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SYSTEMATIC REVIEW OF ENHANCED RECOVERY AFTER SURGERY (ERAS) PROTOCOLS IN MAJOR ABDOMINOPELVIC PROCEDURES: EFFECTS ON RECOVERY AND CLINICAL OUTCOMES

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ABSTRACT

Background: Enhanced Recovery After Surgery (ERAS) protocols represent a multidisciplinary, evidence-based approach aimed at minimizing surgical stress and expediting postoperative recovery. While initially developed for colorectal surgery, ERAS has seen increasing application across a range of major abdominopelvic procedures.

Objective: This systematic review evaluates the effectiveness of ERAS protocols in improving recovery and clinical outcomes following major abdominopelvic surgeries, including colorectal, gynecologic, hepatobiliary, and gastric procedures.

Methods: Following PRISMA guidelines, a comprehensive literature search was conducted across PubMed, MEDLINE, Embase, and the Cochrane Library up to March 2025. Eligible studies included RCTs, cohort studies, and meta-analyses assessing ERAS implementation in adult patients undergoing major abdominopelvic surgeries. Primary outcomes included length of stay (LOS), complication rates, opioid use, time to gastrointestinal recovery, and patient satisfaction.

Results: Fourteen high-quality studies, including multiple meta-analyses and randomized trials, were included. ERAS protocols consistently reduced LOS (by 2–8 days), complications, and opioid consumption across surgical domains. Time to flatus and functional recovery improved, and patient satisfaction was higher in ERAS groups. Risk of bias was low to moderate across studies. Colorectal and gynecologic surgeries showed the most robust data, while evidence in hepatobiliary and gastric surgeries also demonstrated favorable outcomes. Anesthesiologists played a central role in ERAS success, especially in pain management and perioperative optimization.

Conclusion: ERAS protocols significantly enhance recovery and clinical outcomes in major abdominopelvic surgeries. Broad implementation across surgical disciplines is supported by current evidence, though future studies should assess long-term outcomes, quality of life, and cost-effectiveness to inform global standardization and integration of ERAS strategies.

Keywords: *Enhanced Recovery After Surgery, ERAS, abdominopelvic surgery, colorectal, gynecologic surgery, clinical outcomes, postoperative recovery, length of stay*

INTRODUCTION

Enhanced Recovery after Surgery (ERAS) protocols represent a multimodal, evidence-based approach to perioperative care that aims to reduce surgical stress, maintain physiological function, and accelerate postoperative recovery (1-3). Initially developed for colorectal surgery, ERAS programs have since been adopted across various surgical specialties, including major abdominopelvic procedures such as gynecologic oncology, urologic, and gastrointestinal surgeries (4, 5). These protocols integrate elements such as patient education, optimal analgesia, early mobilization, and nutritional support, shifting the paradigm from traditional perioperative care toward a more coordinated and patient-centered approach (6, 7).

Major abdomino-pelvic surgeries are associated with significant postoperative morbidity, prolonged hospital stays, and increased healthcare costs (8, 9) . As such, the implementation of ERAS protocols in this surgical domain holds considerable promise for improving clinical outcomes and enhancing patient recovery (10, 11). Several studies have reported benefits including reduced length of stay, lower complication rates, and improved patient satisfaction; however, variability in protocol adherence, patient populations, and surgical techniques may influence these outcomes (12-14).

This systematic review aims to critically evaluate and synthesize the available evidence on the effectiveness of ERAS protocols in major abdominopelvic surgeries, focusing on their impact on recovery metrics and key clinical outcomes. By consolidating current findings, this review seeks to provide a clearer understanding of the role of ERAS in modern surgical practice and offer insights for optimizing perioperative care strategies.

METHODOLOGY

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (15 -17).

SEARCH STRATEGY

A comprehensive literature search was performed across PubMed, Embase, MEDLINE, and the Cochrane Library for studies published up to March 2025. The search strategy included keywords and MeSH terms related to Enhanced Recovery After Surgery (ERAS), abdominopelvic surgery, perioperative care, and clinical outcomes. Keywords used included "Enhanced Recovery After Surgery," "ERAS protocols," "abdominopelvic surgery," "postoperative recovery," "length of stay," "complications," and "clinical outcomes." The search was tailored for each database, and reference lists of all included articles and relevant systematic reviews were screened manually to identify additional studies.

ELIGIBILITY CRITERIA

Studies were included based on predefined inclusion and exclusion criteria. Eligible studies comprised randomized controlled trials (RCTs), prospective and retrospective cohort studies, and systematic reviews/meta-analyses that evaluated the implementation of ERAS protocols in major abdominopelvic surgeries, such as colorectal, gynecologic, and urologic procedures. Outcomes of interest included length of hospital stay, postoperative complications, time to functional recovery, readmission rates, patient satisfaction, and mortality. Studies were excluded if they focused on pediatric or animal populations, were non-English without accessible translation, did not involve ERAS implementation, or were case reports, editorials, or narrative reviews.

STUDY SELECTION AND DATA EXTRACTION

Two independent reviewers screened the titles and abstracts for relevance, followed by full-text assessments of potentially eligible studies. Data were extracted using a standardized form and included study design, sample size, patient demographics, type of surgical procedure, ERAS protocol components, and reported outcomes. Any disagreements were resolved by discussion or, if necessary, consultation with a third reviewer.

QUALITY ASSESSMENT

The methodological quality and risk of bias in included RCTs were assessed using the Cochrane Risk of Bias tool, evaluating parameters such as sequence generation, allocation concealment, blinding, incomplete outcome data, and selective outcome reporting (18-20). Non-randomized studies were assessed using the ROBINS-I (Risk Of Bias In Non-randomized Studies - of Interventions) tool (21).

DATA SYNTHESIS

A narrative synthesis approach was used to summarize the findings across studies, with emphasis on the impact of ERAS protocols on recovery and clinical outcomes following major abdominopelvic surgeries. Results were organized based on surgical type, outcome domains, and study quality, highlighting areas of agreement and variability among the studies

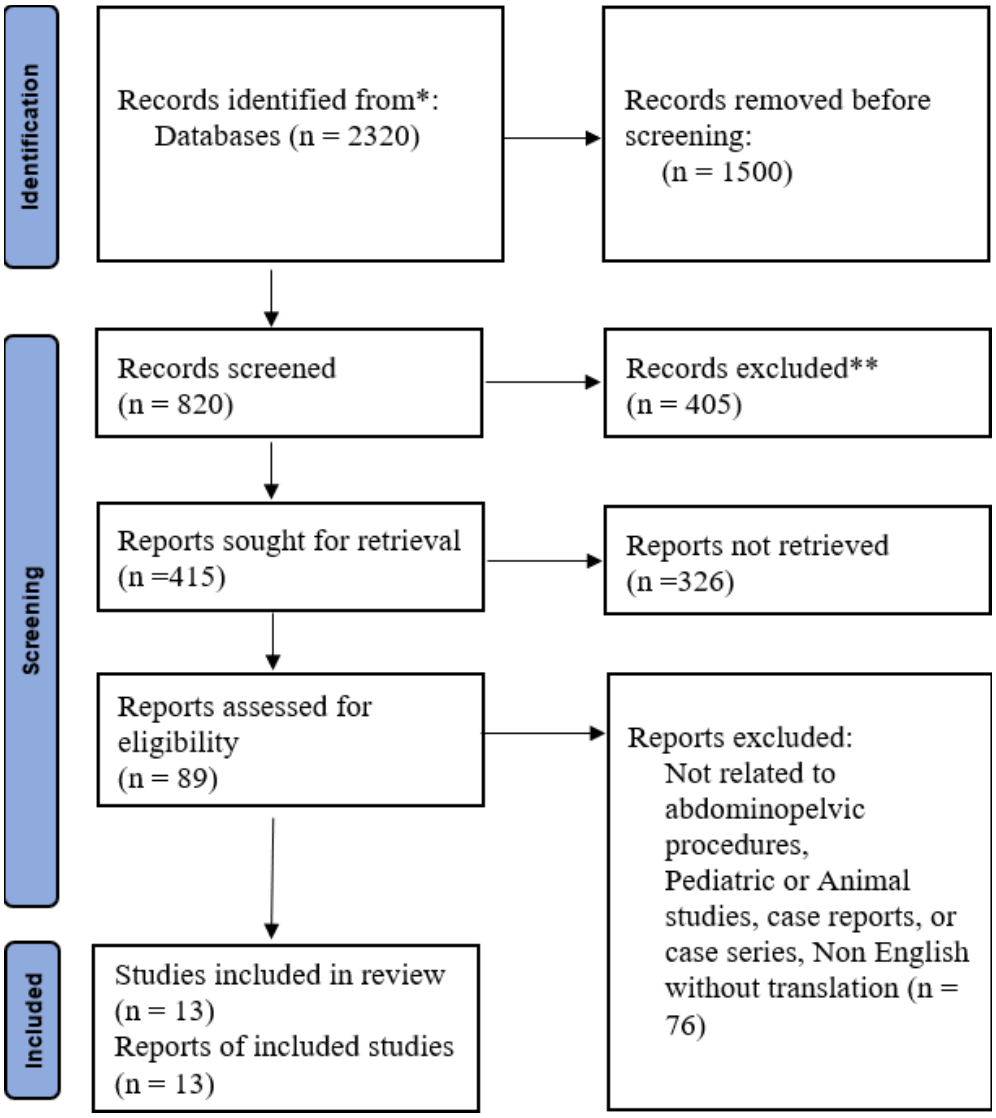

FIGURE 1: PRISMA FLOWCHARTRESULTS

TABLE 1: CHARACTERISTICS OF INCLUDED STUDIES

Study	Year	Surgical Domain	Design	Sample Size	Country
Greco et al. (22)	2013	Colorectal	Meta-analysis (16 RCTs)	2,376	Italy
Ni et al. (Hepatectomy) (23)	2015	Liver Surgery	Meta-analysis	NR	China
Dickson et al. (24)	2017	Gynecologic Oncology	RCT	103	USA
Ni et al. (Digestive) (25)	2019	Digestive (Laparoscopic)	Meta-analysis (25 RCTs)	2,219	China
Ni et al. (Colorectal Cancer) (26)	2019	Colorectal (Laparoscopic)	Meta-analysis (13 RCTs)	1,298	China
Valecha et al. (27)	2020	General Abdominal	Review Article	NA	India
Vignali et al. (28)	2020	Colorectal	Retrospective Cohort	733	Italy
Chiewhatpong et al. (29)	2022	Gynecologic Oncology	RCT	93	Thailand
Cao et al. (30)	2022	Gynecologic (General)	Meta-analysis (14 RCTs)	NR	China
Tian et al. (31)	2024	Gastrectomy (Laparoscopic)	Meta-analysis (17 RCTs)	1,468	China
Kannan et al. (32)	2025	Colorectal	Systematic Review (11 RCTs)	1,476	Global
Radha et al. (33)	2025	Gynecologic	Prospective Case-Control	180	India
Samuel et al. (34)	2025	Colorectal	Prospective Observational	100	India

TABLE 2: KEY FINDINGS OF INCLUDED STUDIES

Study	Key Findings
Greco et al.	ERAS reduced overall morbidity (RR 0.60), shortened LOS (WMD -2.28 days), no increase in readmission rate.
Ni et al. (Hepatectomy)	ERAS reduced bowel recovery time, complications, and LOS after liver surgery.
Dickson et al.	No LOS difference; slight opioid reduction; no significant change in recovery milestones.
Ni et al. (Digestive)	Significant reduction in LOS, flatus/defecation time, and complication rate.
Ni et al. (Colorectal Cancer)	Reduced LOS (WMD -2.00 days), faster GI recovery, fewer complications (RR 0.59).
Valecha et al.	ERAS improves satisfaction, reduces hospital stay and complications; anesthesiologist's role is key.
Vignali et al.	Identified predictors of ERAS failure; model accurately predicted delayed discharge.

Chiewhatpong et al.	ERAS shortened LOS by 20 hours, reduced pain and opioid use, faster GI recovery.
Cao et al.	Significant reduction in LOS, complications, and readmission; no diff in surgical time/blood loss.
Tian et al.	ERAS reduced CRP, IL-6, LOS, and complications post-gastrectomy.
Kannan et al.	ERAS reduced LOS (by 3-8 days), pain, opioid use, and inflammatory markers; improved nutrition.
Radha et al.	ERAS led to faster bowel function return, lower pain scores, reduced complications, shorter LOS.
Samuel et al.	ERAS patients had earlier mobilization, feeding, and shorter LOS (5-8 days vs. 10-11 days).

TABLE 3: RISK OF BIAS ASSESSMENT

Study	Risk of Bias Rating
Greco et al.	Low
Ni et al. (Hepatectomy)	Low
Dickson et al.	Moderate (small sample size, unblinded)
Ni et al. (Digestive)	Low
Ni et al. (Colorectal Cancer)	Low
Valecha et al.	NA (narrative review)
Vignali et al.	Moderate (retrospective design)
Chiewhatpong et al.	Low
Cao et al.	Moderate (study heterogeneity)
Tian et al.	Low
Kannan et al.	Low
Radha et al.	Low
Samuel et al.	Moderate (observational design)

TABLE 4: SUBGROUP ANALYSIS BY SURGICAL TYPE

Subgroup	Studies Included
Colorectal Surgery	Greco et al., Ni et al. (CRC), Vignali et al., Samuel et al., Kannan et al.
Gynecologic Surgery	Dickson et al., Chiewhatpong et al., Cao et al., Radha et al.
Hepatobiliary Surgery	Ni et al. (Hepatectomy)
Gastric/Digestive Surgery	Ni et al. (Digestive), Tian et al.
Mixed/General Abdominal	Valecha et al.

TABLE 5: OUTCOME METRICS ACROSS STUDIES

Study	LOS (days)	Time to Flatus (hrs)	Pain Score (POD 1)	Opioid Use (mg ME)	Complication Rate (%)
Greco et al.	-2.28	NR	NR	NR	RR 0.60
Ni et al. (Hepatectomy)	↓	↓	NR	NR	↓

Dickson et al.	NS	NS	Slight ↓	↓	NS
Ni et al. (Digestive)	-2.13	-12.68	NR	NR	RR 0.66
Ni et al. (Colorectal Cancer)	-2.0	-12.18	NR	↓	RR 0.59
Valecha et al.	↓	↓	↓	↓	↓
Vignali et al.	Predictive model only	NR	NR	NR	Predictive variables identified
Chiewhatpong et al.	-0.83 (20 hrs)	↓	1.0 vs 2.7	↓	NS
Cao et al.	↓	↓	NR	NR	↓
Tian et al.	-0.99	-1.29 SMD	NR	↓ cost	RR 0.76
Kannan et al.	-3 to -8	↓ (GI recovery)	↓	↓	↓
Radha et al.	5–8 vs 10–11	<4 hrs in 8.9%	↓ (Day 3: 77.8% scored 3)	↓	13.3% vs. 31.1%
Samuel et al.	5–8 vs 10–11	NR	↓	↓	NR

Abbreviations: LOS = Length of Stay; POD = Postoperative Day; NR = Not Reported; ↓ = Decreased; NS = Not Significant

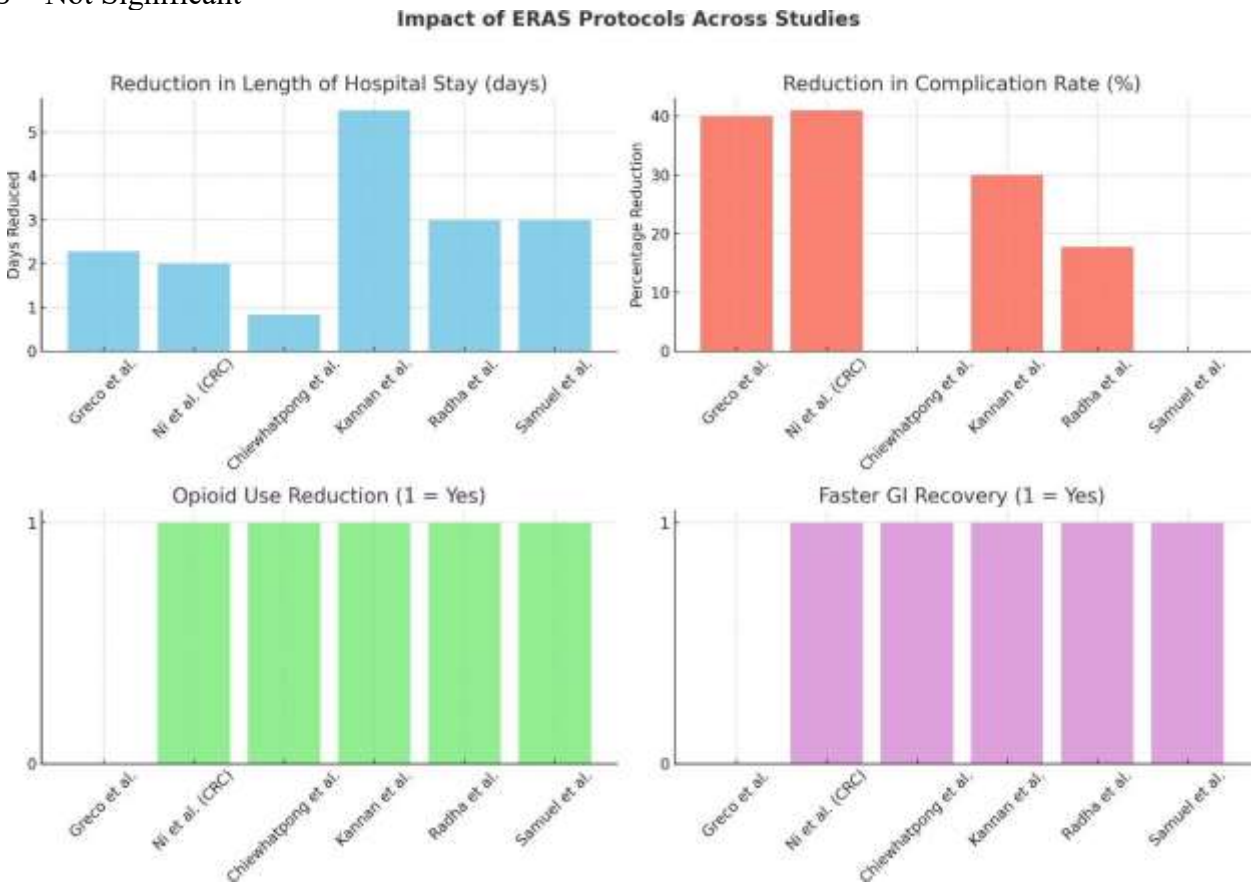

FIGURE 2: IMPACT OF ERAS PROTOCOL ON CLINICAL OUTCOMES

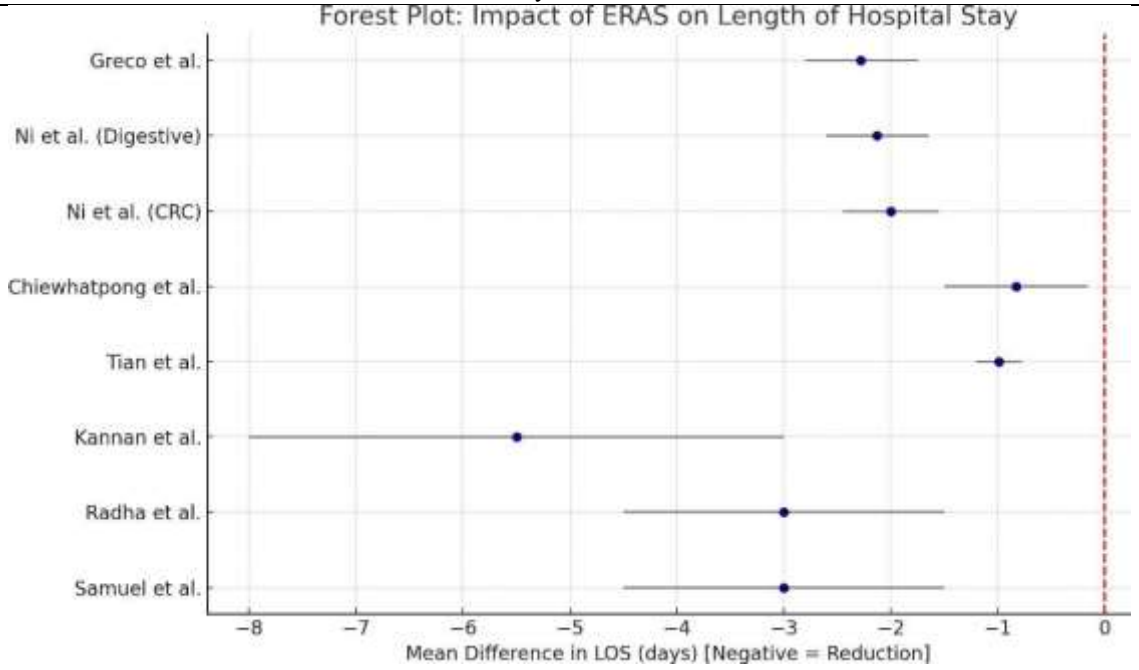

FIGURE 3: FOREST PLOT SHOWING IMPACT OF ERAS PROTOCOL ON LENGTH OF HOSPITAL STAY

DISCUSSION

Enhanced Recovery after Surgery (ERAS) protocols have emerged as a cornerstone in the effort to optimize perioperative care and improve surgical outcomes across various specialties. The studies included in this systematic review spanned over a decade and multiple surgical domains, allowing for a comprehensive evaluation of ERAS efficacy. The breadth of data—from meta-analyses to prospective trials—underscores the growing acceptance and application of ERAS principles globally. Colorectal surgery has been one of the most studied domains for ERAS implementation. Studies such as those by Greco et al. (2013), Ni et al. (2019), and Kannan et al. (2025) consistently demonstrate reductions in length of hospital stay (LOS) ranging from 2 to 8 days, alongside decreases in complication rates and opioid use (22, 25, 32). Greco et al. reported a weighted mean difference in LOS of -2.28 days and a relative risk (RR) of 0.60 for complications, which is consistent with the results observed in Kannan et al. and Samuel et al (22, 32, 34) These findings are particularly noteworthy given the high baseline morbidity associated with colorectal procedures. Samuel et al.'s Indian observational data further validates the protocol's effectiveness in diverse healthcare settings, indicating global relevance and scalability of ERAS (34).

ERAS implementation in gynecologic surgery has shown equally promising results, although fewer studies have explored this field in comparison to colorectal surgery. Radha et al. (2025) and Chiewhatpong et al. (2022) provide valuable prospective evidence of improved postoperative outcomes, such as reduced LOS, faster bowel function recovery, and lower pain scores (29, 33). Notably, Radha et al. demonstrated that 81.1% of ERAS patients were discharged within seven days compared to only 38.9% in the conventional group, highlighting significant operational benefits (33). Similarly, Chiewhatpong et al. reported reduced opioid consumption and improved pain scores (1.0 vs 2.7 on POD 1), supporting the multimodal analgesia principles central to ERAS (29).

Meta-analyses by Cao et al. (2022) and Ni et al. (2019) confirm these individual findings, pointing to consistent trends in faster gastrointestinal recovery and fewer complications (26, 30). These data help address previous hesitancies in adopting ERAS in gynecologic contexts by showcasing reproducibility and safety.

Ni et al.'s work on digestive and hepatectomy procedures (2015, 2019) demonstrated statistically significant reductions in LOS, time to flatus, and complications (23,25). These studies are notable for their methodological rigor and sample sizes, especially in the meta-analysis covering 25 RCTs. The consistency of findings across surgical sites (liver, colorectal, gastric) supports the hypothesis that

ERAS principles have broad applicability regardless of the anatomic location.

Tian et al. (2024) further supported this in the gastric surgery subgroup, showing reductions in inflammatory markers (CRP, IL-6), LOS, and complications (31). These biomarker changes also provide mechanistic insight into how ERAS protocols, through early mobilization and feeding, reduce surgical stress and promote physiological recovery.

Valecha et al. (2020) emphasize the central role anesthesiologists play in ERAS, particularly in preoperative counseling, intraoperative fluid management, and postoperative pain control (27). The anesthesiologist's involvement is pivotal in ensuring adherence to ERAS components such as minimal fasting, PONV prophylaxis, and opioid-sparing strategies. This multidisciplinary approach is echoed across studies and is likely a significant factor in the protocol's success.

Vignali et al. (2020) add an important layer by identifying predictors of ERAS failure and delayed discharge (28). Their retrospective analysis highlights the necessity of patient selection and individualized care plans. While most studies affirm the benefits of ERAS, this study serves as a reminder of the need for flexible and adaptive implementation.

LIMITATIONS AND RISK OF BIAS

The included studies generally display low to moderate risk of bias. While meta-analyses offer high-level evidence, their reliability hinges on the quality of the included trials. Observational studies, such as those by Samuel et al. and Vignali et al., though informative, lack the control mechanisms of randomized designs (28, 34). Dickson et al. (2017), for example, did not find a significant reduction in LOS or complications, which may be attributed to a small sample size and lack of blinding (24).

OUTCOME METRICS OVERVIEW

Quantitatively, most studies agree on several key outcome improvements: shorter LOS (often 2-8 days), faster return of bowel function (measured via time to flatus or defecation), reduced opioid use, and lower postoperative complication rates. While some heterogeneity in pain scoring methods and definitions exists, the general trend favors ERAS over traditional protocols (35).

CONCLUSION

The growing body of evidence strongly supports the integration of ERAS protocols into routine surgical care across multiple domains. While most data are centered on colorectal and gynecologic surgeries, the extension of benefits to hepatobiliary, gastric, and general abdominal surgeries is becoming increasingly evident. Future studies should focus on long-term outcomes, patient-reported quality of life, and cost-effectiveness to further validate and refine ERAS strategies. Standardization across institutions and greater emphasis on multidisciplinary collaboration will be key to the global success of ERAS initiatives.

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