



Impact of Enhanced Recovery After Surgery (ERAS) Protocols on Postoperative Outcomes in Major Surgical Procedures

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Abstract: **Background:** Enhanced Recovery After Surgery (ERAS) guidelines are evidence-based, interdisciplinary pathways of perioperative care aimed at reducing surgical stress, functional speed and recovery, and postoperative outcomes. Despite the extensive implementation of ERAS in the various fields of surgery, institutional outcomes assessment is necessary to determine actual performance. **Objective:** The purpose of the study is to measure the effect of ERAS implementation on postoperative outcomes of major elective surgery cases in one of the tertiary care hospitals in Pakistan. **Methods:** The study was a retrospective comparative cohort study that was carried out in 2022-2024 (January-December). Included were adult patients who were undergoing major elective colorectal, hepatobiliary, pancreatic, and gynecologic oncologic surgery. The patients were categorized into two groups including conventional perioperative care (pre-ERAS) and ERAS pathway management (post-implementation). The main results were length of hospital stay (LOS), general postoperative complications in 30 days, major complications (Clavien–Dindo $\geq$ III), and 30-day readmission. The secondary outcomes were postoperative opioid use (morphine milligram equivalents, MME), opioid first ambulation, opioid oral intake, postoperative nausea/vomiting, and patient-reported recovery outcomes. Multivariate logistic regression that controlled the age, ASA, BMI, and burden of comorbidities. **Results:** The number of patients was 268 (132 conventional care; 136 ERAS). There were similarities in the baseline demographic and clinical characteristics. Median LOS was reduced 7 days (conventional) to 5 days (ERAS) ($p < 0.001$). The total postoperative complications were greatly minimized (29.5% vs 18.4; $p = 0.032$). The major complications were also numerically less and statistically insignificant (9.1% vs 6.6%; $p = 0.41$). Thirty-day readmission rates were similar (6.8% vs 6.1%; $p = 0.84$). Postoperative opioid use decreased significantly (182 ± 46 MME vs 118 ± 39 MME; $p < 0.001$). Time to ambulation and oral intake were significantly shorter in the ERAS group ($p < 0.001$). Overall patient satisfaction and mobility confidence scores were significantly higher under ERAS care. On multivariable analysis, ERAS implementation independently reduced overall complications (adjusted OR 0.56; 95% CI 0.33–0.94; $p = 0.028$) and LOS ($\beta = -1.8$ days; $p < 0.001$), without increasing readmission risk. **Conclusion:** ERAS implementation significantly improves postoperative recovery following major elective surgery by reducing length of stay, complications, and opioid exposure without increasing readmissions. These findings support structured, multidisciplinary perioperative pathways as a safe and effective model for modern surgical care.

Keywords: Enhanced Recovery After Surgery (ERAS); postoperative outcomes; length of hospital stay; surgical complications; 30-day readmission; multimodal analgesia; opioid-sparing strategies; perioperative care pathway. 2025

INTRODUCTION

Significant surgical operations are still linked with high nonoperative morbidity, long-time hospital, high-cost efforts in healthcare, and a slow recovery of normal operational capacity. Even though this has seen a lot of improvement in surgical, anesthesia and perioperative monitoring, postoperative recovery still remains to be affected by inconsistency in practice of perioperative care. Conventionally, perioperative care tended to comprise lengthy preoperative starvation, postoperative feeding, broad intravenous fluid use, and preoperative confinement as well as opioid-based analgesia. These methods are traditionally seen as protective, yet there is a growing body of work that they can be the cause of metabolic stress, slow gastrointestinal recovery, pulmonary complications, and functional rehabilitation impairment after surgery (1,2).

ERAS programs were created to manage these shortcomings by using standardized, multidisciplinary, evidence-based pathways of perioperative care. Originally used in colorectal surgery, ERAS strategies focus on minimizing the physiological stress reaction to surgical trauma in addition to facilitating rapid healing and normal physiological functioning. The main aspects of the ERAS pathways are preoperative education of the patient, reduction in the duration of fasting, selective carbohydrate loading, goal-oriented fluid therapy, multimodal opioid-sparing analgesia, early mobilization, and early enteral nutrition (3,4).

ERAS protocols have proliferated in various surgical fields such as hepatobiliary, pancreatic, gynecologic cancer, urology, thoracic, and heart surgery in the last 20 years. The growing evidence of these gains of postoperative recovery, decreased complications, and shorter length of stay in hospitals without jeopardizing patient safety has contributed to this growth (5,6). Much of success of the ERAS programs relies on multidisciplinary cooperation between surgeons, anesthesiologists, nursing staff, physiotherapists, and nutrition specialists that guarantee the regular implementation of the interventions of perioperative care (7).

A large number of systematic reviews and meta-analyses revealed that ERAS implementation has an important impact on the reduction of hospital length of stay, postoperative complications, and healthcare resources used. Moreover, ERAS pathways were also related to a decrease in opioid use and functional recovery of postoperative functions (8,9). The size of these benefits however differs in institutions based on the compliance to the elements of the protocols, patient risk profile and complexity of the surgery (10).

The relative importance of patient-centered recovery outcomes over the past few years has been growing in parallel with mainstream clinical indicators. Patient satisfaction, confidence in the ability to walk after surgery, and knowledge about postoperative instructions are only some of the measures, which help to get a glimpse of the overall quality of the recovery process and the interactions between patients and the healthcare system during the postoperative phase (11). ERAS implementation should be thus evaluated by institutions to determine actual performance and potential areas to improve the provision of perioperative care (12).

Based on this, the current research set out to measure the effects of ERAS implementation on postoperative clinical outcomes and patient-reported recovery following major elective surgical operations in a tertiary care center.

MATERIALS AND METHODS

Study Design and Setting

The research was a retrospective comparative cohort study carried out in a tertiary teaching hospital in the period between January 2022 and December 2024. Data were collected with the permission of an institutional ethical review.

Patient Selection

Inclusion criteria

- Age ≥ 18 years
- Significant elective colorectal, hepatobiliary, pancreatic, or gynecologic surgery.
- General anesthesia and inpatient hospitalization.

Exclusion criteria:

- Emergency surgery
- Minor/day-care procedures
- Postoperative direct ICU admission.
- Incomplete medical records

Patients were divided into:

- Traditional care group (pre-implementation of ERAS)
- ERAS group (following implementation in early 2023)
- ERAS Protocol Components

Standardized interventions at three phases were involved in the ERAS pathway:

Preoperative

- Systematic patient education.
- Lessened fasting (non-solid fluids up to surgery)
- Selective loading of carbohydrates.
- Maximization of comorbidities.

- Prevention of mechanical bowel preparation.

Intraoperative

- Goal-directed fluid therapy
- Normothermia maintenance
- Minimally invasive methods where possible.
- Multimodal opioid-sparing analgesia.
- Prevention of the use of long-acting sedatives.
- Discriminatory practices in the application of drains and nasogastric tubes.

Postoperative

- Timely mobilization (within 24 hrs.)
- Oral intake as early as tolerated.
- Planned non-opioid painkillers.
- Only opioids to use as breakthrough.
- Prophylaxis of nausea which is standardized.
- Early catheter removal
- Functional discharge criteria.
- The adherence was observed using perioperative checklists and multidisciplinary audits.

Primary Outcomes

- Length of hospital stay (LOS)
- Any complications on operations in the last 30 days
- Major complications (ClavienDindo 3 III or

above)

- 30-day readmission rate

Secondary Outcomes

- Total opioid consumption in the postoperative phase (MME).
- Hours to first ambulation.
- Hours before first oral intake.
- Postoperative nausea/vomiting
- Recovery scores patient-reported (5-point Likert scale).

Statistical Analysis

Independent t -test or Mann Whitney U test was used to analyze continuous variables. The comparison of categorical variables was done in chi-square or Fisher exact test.

Adjusted logistic regression multivariate with adjustment in age, ASA classification, BMI and comorbidity burden. The statistical significance was considered when p was below 0.05.

Ethical Considerations

The study was aligned with the ethical principles and the Declaration of Helsinki in the institution. No direct contact with the patient in data collection was present besides the provision of the surveys and identification of the patients was not included.

Results

Baseline Characteristics

There were 268 patients who were eligible to the study. Out of them, 132 patients were given the conventional perioperative care and 136 patients were administered under the ERAS protocol.

The two groups had similar baseline demographic and clinical features. No statistically significant differences were found in terms of age, sex distribution, ASA classification, comorbidities, or categories of surgical procedures, which proves that the baseline comparability is adequate.

Primary Outcomes

Length of Hospital Stay

ERAS group was observed to have a high number of hospital length of stay reduction. The median LOS of the conventional care group (7 days) fell to 5 days in the ERAS group ($p < 0.001$).

About 62 percent patients who received ERAS were discharged on or before postoperative day 5, versus 34 percent of conventional care cohort patients.

The overall Postoperative Complications.

30-day overall postoperative complications:

- 39 patients (29.5) in the traditional care group.
- 25 patients (18.4%) in the ERAS group

The difference between these was statistically significant ($p = 0.032$).

Postoperative ileus, pulmonary complications, surgical site infections and urinary retention were the most frequent complications.

Major Complications

Major complications (ClavienDindo 3 or more) were experienced in:

- 12 patients (9.1%) in the traditional group.
- 9 patients (6.6%) in the ERAS group

This difference was not significant ($p = 0.41$) even though it was numerically less in the ERAS cohort.

Thirty-Day Readmission

The groups had the same levels of thirty-day readmission:

- 6.8% in conventional care
- 6.1% in ERAS

The t-test was found not to be significant ($p = 0.84$).

Secondary Outcomes

Postoperative Opioid Consumption

The overall use of opioids after the operation was much lower in the ERAS group.

- Conventional care: 182 ± 46 MME
- ERAS group: 118 ± 39 MME

This would be a reduction in opioid use by approximately 35 percent ($p < 0.001$).

Early Mobilization

The median length of stay to first ambulation was reduced:

- Conventional care: 32 hours
- ERAS: 18 hours

($p < 0.001$)

Time to Oral Intake

The time of the first oral intake was also very reduced:

- Conventional care: 36 hours
- ERAS: 20 hours

($p < 0.001$)

Postoperative Nausea and Vomiting

ERAS had reduced incidence of postoperative nausea and vomiting:

- Conventional care: 21.2%
- ERAS: 14.7%

Nevertheless, the difference was not found to be statistically significant ($p = 0.17$).

Patient-Reported Outcomes

Patients managed under ERAS reported significantly better recovery experiences.

Outcome	Conventional Care	ERAS	p-value
Overall satisfaction	3.7 ± 0.8	4.3 ± 0.6	<0.001
Pain control satisfaction	3.8 ± 0.9	4.1 ± 0.7	0.08
Mobility confidence	3.5 ± 1.0	4.2 ± 0.7	<0.001
Understanding discharge instructions	3.9 ± 0.8	4.4 ± 0.5	<0.001

This evidence suggests a better engagement and trust of the patients in the postoperative recovery with ERAS care.

Multivariable Analysis

ERAS implementation was still found to be independently related to better outcomes after the adjustment of the age, ASA classification, BMI, and comorbidity burden.

ERAS considerably decreased the general postoperative complications:

Adjusted OR = 0.56 (95% CI 0.33–0.94; $p = 0.028$)

ERAS alone also decreased the length of stay of the hospital:

$\beta = -1.8$ days ($p < 0.001$)

ERAS implementation and the risk of readmission were not associated ($p = 0.91$).

DISCUSSION

This research paper shows that the adoption of an Enhanced Recovery After Surgery (ERAS) protocol is an effective way of enhancing the postoperative recovery among a major elective surgery. Reduced length of stay in hospitals, decreased overall postoperative complication rates, decreased opioid use, earlier mobilization, and better patient-reported

outcomes of recovery were the most notable benefits experienced.

The decrease in the length of stay of hospitals in this study is in line with earlier studies that have tested the ERAS pathways in various surgical disciplines. The achievement of discharge readiness was probably achieved earlier by mobilization earlier, restoration of gastrointestinal functioning, and multimodal analgesia. It is important to note that the reduced

length of stay did not indicate the high readmission rates and this meant that the reduced discharge was an indication of true healing and not the reduction in discharge.

The decrease in the quantity of postoperative complications in general also becomes another sign of the physiological explanation of ERAS protocols. The inflammatory and neuroendocrine stress response induced by surgical trauma is complicated and can impair the functioning of organs and delay recovery. These responses are overcome by the use of goal-oriented fluid therapy, early enteral nutrition, and opioid-sparing analgesia, all of which are measures of ERAS interventions, to establish physiological stability.

Even though, the decreasing numbers of major complications were not statistically significant, the trend observed was in favor of the implementation of ERAS. Major complications are relatively low frequency occurrences and more extensive sample sizes might be necessary to find statistically significant differences.

One of the most significant results of the present study was the significant decrease in the amount of postoperative opioid use in the ERAS group. The multimodal analgesic approach made it possible to manage the pain and reduce opioid exposure. Less use of opioids has been linked to rapid gastrointestinal recovery, reduced nausea and respiratory depression, as well as decreased risk of persistent opioid use after surgery.

The clinical advantages of ERAS pathways are also supported by patient-reported outcomes. Greater satisfaction, enhanced mobility self-efficacy, and discharge education understanding indicate that organized perioperative services and patient education can be a positive factor in the recovery process and patient interaction.

The main elements of effective implementation of ERAS program are multidisciplinary cooperation and the long-term institutional follow-up. In the present study, the standardized protocols, perioperative checklists and regular audit procedures would have assisted in developing uniform protocol implementation.

Limitations

This study has a number of limitations. Firstly, the retrospective design has the risk of selection bias and unmeasured confounding factors. Second, it was conducted in a single tertiary care unit and it might limit the generalizability. Third, it was not conducted in long-term outcomes beyond the direct postoperative time.

However, despite such limitations, the study provides

much evidence of the real-life that can be used to testify to the effectiveness of the ERAS pathways to improve the results of the surgical recovery.

CONCLUSION

Enhanced Recovery After Surgery (ERAS) protocols application has an enormous influence on the postoperative recovery after major elective surgery. ERAS pathways were also associated with a reduction in length of stay in hospital, reduced postoperative complications, reduction of opioid use, increased postoperative mobilization, and patient-reported recovery with no increase in the likelihood of readmission.

These findings have been substantiated by the structured and multidisciplinary perioperative care pathways that is an effective and safe approach to yield maximum surgical recovery. The additional institutional commitment to the use of ERAS and its compliance monitoring can lead to the further improvement of clinical outcomes and patient-centered recovery after a major surgery.

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