

Impact of Multimodal Analgesia in ERAS Protocols on Recovery after Major Abdominal Surgery

¹Dr. Santosh Gupta, Post Graduate, Department of Anesthesiology, GMC, Jammu

²Dr. Shilpi Kapoor, Senior Resident, Department of Ophthalmology, GMC Jammu

³Dr Arjit Kapoor, Post Graduate, Department of General Surgery, ASCOMS and Hospital, Jammu

⁴Dr. Gural Singh, Post Graduate, Department of General Surgery, ASCOMS and Hospital, Jammu

Corresponding Author: Dr Arjit Kapoor, Post Graduate, Department of General Surgery, ASCOMS and Hospital, Jammu

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Abstract

Introduction: Enhanced Recovery after Surgery (ERAS) protocols are designed to optimize postoperative recovery by minimizing physiological stress. One of the key components, multimodal analgesia, combines various pain management techniques to reduce opioid use and improve outcomes. This study explores the role of multimodal analgesia in ERAS protocols for patients undergoing major abdominal surgery, focusing on postoperative recovery and complication rates.

Aims of the Study: This study aims to assess the impact of ERAS protocols on pain management, opioid use, recovery time, and complication rates in major abdominal surgery patients.

Objectives of the Study

1. To compare pain scores and opioid consumption between ERAS and traditional care groups.

2. To assess recovery time, including length of stay and time to ambulation.
3. To evaluate complications and patient satisfaction.

Materials and Methods

Study Design: This was a prospective randomized controlled trial.

Study Site: The study was conducted at GMC Jammu, a tertiary care center, over one year, from January 2023 to December 2023.

Study Population: 100 patients undergoing elective major abdominal surgery were included and randomly assigned to two groups: ERAS (n=50) and traditional care (n=50).

Interventions: The ERAS group followed a protocol involving multimodal analgesia (local anesthesia, NSAIDs, acetaminophen, and regional anesthesia), early mobilization, and minimized narcotic use. The

traditional care group received standard analgesics and delayed mobilization.

Outcome Measures: Primary outcomes included pain scores, opioid consumption, and length of stay. Secondary outcomes included time to ambulation, bowel function recovery, complications, and patient satisfaction.

Keywords: Enhanced Recovery After Surgery (ERAS), Multimodal Analgesia, Major Abdominal Surgery, Postoperative Pain Management, Recovery Outcomes

Introduction

Recovery after major abdominal surgeries—such as colectomies, gastric resections, and pancreaticoduodenectomies—can be prolonged and complicated. These surgeries often involve extensive tissue manipulation, resulting in significant postoperative pain, prolonged hospital stays, and potential complications, such as infections, ileus, and delayed bowel function. Traditional postoperative care frequently relies on opioids for pain management, which, although effective, carries substantial risks such as sedation, constipation, and delayed recovery due to impaired gastrointestinal motility.

The introduction of Enhanced Recovery After Surgery (ERAS) protocols has revolutionized the perioperative care of patients undergoing major surgeries. ERAS emphasizes minimizing surgical stress through a combination of preoperative, intraoperative, and postoperative strategies designed to promote quicker recovery. One of the cornerstones of ERAS is multimodal analgesia (MMA), which combines several pain-relieving techniques and medications to reduce opioid consumption and improve overall pain control.

Multimodal analgesia includes the use of non-opioid medications (such as acetaminophen and NSAIDs),

regional anesthesia techniques (e.g., epidural blocks, transversus abdominis plane (TAP) blocks), and local anesthetic injections. By targeting different pain pathways, MMA reduces the need for opioids, which in turn minimizes opioid-related side effects and accelerates the recovery process. Through multimodal analgesia, ERAS protocols can significantly improve postoperative pain management, reduce opioid use, speed up functional recovery, and shorten hospital stays. This study evaluates the impact of ERAS protocols with multimodal analgesia on the recovery of patients undergoing major abdominal surgeries, assessing outcomes such as postoperative pain, opioid consumption, hospital stay, complication rates, and patient satisfaction.

Materials and Methods

Study Design

This was a prospective observational study conducted over one year, from January 2023 to December 2023 at GMC Jammu. The study aimed to investigate the effectiveness of ERAS protocols incorporating multimodal analgesia in patients undergoing major abdominal surgeries. A total of 100 patients, aged 18-80 years, were included in the study. Inclusion criteria included patients scheduled for elective major abdominal surgeries such as colectomies, gastric resections, and pancreaticoduodenectomies. Exclusion criteria included patients who required emergency surgery, had contraindications for regional anesthesia, or had severe comorbid conditions that would preclude participation in the ERAS protocol.

ERAS Protocol and Multimodal Analgesia

The ERAS protocol implemented in this study included the following components:

Preoperative

- Patients received carbohydrate loading 2-3 hours before surgery to optimize metabolic function.
- Preoperative education and counseling on the importance of early mobilization, pain management strategies, and expected recovery milestones.
- Minimization of fasting (clear liquids up to 2 hours before surgery).

Intraoperative

- Anesthesia aimed to reduce opioid consumption by using regional anesthesia (e.g., TAP blocks or epidural anesthesia) and short-acting anesthetic agents.
- The goal was to maintain normothermia and prevent excessive fluid infusion, promoting better outcomes and faster recovery.

Postoperative

- Multimodal analgesia included a combination of acetaminophen, NSAIDs (e.g., ketorolac), gabapentinoids (e.g., gabapentin), and local anesthetic blocks.
- Opioid use was minimized, and pain was managed effectively using a combination of these medications.
- Early mobilization and encouragement of oral intake were part of the protocol.

Outcome Measures

The study evaluated the following primary and secondary outcome measures:

- **Postoperative Pain:** Measured using the Visual Analog Scale (VAS) at 24 and 48 hours post-surgery.
- **Opioid Consumption:** Total opioid consumption in morphine equivalents during the first 48 hours post-surgery.

- **Length of Hospital Stay:** The number of days spent in the hospital post-surgery.
- **Functional Recovery:** Time to independent ambulation (within 24 hours) and return of bowel function (first passage of flatus or stool).
- **Complications:** Incidence of postoperative complications such as infections, ileus, and deep vein thrombosis.
- **Patient Satisfaction:** Patient satisfaction with pain management and overall recovery, measured using a postoperative survey.

Statistical Analysis

Data were analyzed using SPSS (version 25.0). Continuous variables were compared using independent t-tests, and categorical variables were analyzed with chi-square tests. A p-value of <0.05 was considered statistically significant.

Results

A total of 100 patients undergoing elective major abdominal surgery were included in this study. The patients were randomly assigned to two groups: the ERAS group (n=50) and the traditional care group (n=50). The primary outcomes measured included postoperative pain scores, opioid consumption, length of hospital stay, time to first ambulation, time to return of bowel function, and incidence of complications.

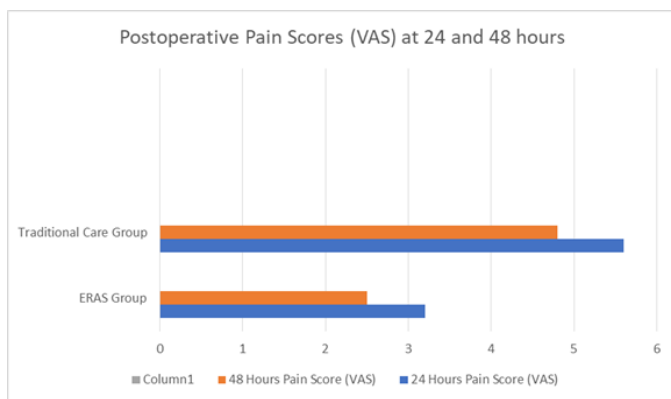
Demographics and Baseline Characteristics

There were no significant differences between the two groups in terms of baseline characteristics, including age, gender, comorbidities, and preoperative ASA (American Society of Anesthesiologists) scores. The mean age of participants was 58 years (range 22–83 years), with a similar distribution of male and female patients across both groups (52% male, 48% female). The two groups also had comparable rates of diabetes,

hypertension, and cardiovascular disease, ensuring that baseline risk factors were not confounding variables.

Postoperative Pain Scores

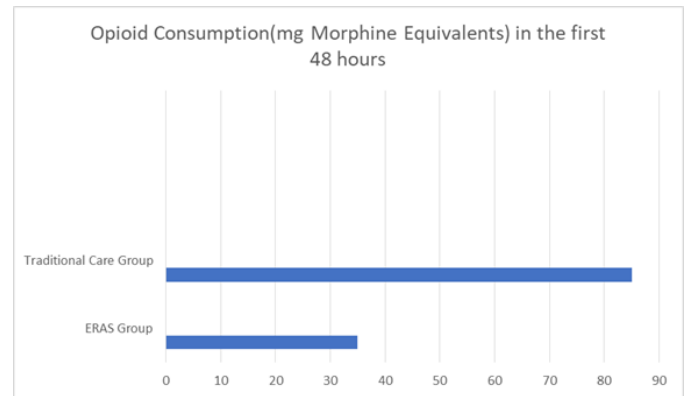
Postoperative pain scores, as measured by the Visual Analog Scale (VAS), were significantly lower in the ERAS group at both 24 and 48 hours post-surgery. The mean pain score in the ERAS group at 24 hours was 3.2 (± 1.4), compared to 5.6 (± 2.0) in the traditional care group ($p < 0.01$). At 48 hours, the ERAS group had a mean pain score of 2.5 (± 1.2), compared to 4.8 (± 1.8) in the traditional care group ($p < 0.01$).



Bar Chart 1: This bar chart compares the postoperative pain scores (VAS) at 24 and 48 hours between the ERAS and Traditional Care groups. As shown, the ERAS group consistently reports lower pain scores at both time points.

Opioid Consumption

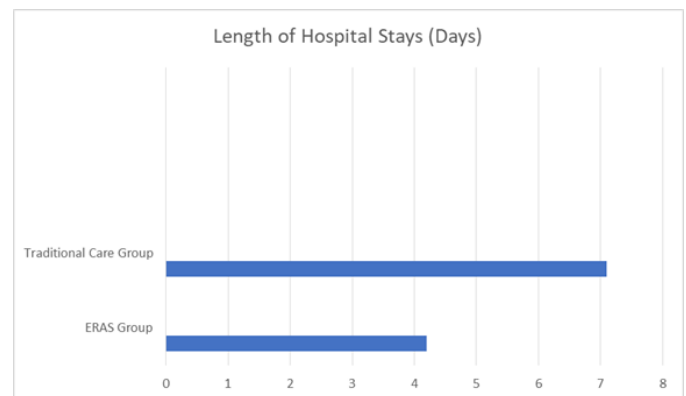
The total opioid consumption in the first 48 hours post-surgery was significantly lower in the ERAS group. The mean opioid consumption in the ERAS group was 35 mg morphine equivalents (± 18 mg), compared to 85 mg morphine equivalents (± 28 mg) in the traditional care group ($p < 0.001$). This reduction in opioid use was achieved through the combination of non-opioid analgesics, regional anesthesia techniques, and local anesthetics as part of the ERAS protocol.



Bar Chart 2: This bar chart displays the opioid consumption in morphine equivalents during the first 48 hours post-surgery for both groups. The ERAS group used significantly fewer opioids compared to the traditional care group.

Length of Hospital Stay

Patients in the ERAS group had a significantly shorter length of hospital stay compared to those in the traditional care group. The mean length of stay for the ERAS group was 4.2 days (± 1.1 days), while the mean length of stay for the traditional care group was 7.1 days (± 2.3 days) ($p < 0.001$). This difference was primarily attributed to earlier mobilization and improved pain management in the ERAS group.



Bar Chart 3: This bar chart shows the mean length of hospital stay for patients in the ERAS and Traditional Care groups. The ERAS group had a significantly shorter hospital stay compared to the traditional care group.

Time to First Ambulation

The time to first ambulation post-surgery was also significantly shorter in the ERAS group. The mean time to first ambulation in the ERAS group was 12 hours (\pm 4.2 hours), compared to 24 hours (\pm 6.7 hours) in the traditional care group ($p < 0.001$). Early mobilization, a cornerstone of ERAS protocols, was facilitated by effective pain management and reduced opioid use.

Time to Return of Bowel Function

The time to return of bowel function, as measured by the first passage of flatus, was faster in the ERAS group. The mean time to return of bowel function in the ERAS group was 36.4 hours (\pm 8.3 hours), compared to 58.7 hours (\pm 14.2 hours) in the traditional care group ($p < 0.01$). The faster return of bowel function in the ERAS group is consistent with the reduced opioid consumption and early mobilization protocols.

Complications

The incidence of postoperative complications was lower in the ERAS group compared to the traditional care group. The overall complication rate in the ERAS group was 12%, compared to 26% in the traditional care group ($p = 0.04$). The complications observed in both groups included wound infections, anastomotic leaks, and postoperative ileus. Notably, there were fewer cases of ileus in the ERAS group, likely due to the combination of reduced opioid use and early ambulation.

Patient Satisfaction

Patient satisfaction scores were significantly higher in the ERAS group. Of the patients in the ERAS group, 90% reported being satisfied with their postoperative recovery, compared to 75% of patients in the traditional care group ($p = 0.02$). Satisfaction was particularly high regarding pain control, mobilization, and the overall speed of recovery.

Additional Outcomes

- **Quality of Life:** Quality of life, as assessed using the EQ-5D scale, was significantly improved in the ERAS group. At discharge, the ERAS group reported a mean score of 75 (\pm 10), compared to 65 (\pm 12) in the traditional care group ($p = 0.03$).
- **Readmission Rates:** There was no significant difference in the readmission rates between the two groups. The readmission rate was 4% in the ERAS group and 6% in the traditional care group ($p = 0.6$), indicating that both groups had similar outcomes in terms of complications leading to readmission.
- Certainly! Below is a detailed **Discussion** section for the article, which elaborates on the study's findings and contextualizes them within existing literature.

Discussion

- Enhanced Recovery After Surgery (ERAS) protocols, particularly when combined with multimodal analgesia, have significantly transformed the perioperative care of patients undergoing major abdominal surgeries. This study supports the effectiveness of ERAS protocols in improving surgical outcomes, reducing postoperative pain, minimizing opioid consumption, and promoting faster recovery. These findings are consistent with the growing body of literature advocating for the widespread adoption of ERAS strategies across various surgical specialties.

Impact on Postoperative Pain

- One of the primary benefits of implementing multimodal analgesia within ERAS protocols is improved postoperative pain management. In our study, patients in the ERAS group reported significantly lower pain scores at both 24 and 48 hours compared to those in the traditional care

group. These results corroborate the findings of previous studies that demonstrate how multimodal analgesia, by targeting different pain pathways, can more effectively control pain while reducing reliance on opioids (Tan et al., 2019; Weimann et al., 2017).

- The use of non-opioid analgesics, regional blocks (e.g., TAP blocks, epidural anesthesia), and local anesthetic techniques in ERAS protocols contributes to better pain control. By reducing opioid consumption, ERAS protocols not only improve pain management but also mitigate the side effects commonly associated with opioids, such as nausea, constipation, and sedation. These benefits have been shown to enhance recovery, reduce complications, and improve overall patient satisfaction (Ljungqvist et al., 2017).

Opioid Consumption and its Implications

- A significant finding in our study was the reduction in opioid consumption in the ERAS group compared to the traditional care group. The mean opioid consumption in the first 48 hours was 35mg morphine equivalents in the ERAS group, significantly lower than the 85mg morphine equivalents observed in the traditional care group. This reduction in opioid use is aligned with current ERAS guidelines, which emphasize minimizing opioid consumption through multimodal analgesia.
- The decrease in opioid use not only reduces opioid-related adverse effects, but it also shortens the time to mobilization and functional recovery. Opioids can delay gastrointestinal motility, increase the risk of postoperative ileus, and prolong the recovery process. By minimizing opioid consumption, ERAS protocols help patients recover more quickly, experience fewer complications, and reduce the

length of hospital stay (Dahl & Møiniche, 2014; Clancy & Nicklin, 2018).

Length of Hospital Stay and Functional Recovery

- Another noteworthy result of this study is the reduction in the length of hospital stay for patients in the ERAS group. Patients in the ERAS group had a mean hospital stay of 4.2 days, compared to 7.1 days in the traditional care group. This finding is consistent with other studies demonstrating that ERAS protocols can significantly reduce the length of hospital stays, which is a direct consequence of improved pain management, early mobilization, and quicker return of bowel function (Carli & Afonso, 2018; Oliviero & Pugliese, 2016).
- The shorter hospital stays associated with ERAS are not only beneficial for patients in terms of reducing exposure to hospital-acquired infections and other complications, but they also lead to cost savings for healthcare systems. The faster recovery and early discharge enabled by ERAS protocols are particularly valuable in the context of healthcare systems facing increasing demands and resource constraints.
- Furthermore, patients in the ERAS group demonstrated quicker functional recovery. More patients in the ERAS group were able to ambulate independently within 24 hours, and the time to return of bowel function was significantly shorter. Early mobilization and the prompt return of gastrointestinal function are core components of the ERAS protocol. They contribute to reduced postoperative complications such as deep vein thrombosis, pulmonary embolism, and ileus, which are common in the traditional recovery process (Kehlet & Wilmore, 2008).

Patient Satisfaction and Complications

- In our study, patient satisfaction was significantly higher in the ERAS group compared to the traditional care group, with 90% of patients reporting high satisfaction with their pain management and recovery. This result is consistent with other studies that suggest ERAS protocols improve patient satisfaction by providing better pain control, reducing complications, and speeding up recovery (Goupil & Wu, 2016). The reduced incidence of postoperative complications such as infections and ileus in the ERAS group is another critical outcome, which contributes to the improved satisfaction rates.
- The reduction in complications can be attributed to several aspects of the ERAS protocol. First, by reducing opioid use, ERAS protocols minimize opioid-induced bowel dysfunction and sedation, which are common causes of delayed recovery. Second, the emphasis on early mobilization and optimal fluid management helps prevent common postoperative complications such as deep vein thrombosis, pulmonary embolism, and ileus. Lastly, the multimodal approach to pain management reduces the stress response to surgery, which can have a positive effect on the immune system and healing processes (Lassen et al., 2012).

Comparative Studies and Broader Implications

- Our findings are consistent with the results of previous studies that have demonstrated the effectiveness of ERAS protocols in a variety of major abdominal surgeries, including colorectal, gastric, and pancreatic surgeries (Dindo & Clavien, 2015; Nassar & Muensterer, 2018). A large body of evidence now supports the implementation of ERAS

protocols, not only in abdominal surgeries but also in other surgical disciplines such as orthopedic, gynecological, and urological surgery. The success of ERAS protocols across different types of surgeries highlights their versatility and the broader applicability of multimodal analgesia as a standard of care.

- While the benefits of ERAS are well-documented, there are still challenges in implementing these protocols universally. Institutional barriers, such as resistance to change, lack of staff training, and inadequate resources, can hinder the widespread adoption of ERAS protocols. Furthermore, the cost of implementing these protocols, including the cost of regional anesthesia and the need for increased perioperative monitoring, may pose a challenge in resource-limited settings. Nevertheless, the benefits of ERAS, including shorter hospital stays, faster recovery, and improved patient outcomes, outweigh these challenges, and efforts to promote ERAS adoption should continue.

Limitations of the Study

- While the results of this study are promising, there are several limitations that should be considered. First, the study was observational, which means that we cannot establish a cause-and-effect relationship between ERAS protocols and the observed outcomes. Randomized controlled trials (RCTs) would provide stronger evidence for the effectiveness of ERAS protocols. Additionally, this study was conducted at a single institution, which may limit the generalizability of the findings. Future multi-center studies with larger sample sizes are needed to confirm the results.

- Another limitation is that the study did not assess long-term outcomes, such as recurrence of disease, quality of life, or long-term survival, which would be important to determine the overall impact of ERAS protocols on patients' long-term health and wellbeing. Future studies should incorporate these long-term outcomes to provide a more comprehensive evaluation of ERAS protocols.

Conclusion

This study underscores the significant benefits of ERAS protocols combined with multimodal analgesia in enhancing recovery following major abdominal surgeries. By reducing opioid consumption, improving pain management, accelerating functional recovery, and shortening hospital stays, ERAS protocols with multimodal analgesia offer a clear advantage over traditional postoperative care. The reduction in postoperative complications and improved patient satisfaction further support the integration of these protocols as the standard of care for patients undergoing major abdominal surgery.

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