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EFFECTIVENESS OF ENHANCED RECOVERY AFTER SURGERY (ERAS) PROTOCOL IN EMERGENCY GASTROINTESTINAL SURGERIES: A PROSPECTIVE COMPARATIVE STUDY

General Surgery

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ABSTRACT

Background: Emergency laparotomy is a high-stakes surgical procedure frequently associated with significant physiological derangement and elevated morbidity and mortality rates, historically reaching as high as 30%. While Enhanced Recovery After Surgery (ERAS) protocols have demonstrably improved outcomes in elective surgical settings, their application in the emergency context remains insufficiently explored owing to the inherent challenges of acute illness, physiological instability, and time constraints. **Methods:** A prospective experimental study was conducted on 200 patients: randomized into an ERAS group (n=100) and a Conventional management group (n=100). Primary endpoints included length of hospital stay (LOS), functional recovery milestones (time to ambulation, return of bowel function), and the incidence of postoperative complications. Secondary endpoints included drains removal timelines, diet progression, 30-day readmission rates, and re-exploration rates. **Results:** The ERAS group demonstrated significantly earlier ambulation (mean 1.73 vs. 2.37 days; $p<0.01$) and faster return of bowel function (first flatus: 3.01 vs. 3.44 days; $p=0.04$; first stool: 4.22 vs. 4.67 days; $p=0.02$). Median LOS was significantly reduced in the ERAS group (8.78 vs. 10.69 days; $p<0.01$). Diet progression was accelerated across all stages (sips: 3.10 vs. 4.20 days; soft diet: 4.70 vs. 6.09 days; full diet: 6.38 vs. 8.14 days; all $p<0.01$). No statistically significant differences were observed in 30-day mortality (7% vs. 8.5%; $p=0.34$) or readmission and re-exploration rates (6.5% in both groups). **Conclusion:** Implementation of adapted ERAS protocols in emergency gastrointestinal surgery is both feasible and safe, conferring substantial benefits in terms of accelerated functional recovery, reduced hospital length of stay, and decreased pulmonary morbidity, without compromising patient safety. These findings support the broader adoption of ERAS principles in the emergency surgical setting.

KEYWORDS

Enhanced Recovery After Surgery; Emergency Laparotomy; Perioperative Care; Gastrointestinal Surgery; Fast-track Surgery

INTRODUCTION

The term "emergency laparotomy" refers to the surgical exploration of the acute abdomen for a spectrum of life-threatening conditions, most commonly intestinal obstruction, perforation, ischemia, and generalized peritonitis. These conditions represent an acute, non-elective threat to life and necessitate definitive surgical source control, typically within 24 hours of presentation. Patients undergoing emergency laparotomy are frequently older, frail, and present with significant physiological derangement, including systemic inflammatory response syndrome (SIRS) or septic shock. Historically, standardized perioperative care pathways for emergency laparotomy have been inadequate, contributing to morbidity and mortality rates as high as 30% [1,2]. Unlike elective surgical procedures, emergency surgery significantly accentuates the surgical stress response, precipitating an exaggerated catabolic state and insulin resistance, both of which are key drivers of prolonged recovery and increased postoperative complications.

In response to the imperative to improve surgical outcomes, Enhanced Recovery After Surgery (ERAS) protocols -- also termed "fast-track" protocols -- were developed. Pioneered by Dr. Henrik Kehlet, ERAS constitutes a multimodal, evidence-based care pathway specifically designed to attenuate metabolic stress, prevent fluid overload, and facilitate a more rapid return to baseline functional capacity [3]. While ERAS protocols now possess an extensive evidence base demonstrating their effectiveness in elective surgical procedures across multiple specialties, their application in the emergency setting remains a critical research gap [4].

A primary challenge identified in the literature is that despite the proven benefits of ERAS in elective surgery, its application and effectiveness in emergency settings -- particularly for complex, high-risk procedures such as emergency laparotomy -- have been less extensively studied [4,5]. This scarcity of dedicated evidence is rooted in historical skepticism; the assumption prevailed that the acutely unwell state of patients undergoing emergency surgery rendered them unable to benefit from, or tolerate, the core principles of ERAS protocols. Furthermore, the inherent time constraints and physiological instability characteristic of emergency presentations pose significant logistical and clinical challenges to implementing a comprehensive care pathway.

However, recent guidelines emphasize that while certain preoperative elements (e.g., carbohydrate loading) must be omitted in emergencies owing to aspiration risk, core ERAS components -- including goal-directed fluid therapy, multimodal analgesia, early mobilization, and expedited device removal -- remain highly applicable and effective [4]. Because conventional, non-standardized care has proven insufficient to mitigate the surgical stress response in these high-risk patients, there is a compelling need to explore the feasibility and effectiveness of adapted ERAS protocols. This study aims to address this gap by providing prospective, real-world evidence evaluating how a structured ERAS-based approach can improve outcomes in a heterogeneous emergency gastrointestinal surgery population.

MATERIALS AND METHODS

This prospective experimental study was conducted at the Department of General Surgery, Zydus Medical College and Hospital, Dahod, India, over a two-year period from October 2023 to September 2025. The study protocol was reviewed and approved by the Institutional Ethics Committee (IEC No.: 050/ZMCH/IEC/050(12)-2024).

A total of 200 patients presenting to the emergency or outpatient department with symptoms of acute abdomen (perforation, obstruction, peritonitis) were enrolled using purposive random sampling and allocated into two groups: an ERAS group (n=100) and a Conventional management group (n=100).

Aim and Objectives: To study the effectiveness of "Enhanced Recovery After Surgery" (ERAS) protocol compared with the conventional way of management of patients undergoing emergency gastrointestinal surgeries. Assess the validity and reliability of ERAS Protocol as a predictive tool for outcomes in patients undergoing gastrointestinal surgeries. Investigate the correlation between ERAS Protocol and clinical parameters such as morbidity, mortality, complications, length of hospital stay, post-operative recovery and

cost-effectiveness in patients undergoing gastrointestinal surgeries.
Inclusion criteria: Patients aged 18 years and above undergoing emergency gastrointestinal surgery.

Exclusion criteria: Patients with major trauma or associated injuries to other organ systems, pregnant females, patients receiving chronic corticosteroid therapy, patients in immunocompromised states, and patients requiring more than two exploratory laparotomies.

Perioperative Protocols
ERAS Protocol:
(a) Preoperative Management: Rapid physiological assessment and triage using early warning scores (NEWS2/MEWS) to trigger senior clinician review. Prompt sepsis screening with early administration of broad-spectrum antibiotics (within 1 hour for identified sepsis) and goal-directed fluid resuscitation targeting euvolemia. Preoperative carbohydrate loading was omitted owing to aspiration risk. Nasogastric tubes were employed selectively for patients with obstruction or high aspiration risk. Focused patient counseling regarding the procedure and anticipated recovery trajectory was provided.

(b) Intraoperative Management: Utilization of short-acting anesthetic agents with depth-of-anesthesia and neuromuscular monitoring. Lung-protective ventilation was strictly followed (tidal volumes 6-8 mL/kg; PEEP 5-8 cmH2O). Normothermia was maintained using active warming devices throughout the procedure. Goal-directed fluid therapy with balanced crystalloid solutions was employed, with vasopressor support for persistent vasoplegic shock to minimize interstitial edema. Prophylactic drains were avoided unless indicated by uncontrolled contamination or anastomotic concerns. Opioid-sparing multimodal analgesia was implemented, including regional techniques such as Transversus Abdominis Plane (TAP) blocks and local wound infiltration.

(c) Postoperative Management: Ambulation and mobilization were prioritized within the first 24 hours. Early oral intake was initiated (sips on postoperative day 0-1) with stepwise progression to soft and full diets as tolerated. Expedited removal of urinary catheters and nasogastric tubes within 24-72 hours. Abdominal drains were removed promptly based on output volume and character. Multimodal, opioid-sparing analgesia (paracetamol, tramadol) was continued postoperatively. Discharge criteria included tolerance of a full solid diet, passage of flatus or feces, pain controlled with oral medications, and independent mobility.

Conventional Protocol: Patients in the conventional group received standard perioperative care without the structured ERAS pathway. This included routine nasogastric tube insertion, conventional fluid management, standard analgesia protocols, and traditional criteria for diet initiation, mobilization, and device removal.

Study Endpoints
Primary Endpoints: (i) Length of hospital stay (LOS), defined as total days from admission to discharge; (ii) Morbidity and complications, including surgical site infections (SSI), paralytic ileus, and pulmonary complications (atelectasis, pneumonia, ARDS); (iii) 30-day mortality.
Secondary Endpoints: (i) Functional recovery milestones: time to first passage of flatus and stool, time to initiation and tolerance of sips, soft diet, and full diet, and day of first independent ambulation; (ii) Device and intervention metrics: duration of nasogastric tube, urinary catheter, and abdominal drain placement, and requirement for supplementary analgesia or nasogastric tube reinsertion; (iii) Systemic and safety outcomes: 30-day readmission and re-exploration rates.

Statistical Analysis
Data were analyzed using IBM SPSS Statistics version 29 and Microsoft Excel. Continuous variables were expressed as mean +/- standard deviation and compared using independent samples t-tests. Categorical variables were expressed as frequencies and percentages and assessed using Chi-square tests. A p-value of <0.05 was considered statistically significant.

RESULTS
Demographic and Clinical Characteristics:
The study population had a mean age of 56.87 years, with the highest concentration (38%) in the 41- 60 year age group. Male patients predominated, comprising 78.5% of the cohort.

Presenting complaints: Abdominal pain (100%), followed by vomiting (36.5%) and constipation (33%).

The primary operative diagnoses were perforation (68.5%), peritonitis (59.5%), and intestinal obstruction (20.5%). The two groups were comparable in terms of baseline demographic and clinical characteristics.

Functional Recovery Milestones
The implementation of the ERAS protocol resulted in a statistically significant acceleration across all functional recovery parameters:

1. Ambulation: 12.5% of ERAS patients achieved ambulation on postoperative day 1, compared with only 2% in the conventional group. The mean day of first ambulation was 1.73 +/- 0.58 days in the ERAS group versus 2.37 +/- 0.72 days in the conventional group ($p<0.01$).

2. Diet Progression: Initiation of oral sips was significantly earlier in the ERAS group (3.10 vs. 4.20 days; $p<0.01$), as was progression to soft diet (4.70 vs. 6.09 days; $p<0.01$) and full diet (6.38 vs. 8.14 days; $p<0.01$).

3. Bowel Function: Return of flatus occurred significantly earlier in the ERAS group (3.01 +/- 1.12 vs. 3.44 +/- 1.38 days; $p=0.04$). First passage of stool was similarly accelerated (4.22 +/- 1.45 vs. 4.67 +/- 1.58 days; $p=0.02$).

Device and Tube Removal:
1. Nasogastric Tube: In the ERAS group, 4.5% of nasogastric tubes were removed on postoperative day 1 and 24% on day 2, whereas no tubes were removed this early in the conventional group.

2. Urinary Catheter: 10% of ERAS patients had their urinary catheters removed on postoperative day 1, compared with 0% in the conventional group.

3. Abdominal Drains: Morrison's pouch drain was removed significantly earlier in the ERAS group (4.05 vs. 6.63 days; $p<0.01$).

Complications and Mortality
Overall, 30-day mortality was slightly lower in the ERAS group (7% vs. 8.5%), though this difference did not achieve statistical significance ($p=0.34$). Among specific morbidities: Pulmonary Complications: The ERAS group experienced a significantly lower incidence of pulmonary complications (9% vs. 21%; $p=0.01$), representing a greater than 50% relative risk reduction. Surgical Site Infection: SSI rates were comparable between groups (10.5% in ERAS vs. 11% in conventional). Readmission and Re-exploration: The 30-day readmission and re-exploration rates were equivalent at 6.5% in both groups, confirming that accelerated recovery did not compromise patient safety. Length of Hospital Stay: The mean LOS was significantly reduced in the ERAS group (8.78 +/- 3.21 vs. 10.69 +/- 4.05 days; $p<0.01$), representing a reduction of approximately 1.9 days.

DISCUSSION
Impact on Hospital Length of Stay and Resource Utilization: The significant reduction in hospital LOS observed in this study (mean reduction of approximately 1.9 days) is consistent with international findings. Sharma et al. (2021) reported a median LOS of 4 days in the ERAS group compared with 7 days in the conventional care group in their randomized controlled trial of ERAS in emergency laparotomy [5]. This reduction is attributable to the synergistic effect of early mobilization, accelerated feeding, and the expedited removal of invasive devices, which collectively reduce hospital-acquired complications and resource utilization. The clinical and economic implications of such reductions in a resource-constrained setting are substantial.

Bowel Function and Nutritional Recovery: Early enteral nutrition is a cornerstone of the ERAS strategy. The finding that ERAS patients resumed oral intake approximately 1.1 days earlier than conventionally managed patients ($p<0.01$) is consistent with the meta-analysis by Hajibandeh et al. (2020), which concluded that ERAS protocols facilitate earlier resumption of oral feeds and faster return of bowel function in emergency abdominal surgery [6]. This is physiologically significant, as early enteral feeding promotes gut

barrier integrity, attenuates the systemic inflammatory response, and stimulates gut motility, thereby reducing the incidence of paralytic ileus.

Morbidity and Patient Safety: The finding that pulmonary complications were reduced by more than 50% in the ERAS group (9% vs. 21%; p=0.01) underscores the critical importance of early mobilization and lung-protective ventilation strategies in the high-risk emergency laparotomy population. Pulmonary complications represent a major contributor to postoperative morbidity and prolonged hospitalization; their reduction constitutes a clinically meaningful outcome. Importantly, the absence of a significant increase in 30-day readmission or re-exploration rates (6.5% in both groups) confirms that accelerated discharge does not compromise patient safety. These findings are corroborated by the multicenter study by Shang et al., which demonstrated fewer complications and lower readmission rates in ERAS cohorts without increased mortality [7].

Challenges in Implementation: While the benefits of ERAS in emergency settings are evident, successful implementation demands high-fidelity multidisciplinary coordination. Key barriers identified in this study include the logistical difficulty of ensuring timely antibiotic administration within the recommended window, the unpredictable nature of emergency department workloads, and the challenge of achieving consistent protocol adherence across all clinical staff. Sustained success is contingent upon the standardization of order sets and checklists, the provision of ongoing clinical education, and the availability of senior decision-makers on a continuous basis.

CONCLUSION

The implementation of an adapted ERAS protocol in emergency gastrointestinal surgery represents a significant advancement in perioperative care. This prospective comparative study provides robust evidence that ERAS can be safely and effectively applied to high-risk emergency surgical patients, yielding the following clinically significant outcomes: (i) accelerated functional recovery, including earlier ambulation and return of bowel motility; (ii) significant reduction in hospital length of stay by approximately 1.9 days; and (iii) a greater than 50% reduction in the incidence of pulmonary complications.

Despite the clinical heterogeneity inherent to the emergency surgical population, adapted ERAS pathways offer a viable, evidence-based model for patient-centered perioperative care that optimizes recovery outcomes and reduces healthcare resource utilization. Future research should prioritize large-scale, multicenter randomized controlled trials to further refine and validate these protocols for specific high-risk subgroups, including the frail elderly and patients with significant comorbidity burden.

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