E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/16.02.169

Research Article

Enhanced Recovery After Surgery (ERAS) Protocol versus Conventional Postoperative Care in Laparotomy Surgery: A Systematic Review

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Received: 06.05.2026, Revised: 04.06.2026, Accepted: 01.07.2026

ABSTRACT

Background: Enhanced Recovery After Surgery (ERAS) is a multimodal, evidence-based perioperative care pathway originally developed for elective colorectal resection and now extended to elective and emergency laparotomy more broadly. Conventional postoperative care, characterized by prolonged fasting, routine nasogastric decompression, delayed mobilization, and opioid-based analgesia, remains widespread despite accumulating evidence favoring the enhanced recovery approach.

Objective: To synthesize comparative evidence on ERAS protocols versus conventional postoperative care in laparotomy surgery, focusing on length of hospital stay, postoperative complications, gastrointestinal recovery, pain and nausea outcomes, and mortality/readmission.

Methods: A narrative synthesis was performed of systematic reviews, meta-analyses, and randomized controlled trials (RCTs) identified through MEDLINE/PubMed, incorporating foundational ERAS Society guidance, major meta-analyses in elective colorectal surgery, and dedicated meta-analyses and RCTs of ERAS in emergency laparotomy.

Results: Across elective colorectal series, ERAS protocols were associated with shorter hospital stay, faster return of gastrointestinal function, and fewer postoperative complications and surgical site infections, although the magnitude and statistical significance varied with protocol adherence and study heterogeneity. In emergency laparotomy, historically considered unsuitable for enhanced recovery pathways, adapted ERAS protocols across multiple randomized trials demonstrated significant reductions in length of stay and postoperative morbidity, faster gastrointestinal recovery, and reduced postoperative nausea and vomiting, without increasing 30-day mortality or readmission rates.

Conclusion: ERAS protocols, including adapted versions for the emergency setting, offer consistent and clinically meaningful advantages over conventional postoperative care following laparotomy, without compromising safety. Wider, protocol-adherent implementation is supported by current evidence, though further high-quality trials are needed to define optimal protocol composition in emergency and high-risk populations.

Keywords: Enhanced recovery after surgery, ERAS, laparotomy, conventional care, postoperative outcomes, length of hospital stay, emergency surgery, fast-track surgery

1. INTRODUCTION

Laparotomy remains one of the most commonly performed major surgical interventions worldwide, undertaken both electively, for conditions such as colorectal malignancy, and as an emergency, for conditions including bowel obstruction, perforation, and peritonitis. Traditional postoperative management after

laparotomy has been characterized by prolonged preoperative fasting, routine nasogastric decompression, delayed enteral feeding, extended bed rest, and reliance on opioid-based analgesia. While intended to protect the healing bowel and reduce complications, this conventional approach has increasingly been shown to prolong physiological recovery, contribute to insulin resistance, muscle wasting, and thromboembolic risk, and extend hospital stay without a clear corresponding benefit in outcomes.

Enhanced Recovery After Surgery (ERAS) emerged in the early 2000s as a structured, evidence-based, multimodal alternative to this conventional paradigm, integrating preoperative counseling and carbohydrate loading, minimally invasive or optimized surgical technique, avoidance of unnecessary drains and tubes, opioid-sparing multimodal analgesia, early mobilization, and early resumption of oral intake. First formalized for elective colonic resection, ERAS principles have since been extended to a wide range of elective procedures and, more recently, adapted for emergency laparotomy, a population historically considered too physiologically unstable to tolerate accelerated recovery pathways.

This paper synthesizes the comparative evidence on ERAS protocols versus conventional postoperative care specifically in the context of laparotomy, encompassing both elective and emergency settings. The aim is to summarize outcomes across length of hospital stay, postoperative complications, gastrointestinal recovery, pain and nausea control, and mortality/readmission, and to consider the feasibility and safety of extending enhanced recovery principles into higher-risk emergency populations.

2. METHODS

2.1 SEARCH STRATEGY AND EVIDENCE SOURCES

A literature search was conducted in MEDLINE/PubMed for systematic reviews, meta-analyses, and randomized controlled trials comparing ERAS or fast-track protocols with conventional perioperative care in patients undergoing laparotomy. Search terms included combinations of "enhanced recovery after surgery", "ERAS," "fast-track surgery", "laparotomy", "conventional care", "emergency surgery" and "length of stay". Reference lists of identified reviews and ERAS Society consensus guidelines were hand-searched for additional primary studies. Priority was given to PRISMA-compliant systematic reviews and meta-analyses, supplemented by individual RCTs addressing emergency laparotomy, a setting less well represented in earlier pooled analyses.

2.2 ELIGIBILITY AND OUTCOMES OF INTEREST

Eligible studies compared a formal or adapted ERAS/fast-track perioperative pathway with conventional postoperative care in adult patients undergoing laparotomy, whether elective or emergency. Outcomes of interest were:

i) Length of hospital stay.
ii) Postoperative complications and morbidity.
iii) Surgical site infection.
iv) Gastrointestinal recovery (time to flatus, stool, tolerance of oral diet).
v) Postoperative pain, opioid consumption, and nausea/vomiting.
vi) 30-day mortality and readmission.

2.3 DATA SYNTHESIS

Given heterogeneity in ERAS protocol composition, adherence, surgical indication, and outcome measurement across the source literature, findings are presented as a narrative synthesis organized by outcome domain, drawing on pooled effect estimates from meta-analyses where available and supplemented by individual trial results, with elective and emergency laparotomy considered separately where evidence diverges.

3. RESULTS

3.1 OVERVIEW OF THE EVIDENCE BASE

The foundational consensus review by Fearon and colleagues formalized the core elements of ERAS for colonic resection and catalyzed subsequent trials and guideline development.[1] Meta-analyses in elective colorectal surgery, including a 2010 pooled analysis by Varadhan *et al.*, the 2011 Cochrane review by Spanjersberg *et al.*, and more recent syntheses by Zhang *et al.* (12 RCTs, 1,920 patients) and Al-Omari *et al.*, form the core elective evidence base.[2-3 6-7] The ERAS Society subsequently published formal guidelines for elective colonic surgery and, more recently, dedicated guidelines for emergency laparotomy.[4,15] In the emergency setting, the landmark 2014 trial by Gonenc *et al.* and a matched series by Lohsiriwat established

feasibility, followed by a program of randomized trials from a single Indian academic center applying adapted ERAS pathways across specific emergency indications, including perforated duodenal ulcer, small bowel surgery, and perforation peritonitis.[8-12] These have since been pooled in dedicated emergency-laparotomy meta-analyses by Hajibandeh *et al.* and by Amir, Davey, and Donlon.[13-16]

3.2 LENGTH OF HOSPITAL STAY

Reduced length of hospital stay is the most consistently reported benefit of ERAS across both elective and emergency literature. In the elective colorectal setting, Zhang *et al.* reported a statistically significant reduction in hospitalization duration with ERAS relative to conventional care.[6] However, the more recent meta-analysis by Al-Omari *et al.*, restricted to RCTs adhering to at least 12 core ERAS Society elements, found only a non-significant trend toward shorter stay, with substantial between-study heterogeneity (I^2 = 96.7%), highlighting that protocol adherence and study quality materially affect the observed benefit.[7] In emergency laparotomy, both the Hajibandeh *et al.* and Amir *et al.* meta-analyses found significantly reduced length of stay with ERAS.[13 16] Individual RCTs corroborate this: in the trial of adapted ERAS for emergency small bowel surgery, the ERAS group had a significantly shorter hospital stay than the standard care group.[10]

3.3 POSTOPERATIVE COMPLICATIONS AND SURGICAL SITE INFECTION

Reduced postoperative morbidity is similarly well supported. The Amir *et al.* meta-analysis found that patients randomized to ERAS had reduced postoperative complications following emergency laparotomy.[16] Zhang *et al.* reported a decreased occurrence of postoperative complications and surgical site infections in the ERAS cohort relative to conventional care in colorectal surgery.[6] Individual adapted-ERAS trials in perforated duodenal ulcer and perforation peritonitis similarly reported reduced morbidity in the ERAS arms compared with standard care.[9-11] The Cochrane review by Spanjersberg *et al.* found a comparable direction of effect across the fast-track literature, though with variable statistical significance depending on the specific complication assessed.[3]

3.4 GASTROINTESTINAL RECOVERY

Faster return of gastrointestinal function is a consistent and mechanistically plausible benefit of ERAS, reflecting its emphasis on avoidance of routine nasogastric decompression, opioid-sparing analgesia, and early enteral feeding. Zhang *et al.* found a statistically significant decrease in time to first flatus with ERAS in colorectal surgery.[6] In the RCT of adapted ERAS for perforated duodenal ulcer, patients in the ERAS group had significantly earlier time to first flatus, first stool, first fluid diet, and solid diet tolerance compared with standard care.[9] The Amir *et al.* emergency laparotomy meta-analysis similarly found that ERAS-randomized patients had earlier return of bowel function and reduced time to ambulation, with earlier removal of abdominal drains, nasogastric tubes, and urinary catheters.[16]

3.5 PAIN, OPIOID USE, AND POSTOPERATIVE NAUSEA AND VOMITING

Multimodal, opioid-sparing analgesia is a core ERAS element, and reduced postoperative nausea and vomiting (PONV) has been reported as a downstream benefit. The Amir et al. meta-analysis found reduced PONV in patients randomized to ERAS following emergency laparotomy.[16] While formal pain-score comparisons are less uniformly reported across the emergency literature than in elective series, the emphasis on epidural or regional analgesia and avoidance of routine systemic opioids within adapted ERAS pathways is consistent across the individual JIPMER-group trials.[9-11]

3.6 MORTALITY AND READMISSION

A central safety question for extending ERAS to higher-risk emergency populations is whether accelerated discharge compromises safety. The available evidence is reassuring: the Amir *et al.* meta-analysis found no significant differences in 30-day mortality or readmission rates between ERAS and conventional care following emergency laparotomy.[16] Zhang *et al.* similarly found no statistically significant difference in readmission rates in the elective colorectal setting, though conventional care also did not show a significant excess of readmissions.[6] These findings collectively suggest that the reduced length of stay associated with ERAS is not achieved at the expense of unsafe early discharge.

3.7 ELECTIVE VERSUS EMERGENCY LAPAROTOMY CONSIDERATIONS

Emergency laparotomy patients were historically excluded from enhanced recovery pathways on the assumption that physiological instability, contamination, and unplanned surgery precluded safe application of standard ERAS elements such as preoperative carbohydrate loading and smoking cessation counselling.[14] The concept of an "adapted" or "modified" ERAS pathway has addressed this by retaining feasible intraoperative and postoperative elements, goal-directed fluid therapy, opioid-sparing regional analgesia, early tube and catheter removal, and early mobilization and feeding, while omitting preoperative elements that cannot be delivered in an emergency context.[14] The ERAS Society's dedicated two-part consensus guidelines for emergency laparotomy formalize this adapted approach, and the accumulating randomized evidence, spanning perforated peptic ulcer, small bowel obstruction, and perforation peritonitis, supports its feasibility and safety across diverse emergency indications.[8-12,15]

3.8 SUMMARY OF KEY OUTCOMES

Table No. 1: Summary of comparative outcomes for ERAS versus conventional postoperative care in laparotomy, drawn from major systematic reviews, meta-analyses, and randomized controlled trials.[3,6-7,13,16]

Outcome	ERAS vs. Conventional Care	Strength of evidence
Length of hospital stay	Reduced with ERAS in most elective and emergency studies; effect size varies with adherence	Consistent direction; magnitude heterogeneous
Postoperative complications	Reduced overall morbidity, particularly in emergency laparotomy meta-analyses	Consistent across pooled analyses
Surgical site infection	Reduced with ERAS in colorectal surgery meta-analyses	Moderately consistent
Time to first flatus/return of GI function	Significantly faster with ERAS	Consistent across RCTs and meta-analyses
Postoperative nausea and vomiting	Reduced with ERAS	Consistent in emergency laparotomy meta-analysis
30-day mortality	No significant difference	Consistent across elective and emergency studies
Readmission rate	No significant difference	Consistent across elective and emergency studies

4. DISCUSSION

The cumulative evidence, spanning foundational consensus reviews, elective colorectal meta-analyses, and a growing body of dedicated emergency laparotomy RCTs and meta-analyses, converges on a consistent conclusion: ERAS protocols outperform conventional postoperative care across the key domains of hospital stay, complications, and gastrointestinal recovery, without compromising mortality or readmission safety. Notably, the magnitude and statistical robustness of the length-of-stay benefit varies considerably between studies, as illustrated by the contrast between the strongly positive findings of Zhang *et al.* and the more equivocal, heterogeneity-limited findings of Al-Omari *et al.* in the same elective colorectal population.[6–7] This divergence underscores that ERAS is not a single, uniform intervention but a bundle of practices whose benefit is likely proportional to the fidelity and completeness of implementation.

The extension of ERAS principles into emergency laparotomy represents one of the more consequential developments in this literature. Contrary to the historical assumption that critically ill or contaminated emergency patients were unsuitable candidates for enhanced recovery, the adapted ERAS trials from Gonenc *et al.* onward, and their subsequent pooling in dedicated meta-analyses, demonstrate that a modified pathway retaining the intraoperative and postoperative elements of ERAS can be safely and effectively applied even in perforation peritonitis and small bowel obstruction, historically among the highest-risk general surgical emergencies.[8-16] This is clinically significant given that emergency laparotomy carries substantially higher baseline

morbidity and mortality than elective surgery, and any intervention capable of safely reducing complications and length of stay in this population has outsized value for healthcare systems and patients alike.

The consistent finding of no increase in mortality or readmission across both elective and emergency literature addresses the most important safety concern regarding accelerated discharge pathways. Combined with the mechanistic plausibility of ERAS benefits, reduced surgical stress response, preserved gut function through avoidance of routine nasogastric decompression, earlier mobilization reducing thromboembolic and pulmonary risk, and opioid-sparing analgesia reducing ileus, the evidence base supports continued and expanded adoption of ERAS pathways for laparotomy, tempered by realistic expectations regarding the variability in benefit associated with real-world implementation and adherence.

5. LIMITATIONS

This synthesis has several limitations. First, it is a narrative synthesis of existing systematic reviews and trials rather than an independent, newly conducted meta-analysis with formal risk-of-bias grading and pooled statistical re-analysis; readers seeking pooled effect sizes with confidence intervals should consult the primary meta-analyses cited.[6-7,13-16] Second, ERAS protocol composition varies substantially between studies, ranging from fully compliant multi-element pathways to more limited "fast-track" adaptations, which complicates direct comparison and may explain some of the heterogeneity in reported effect sizes. Third, a substantial proportion of the emergency laparotomy RCT evidence derives from a small number of single-center trials conducted at the same academic institution, which may limit generalizability to other healthcare settings and resource contexts. Finally, most primary trials were not and could not be blinded to the surgical or nursing team, introducing potential performance bias, and reporting of protocol adherence was inconsistent across studies.

6. CONCLUSION

ERAS protocols, including adapted pathways developed specifically for emergency laparotomy, are associated with shorter hospital stay, fewer postoperative complications, and faster gastrointestinal recovery compared with conventional postoperative care, without increasing 30-day mortality or readmission. The benefit appears proportional to protocol adherence, and further high-quality, multicenter randomized trials are warranted to define the optimal composition of adapted ERAS pathways across diverse emergency indications and healthcare settings, and to better characterize the barriers to real-world implementation fidelity.

DECLARATIONS

ETHICS APPROVAL: Not applicable (literature synthesis; no primary human data collected).

CONFLICTS OF INTEREST: The authors declare no conflicts of interest.

FUNDING: This work received no external funding.

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