sex distribution, BMI, ASA status, and duration of surgery. The mean duration of surgery was 158.6 ± 31.8 minutes in the ERAS group and 160.9 ± 33.1 minutes in the conventional group. Comparable baseline characteristics have been reported in previous ERAS studies and systematic reviews, allowing postoperative differences to be primarily attributed to the care pathway rather than patient-related factors [1,4,10]. A significant improvement was observed in early postoperative mobilization, with ERAS patients ambulating earlier than conventional care patients (13.8 ± 2.9 vs 22.1 ± 4.3 hours). Early mobilization reduces postoperative complications by limiting muscle loss, venous stasis, pulmonary dysfunction, and functional decline. Gustafsson et al. and Oodit et al. emphasized early mobilization as a key ERAS component, recommending sitting out of bed on the day of surgery and ambulation by the first postoperative day when clinically appropriate (2,5).ERAS significantly accelerated gastrointestinal recovery. Return of bowel sounds, first flatus, and first bowel movement occurred earlier in the ERAS group compared with conventional care (20.4 ± 4.8 vs 30.8 ± 5.6 hours; 26.7 ± 5.8 vs 38.9 ± 7.3 hours; and 39.6 ± 8.2 vs 55.8 ± 9.6 hours, respectively). These improvements are likely related to the combined effects of early feeding, reduced opioid exposure, balanced fluid therapy, early mobilization, and avoidance of routine nasogastric decompression.

Fearon et al. identified these interventions as central elements of enhanced recovery following abdominal surgery [3]. Similar benefits have been reported by Scott et al. and Kehlet and Wilmore, who highlighted the synergistic effects of multimodal perioperative strategies [6,9].

Early oral intake was achieved significantly more frequently in the ERAS group, with 78.3% tolerating diet within 24 hours compared with 31.7% in conventional care. Early feeding supports intestinal function, maintains nutritional status, and reduces catabolic stress. Oodit et al. strongly recommended early oral nutrition after elective abdominal surgery, particularly in low- and middle-income settings [5]. Reduced nasogastric tube reinsertion in the ERAS group (3.3% vs 13.3%) further suggested improved gastrointestinal recovery and supports current recommendations against routine prolonged nasogastric decompression [2,3].

Pain outcomes were significantly improved with ERAS. Patients had lower VAS scores throughout the first 24 hours, prolonged time to rescue analgesia (9.6 ± 2.1 vs 5.4 ± 1.8 hours), and approximately 45% reduction in opioid consumption (18.4 ± 5.2 vs 33.7 ± 7.1 mg morphine equivalents). These findings reinforce the importance of multimodal, opioid-sparing analgesia advocated by Kehlet and Scott et al., as effective analgesia facilitates mobilization, respiratory function, and gastrointestinal recovery (6,8).ERAS was associated with significantly lower rates of postoperative nausea and vomiting (13.3% vs 33.3%), postoperative ileus (5.0% vs 18.3%), and pulmonary complications (5.0% vs 16.7%). Although reductions in surgical site infection, urinary retention, and deep vein thrombosis were not statistically significant, numerical trends favored ERAS. The reduction in ileus and pulmonary complications is biologically plausible due to reduced opioid use, early mobilization, and optimized fluid management [2,5,10]. The length of hospital stay was reduced by 2.2 days in the ERAS group (5.1 ± 1.2 vs 7.3 ± 1.7 days), representing approximately a 30% reduction. Ljungqvist et al. reported similar reductions of 30–50% in hospitalization and complications following ERAS implementation [1]. Visioni et al. also demonstrated reduced hospital stay without increased morbidity in major noncolorectal abdominal surgery [4]. Importantly, shorter hospitalization was not associated with increased readmission, as 30-day readmission rates remained comparable between groups. Overall recovery was superior with ERAS, with more patients achieving uneventful recovery (86.7% vs 68.3%) and significantly higher satisfaction scores (9.1 ± 0.8 vs 7.8 ± 1.0). The improved satisfaction likely reflected better pain control, earlier independence, reduced tubes and catheters, and shorter hospitalization. Oodit et al. emphasized that patient education and structured perioperative pathways improve satisfaction and recovery outcomes [5]. The findings are particularly relevant for resource-limited healthcare systems, as many ERAS components can be implemented through teamwork, protocol adherence, patient counseling, multimodal analgesia, early feeding, and mobilization. Oodit et al. highlighted the feasibility of adapting ERAS pathways in low- and middle-income countries [5].

Conclusion

The implementation of the Enhanced Recovery after Surgery (ERAS) protocol significantly improved postoperative outcomes in patients undergoing major abdominal surgery compared with conventional perioperative care. Patients managed under the ERAS pathway demonstrated earlier mobilization, faster gastrointestinal recovery, lower postoperative pain scores, reduced opioid consumption, shorter hospital stay, and higher patient satisfaction. In addition, ERAS was associated with a lower incidence of postoperative nausea and vomiting, postoperative ileus, and pulmonary complications without increasing readmission, reoperation, or mortality. These findings support the routine implementation of ERAS protocols as a safe, feasible, and effective perioperative care strategy for enhancing recovery following major abdominal surgery.

Limitation

The present study was conducted at a single tertiary care center with a relatively modest sample size, which may limit the generalizability of the findings. In addition, long-term postoperative outcomes, quality-of-life measures, and compliance with individual ERAS components were not evaluated. Future multicenter studies with larger sample sizes and longer follow-up are warranted to validate these findings.

References:

1. Ljungqvist O, Scott M, Fearon KC. Enhanced recovery after surgery: a review. JAMA Surg. 2017;152(3):292-298.
2. Gustafsson UO, Scott MJ, Hubner M, Nygren J, Demartines N, Francis N, et al. Guidelines for perioperative care in elective colorectal surgery: Enhanced Recovery After Surgery Society recommendations: 2018. World J Surg. 2019;43(3):659-695.
3. Fearon KC, Ljungqvist O, Von Meyenfeldt M, Revhaug A, Dejong CH, Lassen K, et al. Enhanced recovery after surgery: a consensus review of clinical care for patients undergoing colonic resection. Clin Nutr. 2005;24(3):466-477.

4. Visioni A, Shah R, Gabriel E, Attwood K, Kukar M, Nurkin S, et al. Enhanced Recovery After Surgery for noncolorectal surgery: a systematic review and meta-analysis. Ann Surg. 2018;267(1):57-65.
5. Oodit R, Biccard BM, Panieri E, Alvarez AO, Sioson MRS, Maswime S, et al. Guidelines for perioperative care in elective abdominal and pelvic surgery at primary and secondary hospitals in low- and middle-income countries: Enhanced Recovery After Surgery Society recommendations. World J Surg. 2022;46(8):1826-1843.
6. Scott MJ, Hubner M, Nygren J, Mythen MG, Fearon KC, Ljungqvist O, et al. Enhanced Recovery After Surgery: perioperative care and outcomes. Anesthesiol Clin. 2015;33(1): 65-80.
7. Ljungqvist O, de Boer HD, Balfour A, Fawcett WJ, Lobo DN, Nelson G, et al. Opportunities and challenges for the next phase of enhanced recovery after surgery. JAMA Surg. 2021;156(8):775-784.
8. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. Br J Anaesth. 1997;78(5):606-617.
9. Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. Ann Surg. 2008;248(2):189-198.
10. Nelson G, Kiyang LN, Crumley ET, Chuck A, Nguyen T, Faris P, et al. Implementation of Enhanced Recovery After Surgery pathways in colorectal surgery: a systematic review and meta-analysis. J Am Coll Surg. 2016;223(2): 219-231.e1.