Original Article

Recovery After Emergency General Surgery

Enhanced Recovery After Surgery (ERAS) Guidelines in Emergency General Surgery: A Prospective Evaluation of Feasibility and Clinical Outcomes in a Developing Country

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ABSTRACT

Objective: This study aimed to evaluate the suitability and clinical impact of a tailored ERAS protocol in emergency general surgery within a resource-constrained low- and middle-income country (LMIC) setting. The primary focus was on outcomes such as hospital length of stay and postoperative complications.
Study Design: Prospective observational study
Place and Duration of Study: This study was conducted at the Emergency General Surgery of a Tertiary Care Center between January 2024 and December 2024.
Methods: We performed a 12-month prospective observational study involving 150 consecutive adult patients undergoing emergency general surgery at a tertiary care center. Patients were divided into an ERAS group (n=75), managed with adapted emergency-specific protocol, and a control group (n=75) receiving standard postoperative care. The ERAS protocol included preoperative optimization if feasible, early mobilization, multimodal analgesia, early oral intake, and standardized discharge criteria. The primary outcome was length of hospital stay (LOH). Secondary outcomes included postoperative complications (Clavien-Dindo classification), time to first bowel movement, pain scores (Visual Analog Scale), and 30-day readmission rates. Feasibility was inferred as compliance with protocol elements.
Results: ERAS implementation was feasible, with a mean compliance rate of 78%. Median LOH was significantly shorter in the ERAS group (5 vs. 8 days, $p<0.001$). Postoperative complication rates were lower in the ERAS group (21.3%) compared to controls (37.3%) ($p=0.029$), particularly for surgical site infections and ileus. Time to first bowel movement was shorter in the ERAS group (2.8 vs. 4.1 days, $p<0.001$). While pain scores were similar on postoperative day 1, they were significantly lower in the ERAS group from day 2 onward. The 30-day readmission rate was lower in the ERAS group (6.7% vs. 13.3%), though not statistically significant ($p=0.178$).
Conclusion: The implementation of tailored ERAS protocol in resource constrained settings is feasible in emergency general surgery and is associated with shorter hospital stay, reduced complications, Enhanced recovery of bowel activity, and improved pain control. These findings support the broader adoption of ERAS in the EGS setting in under resourced hospitals.
Key Words: Enhanced Recovery After Surgery, ERAS, Acute care Surgery, Length of Stay, Postoperative Complications, Feasibility.

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INTRODUCTION

Enhanced Recovery After Surgery (ERAS) has revolutionized perioperative care beyond traditional surgical management through adoption of structured, evidence-based approach based on minimizing physiological stress. First introduced by Kehlet and later formalized through the ERAS Society, these protocols emphasize multidisciplinary collaboration and have demonstrated substantial benefits in elective surgery[1,2].

Initially developed for colorectal procedures[3], since then ERAS methodology has been tailored to various surgical practices, including gastrointestinal, urologic, hepatobiliary, geriatric, and emergency laparotomy settings[4,5]. Key elements include reduced preoperative fasting, early mobilization, multimodal (opioid-sparing) analgesia, and prompt initiation of enteral nutrition[3].

In elective surgery, this methodology is associated with faster recovery, shorter hospital stays, and lower complication rates. However, their implementation in emergency general surgery (EGS) presents unique challenges[6]. Limited time for preoperative optimization,

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patient instability, and urgent decision-making often constrain adherence to protocol elements[7].

Despite these obstacles, emerging evidence, including systematic reviews and randomized trials, suggests that adapted ERAS pathways can still be feasible, cost-effective[8], and clinically beneficial in emergency settings[6]. Reported improvements include reduced complication rates and decreased length of hospitalization[9]. Nonetheless, there remains a pressing need for prospective evaluations to determine how ERAS can be reliably applied across varied EGS populations.

METHODS

We performed a prospective observational study on 150 consecutive adult patients (≥18 years of age) who underwent emergency general surgery at a tertiary care center between January 2024 and December 2024 in resource constrained settings. Patients undergoing surgery for trauma were excluded, as a separate modified protocol may be more appropriate for this specific population. Patients were eligible for inclusion if they required urgent or emergency surgical intervention for a range of general surgical conditions, including but not limited to acute appendicitis, bowel obstruction, perforated peptic ulcer, diverticulitis, and acute cholecystectomy.

Patients were approached for participation as soon as feasible after admission, and informed consent was obtained. Patients were divided into two groups based on the timing of ERAS protocol implementation within the study period: the control group (first 75 patients) received standard postoperative care, while the ERAS group (subsequent 75 patients) received care according to a newly implemented ERAS protocol.

ERAS Protocol: The ERAS protocol for emergency general surgery was reviewed by a multidisciplinary team comprising surgeons, anesthetists, nurses, and physiotherapists, based on existing ERAS guidelines and adapted to the specific challenges of the emergency setting. The core elements of the protocol included:

- **Preoperative Optimization (where feasible):** Brief preoperative assessment and optimization of fluid status, electrolyte balance, and pain control, when time allowed.
- **Early Mobilization:** Encouragement of early and progressive mobilization starting within 24 hours of surgery.
- **Multimodal Analgesia:** Utilization of opioid-sparing multimodal analgesia regimens, including regional anesthesia techniques where appropriate, and scheduled non-opioid analgesics.
- **Early Oral Intake:** Introduction of clear fluids and progression to a regular diet as soon as bowel function returned, typically within 24-48 hours postoperatively.
- **Avoidance of Routine Nasogastric Tubes:** Selective use of nasogastric tubes only for specific indications (e.g., persistent vomiting, high output obstruction).
- **Standardized Discharge Criteria:** Utilization of predefined criteria for discharge, focusing on pain control, adequate oral intake, ability to ambulate, and understanding of discharge instructions.

Prior to the adoption of the enhanced recovery protocol, the control group was managed with standard postoperative care following institutional guidelines, which typically involved a more gradual advancement of diet, delayed mobilization, and reliance on opioid-based analgesia[4,6].

Outcome Measures:

The primary outcome of the study was the length of hospital stay (LOH), defined as the number of days from the date of surgery to the date of discharge.

Secondary outcomes included:

- Incidence of **complications after surgery**, classified according to the Clavien-Dindo classification[16] of surgical complications.
- **Time to first bowel movement**, defined as the number of days from surgery until the passage of flatus or stool.
- **Pain scores**, measured using a 10-point Visual Analog Scale (VAS) [18] at 6 hours, 12 hours, 24 hours, and daily until discharge.
- **30-day readmission rate**, defined as any unplanned admission to the hospital within 30 days of the index surgery.
- **Feasibility** of ERAS protocol implementation, assessed by the compliance rate with the core elements of the protocol in the ERAS group, documented through daily charting and a dedicated ERAS audit form.

Data Collection and Analysis: Data were collected after surgery by trained research personnel. Adherence with ERAS protocol elements were documented daily for patients in the ERAS group. Data on patient demographics, surgical details, postoperative course, complications, and LOH were extracted from patient charts and electronic medical records for both the ERAS and control groups.

Statistical analysis was performed using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality using the Shapiro-Wilk test. Normally distributed continuous variables were compared using the independent samples t-test, and non-normally distributed continuous variables were compared using the Mann-Whitney U test. Categorical variables were compared using the chi-square test or Fisher's exact test as appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

Baseline Characteristics: The baseline demographic and clinical characteristics of the patients in the ERAS group and the control group were comparable (Table 1). There were no significant differences in age, sex, BMI, American Society of Anesthesiologists (ASA) classification, or the types of surgical procedures performed between the two groups.

Table No.1: Baseline Characteristics of Study Participants

Characteristic	ERAS Group (n=75)	Control Group (n=75)	p-value
Age (years), mean ± SD	56.3±18.2	58.1±16.9	0.512
Female, n (%)	38 (50.7)	40 (53.3)	0.764
BMI (kg/m2), mean ± SD	26.8±5.1	27.5±4.8	0.391
ASA Classification, n (%)			0.635
I	12 (16.0)	10 (13.3)	
II	35 (46.7)	38 (50.7)	
III	22 (29.3)	20 (26.7)	
IV	6 (8.0)	7 (9.3)	
Type of Surgery, n (%)			0.881
Appendectomy	18 (24.0)	17 (22.7)	
Bowel Obstruction	15 (20.0)	16 (21.3)	
Perforated Peptic Ulcer	8 (10.7)	7 (9.3)	
Diverticulitis	12 (16.0)	10 (13.3)	
Cholecystectomy	10 (13.3)	12 (16.0)	
Other	12 (16.0)	13 (17.3)	

Feasibility of ERAS Implementation: The mean compliance rate with the core ERAS protocol elements in the ERAS group was 78%. Compliance rates for individual elements were as follows: early mobilization (72%), multimodal analgesia (85%), early oral intake (79%), avoidance of routine nasogastric tubes (91%), and standardized discharge criteria (63%).

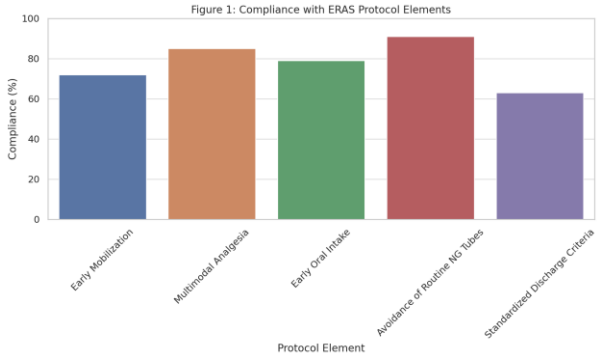

Figure No.1: A bar graph showing the percentage compliance with each of the core ERAS protocol elements in the ERAS group.

Primary Outcome: Length of Hospital Stay: The median length of hospital stay (LOH) was significantly shorter in the ERAS group (5 days, IQR 3-7 days) compared to the control group (8 days, IQR 6-11 days) (Mann-Whitney U test, $p<0.001$) (Figure 2). The mean LOH was also significantly shorter in the ERAS group (5.6±2.1 days vs. 8.3±3.5 days, $p<0.001$).

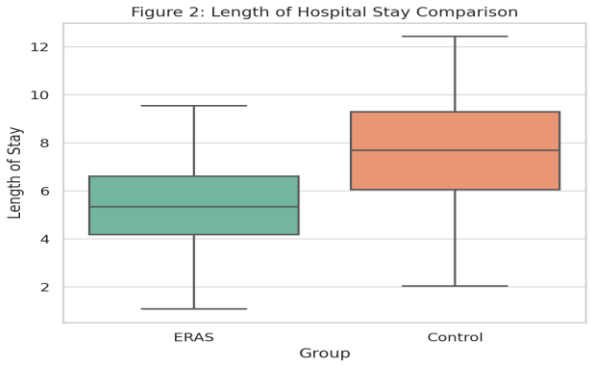

Figure No.2: A box plot demonstrates a shorter median hospital stay in ERAS groups.

Secondary Outcomes: Complications after surgery occurred significantly less frequently in the enhanced recovery group (16/75, 21.3%) compared to the control group (28/75, 37.3%) ($\chi2=5.37$, $p=0.029$) (Table 2).

Return of Bowel Function: Patients in the enhanced recovery group experienced an earlier return of bowel function (mean 2.8±0.9 days) compared to the control group (mean 4.1±1.3 days) ($t = -6.34$, $p<0.001$) (Figure 3).

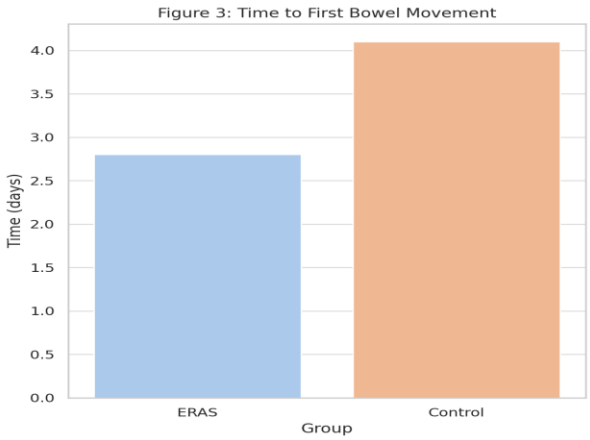

Figure No.3: A bar graph comparing the mean time to first bowel movement (in days) between the ERAS group and the control group.

Postoperative Pain Scores: Pain scores (VAS) were comparable between the groups at 6, 12, and 24 hours

postoperatively (p>0.05). However, from postoperative day 2 until discharge, pain scores were significantly lower in the ERAS group (Figure 4).

Table No.2: Postoperative Complications

Complication	ERAS Group (n=75), n (%)	Control Group (n=75), n (%)	p-value
Overall Complications (Any)	16 (21.3)	28 (37.3)	0.029*
Surgical Site Infection	4 (5.3)	11 (14.7)	0.048*
Postoperative Ileus	3 (4.0)	9 (12.0)	0.065
Pneumonia	2 (2.7)	4 (5.3)	0.432
Urinary Tract Infection	3 (4.0)	2 (2.7)	0.621
Deep Vein Thrombosis/Pulmonary Embolism	1 (1.3)	2 (2.7)	0.559

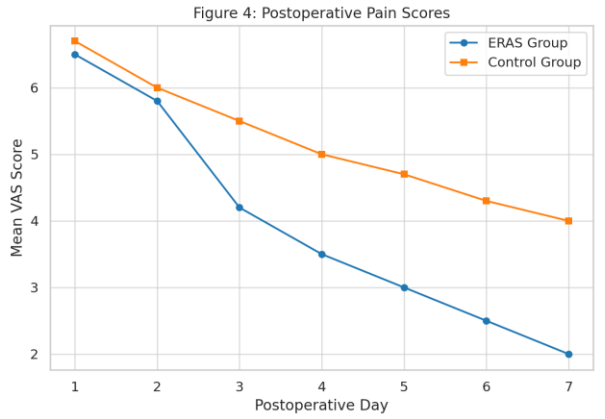

Figure No. 4: Line graph displaying daily postoperative pain scores (VAS) for both groups.

The 30-day readmission rate was 6.7% (5/75) in the ERAS group and 13.3% (10/75) in the control group, but this difference was not statistically significant ($\chi 2=2.15$, p=0.178).

DISCUSSION

This prospective study demonstrates that a tailored ERAS protocol can be feasibly implemented in emergency general surgery in resource limited environment and is associated with meaningful improvements in clinical outcomes. Patients managed under the ERAS pathway experienced a significantly shorter hospital stay, lower rates of postoperative complications, particularly surgical site infections and ileus, and faster return of bowel function. Additionally, pain scores were lower from the second postoperative day onward, likely reflecting the effectiveness of multimodal analgesia.

The protocol's 78% compliance rate highlights the feasibility of implementing ERAS principles even in the unpredictable context of emergency surgery. Although full adherence to all components can be challenging, our findings suggest that partial implementation still yields substantial benefits[3,10].

Reduced length of stay not only enhances patient recovery and satisfaction but also has important implications for hospital efficiency and resource allocation[8,9]. Likewise, the decreased complication rate supports the role of ERAS in mitigating surgical risk, particularly for infections and ileus, which are common drivers of morbidity and prolonged hospitalization.[11,12]

The trend toward lower 30-day readmission rates, although not statistically significant in this study, warrants further investigation in larger cohorts. Previous studies have similarly reported the benefits of ERAS in emergency and geriatric populations, reinforcing its applicability beyond elective surgery.[13]

Consistent with prior literature, our results confirm that ERAS protocols contribute to improved postoperative recovery by reducing complications, accelerating gastrointestinal function, and minimizing pain.[2] The success of these programs depends on coordinated multidisciplinary efforts, including surgeons, anesthesiologists, nurses, and physiotherapists and on adherence to protocol elements, which has been shown to correlate with better outcomes.

Standardized outcome reporting, such as through the Clavien-Dindo classification[14], further enhances the comparability of ERAS studies and supports ongoing quality improvement. Moreover, economic evaluations increasingly show that ERAS implementation is cost-effective, largely through reduced complications and shorter hospital stays. [8]

Although some endpoints, such as readmission rates, remain inconsistently significant across studies, the overall evidence supports the broader adoption of ERAS protocols in emergency general surgery[15]. Future multicenter randomized controlled trials are needed to further validate these findings and to refine ERAS strategies for diverse emergency surgical populations.

Limitations: This single-center prospective observational study with a historical control group is subject to potential biases, including unmeasured confounders and temporal changes unrelated to ERAS implementation. Applying ERAS protocols in low and middle income countries can be difficult, as healthcare settings often differ widely in terms of available resources. To make these protocols truly effective, more research is needed to understand how they can be adapted to fit the realities of resource limited environments. A randomized controlled trial (RCT) would provide more robust evidence.

Implications for Practice: Findings support the integration of ERAS protocols into emergency general surgery (EGS), aligning with international guidelines. Institutions should adapt ERAS bundles for emergency settings. Future studies should focus on multicenter RCTs and long-term outcomes.

CONCLUSION

Implementation of a tailored ERAS protocol in emergency general surgery within an LMIC context is feasible and associated with improved clinical outcomes, including reduced hospital stay and postoperative complications. These results advocate for broader ERAS adoption in EGS to enhance recovery and resource efficiency. Future multicenter RCTs are needed to validate these findings and refine ERAS strategies for diverse populations. Standardized outcome reporting, such as using the Clavien-Dindo classification, is essential for future research.

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Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Muhammad Munir Memon, Faiza Riaz Malik
Drafting or Revising Critically:	Muhammad Munir Memon, Faiza Riaz Malik
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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