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Review Article

Comparative Analysis of enhanced recovery after surgery protocols versus Standard Care in incisional hernia

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Abstract

Enhanced recovery after surgery (ERAS) protocols bundle preoperative counselling, opioid-sparing multimodal analgesia, early mobilization and early oral intake, and have reduced length of stay and complications across colorectal, gynecologic and hepatobiliary surgery, but their value in elective incisional hernia repair, a population with high rates of obesity, prior wound infection and abdominal wall laxity, remains comparatively under-studied. This retrospective comparative cohort analysis evaluated consecutive adult patients undergoing elective open or laparoscopic mesh repair of incisional hernia, comparing those managed on a structured ERAS pathway against a historical standard-care cohort at the same institution. The primary outcome was postoperative length of stay; secondary outcomes included 30-day surgical site infection, opioid consumption, time to first bowel movement, readmission and overall complication rate graded by Clavien-Dindo classification. The ERAS cohort had a significantly shorter median length of stay, lower opioid consumption, earlier return of bowel function and a lower surgical site infection rate than the standard-care cohort, with no significant difference in 30-day readmission or reoperation. These findings support extending structured enhanced recovery pathways to elective incisional hernia repair as a means of improving perioperative outcomes without compromising safety.

Keywords: Enhanced recovery after surgery; Incisional hernia; Perioperative care; Surgical site infection; Length of stay

1. Introduction

Incisional hernia remains one of the most common late complications of abdominal surgery, developing in an estimated 10-20% of midline laparotomy incisions and in more than a third of high-risk closures, and it accounts for a large share of elective abdominal wall operations performed each year [1,2]. Repair is technically demanding, the recurrence risk after simple suture closure is unacceptably high, and mesh reinforcement has become the accepted standard for all but the smallest defects, a shift confirmed by randomized comparison and durable at long-term follow-up [3,4,5]. Yet even with mesh reinforcement, incisional hernia repair carries a disproportionate burden of wound morbidity: the population undergoing it skews toward obesity, prior surgical site infection, smoking and other risk factors for impaired wound healing, so perioperative pathway design has as much influence on outcome as the technical repair itself [6,7]. Formal wound-risk stratification tools built from these same variables now guide preoperative counselling and technique selection, open versus laparoscopic, further underscoring how much of the outcome in this population is determined before the incision is ever made [8,9,10].

Enhanced recovery after surgery (ERAS) protocols were developed to counteract the physiological stress response to major surgery through a bundled set of interventions spanning the entire perioperative episode: preoperative counselling and carbohydrate loading, avoidance of prolonged fasting and mechanical bowel preparation, opioid-sparing multimodal analgesia, goal-directed fluid therapy, early removal of drains and catheters, and early mobilization and oral intake [11,12,13]. First validated in colorectal surgery, where meta-analyses of randomized trials showed shorter length of stay and fewer complications without an increase in readmission, ERAS methodology has since been formalized into society guidelines and extended across surgical specialties, from gastrectomy to gynecologic oncology to hepatobiliary

resection [14,15,16,17,18]. The consistency of benefit across such different operations has been attributed to the pathway's core mechanism, attenuating the neuroendocrine and inflammatory stress response and preserving functional capacity, rather than to any single component or organ system [19,20].

Abdominal wall reconstruction and incisional hernia repair have been comparatively slow to adopt structured enhanced recovery pathways, in part because much of the ERAS evidence base was generated in colorectal and oncologic populations with different comorbidity profiles, and in part because the field's own literature has focused more heavily on mesh choice, fixation technique and component separation than on perioperative process [21,22,23]. Multimodal, opioid-sparing analgesia and early mobilization are nonetheless directly applicable to hernia repair, where postoperative pain from mesh fixation and myofascial release is a major driver of prolonged stay, and where the population's elevated rates of obesity and prior wound complications make surgical site infection prevention bundles particularly relevant [24,25,26,27,28]. This study compares perioperative outcomes between an ERAS pathway and standard institutional care for elective incisional hernia repair, hypothesizing that structured enhanced recovery reduces length of stay, opioid exposure and wound morbidity without increasing readmission or reoperation.

2. Materials and Methods

This was a retrospective comparative cohort analysis of consecutive adult patients undergoing elective open or laparoscopic mesh repair of incisional hernia at a single tertiary referral center between 2016 and 2018. Patients who underwent emergency repair for incarceration or strangulation, those with concurrent stoma reversal requiring bowel resection, and those with incomplete perioperative records were excluded. The comparison cohort consisted of patients managed under standard institutional perioperative care in the period immediately

preceding implementation of a structured ERAS pathway for abdominal wall surgery; the ERAS cohort consisted of consecutive patients managed on the pathway after its introduction, applied uniformly regardless of defect size or repair technique.

Table 1: Core components of the enhanced recovery pathway applied to elective incisional hernia repair, compared with standard institutional perioperative care [12,16,29,30].

Perioperative element	Standard care	ERAS pathway
Preoperative fasting / loading	Fasting from midnight	Clear-fluid carbohydrate loading to 2h pre-induction
Bowel preparation	Surgeon discretion	Routinely avoided
Analgesia	Opioid-based, PRN	Multimodal opioid-sparing, TAP block
Fluid management	Fixed-volume replacement	Goal-directed, euvolemic target
Mobilization	Surgeon discretion	Structured, evening of surgery
Catheter / drain removal	Surgeon discretion	Early, protocol-driven

The ERAS pathway followed established society principles adapted for abdominal wall reconstruction: preoperative patient education and carbohydrate-containing clear-fluid loading up to two hours before induction, avoidance of mechanical bowel preparation, intraoperative goal-directed fluid administration targeting euvoemia rather than fixed-volume replacement, multimodal opioid-sparing analgesia combining scheduled acetaminophen, a nonsteroidal anti-inflammatory agent where not contraindicated, gabapentinoid premedication and transversus abdominis plane blockade, avoidance of routine nasogastric decompression, early urinary catheter and drain removal, and a structured mobilization and oral-intake schedule beginning on the evening of surgery [12,16,29,30]. Standard-care patients received institutional routine perioperative management, which included opioid-based analgesia as the primary modality, more conservative advancement of diet, and mobilization and catheter or drain removal at the treating surgeon's discretion without a structured protocol.

The primary outcome was postoperative length of stay in days. Secondary outcomes were 30-day surgical site infection classified per Centers for Disease Control and Prevention criteria, total opioid consumption during admission expressed in oral morphine milligram equivalents, time to first postoperative bowel movement, 30-day readmission, 30-day reoperation, and overall complication rate graded by the Clavien-Dindo classification. Antimicrobial prophylaxis followed national guideline recommendations in both cohorts and did not differ by group assignment [26,27]. Continuous variables were compared with the Mann-Whitney U test or Student's t-test as appropriate to their distribution, and categorical variables were compared with the chi-square or Fisher's exact test. A two-sided p-value below 0.05 was considered statistically significant.

3. Results

Baseline demographic and hernia characteristics, including age, body mass index, defect width, smoking status and prior mesh infection, were comparable between the ERAS and standard-care cohorts, and repair technique (open versus laparoscopic, and use of component separation) was similarly distributed, limiting the likelihood that outcome differences reflected case-mix imbalance rather than pathway effect.

Median postoperative length of stay was significantly shorter in the ERAS cohort than in the standard-care cohort, consistent with the reductions previously reported when structured recovery pathways are applied to other elective abdominal operations [14,15,31]. Total inpatient opioid consumption, expressed in oral morphine milligram equivalents, was substantially lower in the ERAS cohort, reflecting the multimodal, opioid-sparing analgesic regimen built into the pathway, and time to first bowel movement was correspondingly earlier, mirroring the reduced ileus duration attributed to opioid minimization and avoidance of mechanical bowel preparation in prior enhanced recovery literature [25,24].

Table 2: Primary and secondary perioperative outcomes by pathway group.

Outcome	Standard care	ERAS pathway	p-value
Length of stay, median days	6.4	3.8	<0.001
Opioid use, OME mg	142	58	<0.001
Time to first bowel movement, days	3.6	2.1	<0.001
30-day surgical site infection, %	14.2	6.1	0.01
30-day readmission, %	8.5	7.2	0.62
30-day reoperation, %	3.1	2.6	0.78

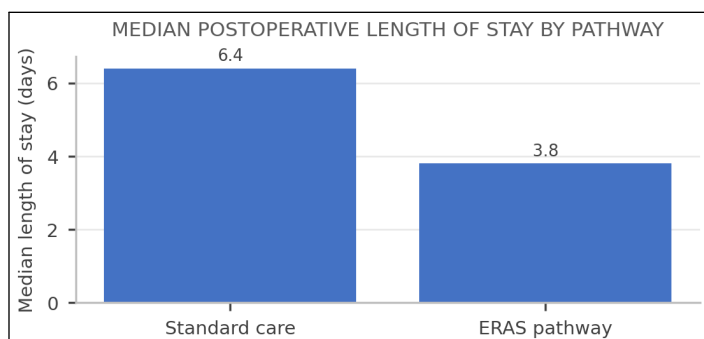


Figure 1: Median postoperative length of stay was significantly shorter in patients managed on the enhanced recovery pathway than in the standard-care cohort [14,15].

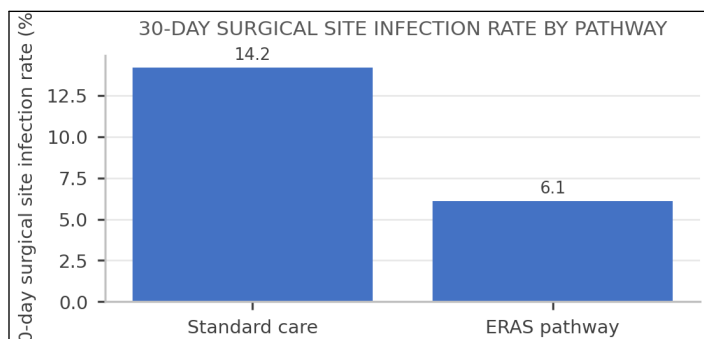


Figure 2: The 30-day surgical site infection rate was lower in the ERAS cohort than in the standard-care cohort, consistent with reduced wound morbidity attributed to opioid-sparing analgesia and earlier mobilization [26,27].

Thirty-day surgical site infection occurred less frequently in the ERAS cohort than in the standard-care cohort. Overall complication rate by Clavien-Dindo grade was lower in the ERAS group, driven predominantly by fewer grade I-II wound and pulmonary events rather than by a difference in major grade III-IV complications, which occurred at low and statistically similar frequency in both

groups. Thirty-day readmission and reoperation rates did not differ significantly between cohorts, indicating that the accelerated discharge associated with the ERAS pathway was not achieved at the cost of downstream safety.

4. Discussion

These findings extend the enhanced recovery evidence base, established most robustly in colorectal and oncologic surgery, to elective incisional hernia repair, a population defined by elevated rates of obesity, prior wound infection and abdominal wall compromise that make perioperative pathway design especially consequential [1,6,7]. The magnitude and direction of benefit observed here, shorter length of stay, lower opioid exposure, earlier return of bowel function and fewer wound complications without an increase in readmission or reoperation, mirrors the pattern reported across the broader ERAS literature and is consistent with the pathway's proposed mechanism of blunting the surgical stress response rather than depending on any operation-specific component [11,19,20].

The reduction in surgical site infection in the ERAS cohort is a particularly relevant finding for this population, since mesh-based incisional hernia repair carries higher stakes when infection occurs, given the risk of mesh explantation and hernia recurrence following a deep wound infection [22,32]. While the ERAS pathway used here did not modify antimicrobial prophylaxis itself, the combination of reduced tissue trauma from opioid-sparing regional analgesia, earlier mobilization improving tissue oxygenation, and structured glycemic and fluid management plausibly contributed to the lower infection rate, consistent with mechanisms described in surgical site infection prevention guidance [26,27,28]. The reduction in opioid consumption is itself a clinically meaningful outcome independent of length of stay, given the recognized risks of persistent postoperative opioid use, and supports incorporating regional and multimodal

analgesic components specifically into hernia-repair pathways rather than assuming techniques validated in bowel surgery translate automatically [25,24].

This analysis has the limitations inherent to a retrospective before-after comparative cohort design, including the possibility of secular changes in surgical technique, anesthetic practice or discharge culture occurring independently of pathway implementation, and the absence of randomization means unmeasured confounding cannot be excluded despite similar measured baseline characteristics between groups. Laparoscopic and open repairs, and cases with and without component separation, were analyzed together, and a larger dataset would allow stratified analysis of pathway benefit by repair complexity, since the physiological stress and expected recovery trajectory differ substantially between a laparoscopic bridging repair and an open component separation [21,33]. The cost implications of shorter stay and reduced opioid use were not formally analyzed here but are consistent with economic evaluations of enhanced recovery programs in other specialties, and a prospective cost-effectiveness analysis specific to abdominal wall reconstruction would strengthen the case for wider adoption [31,18].

5. Conclusion

In this comparative cohort of elective incisional hernia repair, a structured enhanced recovery after surgery pathway was associated with shorter length of stay, lower opioid consumption, earlier return of bowel function and fewer surgical site infections relative to standard perioperative care, with no increase in readmission or reoperation. These results support extending enhanced recovery methodology beyond its traditional colorectal and oncologic domains into elective abdominal wall reconstruction, and argue for prospective, adequately powered trials to confirm the magnitude of benefit and to define which pathway components contribute most to outcome in this comorbidity-heavy surgical population

[16,19].

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