

Review Article

Postoperative ileus after abdominal surgery: pathophysiology, prevention and contemporary management: a narrative review

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ABSTRACT

Postoperative ileus (POI) remains one of the most frequent complications following abdominal surgery, significantly contributing to delayed gastrointestinal recovery, prolonged hospitalization, and increased healthcare costs. Although a transient impairment of bowel motility is expected after surgical intervention, prolonged POI represents a pathologic state driven by complex perioperative mechanisms. To provide a focused narrative synthesis of the current evidence regarding the pathophysiology, epidemiology, risk factors, prevention strategies, and contemporary management of postoperative ileus in adult abdominal surgery. A targeted literature review was conducted using major biomedical databases, including PubMed/MEDLINE, Scopus, and Google Scholar. Emphasis was placed on high-impact studies published between 2000 and 2025, including randomized controlled trials, systematic and narrative reviews, and Enhanced Recovery After Surgery (ERAS) guidelines. Fifteen high-yield references were selected for narrative analysis based on clinical relevance and methodological robustness. POI is a multifactorial entity involving neurogenic inhibition, inflammatory activation, opioid-mediated dysmotility, and perioperative fluid disturbances that collectively impair coordinated gastrointestinal function. Identified risk factors include advanced age, open surgical approaches, prolonged operative time, and high perioperative opioid exposure. Preventive strategies centered on ERAS pathways — including minimally invasive surgery, opioid-sparing analgesia, early enteral nutrition, mobilization, and goal-directed fluid therapy — demonstrate consistent reductions in POI incidence and duration. Pharmacologic agents such as alvimopan provide adjunctive benefit, while non-pharmacologic measures, including sham feeding, further support gastrointestinal recovery. Effective mitigation of postoperative ileus relies on comprehensive, protocol-driven perioperative care rather than isolated therapeutic interventions. Continued refinement of ERAS implementation, alongside emerging predictive and pharmacologic strategies, will be essential to optimize postoperative recovery and surgical outcomes.

Keywords: Postoperative ileus, Abdominal surgery, Gastrointestinal motility, Enhanced recovery after surgery, ERAS protocols, Opioid-sparing analgesia

INTRODUCTION

Background

Postoperative ileus (POI) represents a transient impairment of coordinated bowel motility following surgery, preventing effective transit of intestinal contents and tolerance of oral intake. Although a physiologic degree of gastrointestinal dysmotility is expected after abdominal operations, prolonged POI constitutes one of the most frequent postoperative complications, particularly in colorectal and major intra-abdominal procedures.^{1,2} Clinically, POI manifests with abdominal distension, delayed flatus or stool passage, nausea, vomiting, and inability to tolerate diet. Beyond patient discomfort, its development is associated with increased morbidity, delayed recovery, prolonged hospitalization, and substantial healthcare costs.^{3,4}

Rationale

Despite advances in minimally invasive surgery, anesthetic techniques, and perioperative care pathways, POI continues to impose a significant burden on surgical systems worldwide. Its multifactorial pathophysiology, involving neurogenic, inflammatory, pharmacologic, and fluid-related mechanisms, makes prevention and management particularly challenging.^{2,3} Enhanced Recovery After Surgery (ERAS) protocols and opioid-sparing strategies have demonstrated measurable improvements; however, variability in implementation and outcomes persists.^{5,6} A focused synthesis of high-yield evidence is therefore valuable for guiding contemporary surgical practice.

Objective

This narrative mini-review aims to provide a concise and clinically oriented overview of postoperative ileus, summarizing its pathophysiology, epidemiology, risk factors, prevention strategies, and current management approaches, with emphasis on evidence-based perioperative interventions.

METHODS

Literature search

A focused literature search was conducted across major biomedical databases, including PubMed/MEDLINE, Scopus, and Google Scholar. Keywords and MeSH terms included: “Postoperative ileus”, “Prolonged ileus”, “Abdominal surgery recovery”, “Enhanced recovery after surgery”, “Alvimopan”, “Bowel motility postoperative”.

The search emphasized literature published between 2000 and 2025, while seminal earlier studies were included when historically relevant. Priority was given to randomized trials, major reviews, ERAS guidelines, and high-impact surgical journals.

Selection criteria

Studies were selected based on their relevance to the pathophysiology, prevention, and management of POI in adult surgical populations. Priority was given to high-quality evidence, including randomized controlled trials evaluating pharmacologic or perioperative interventions, as well as systematic and narrative reviews synthesizing current knowledge on gastrointestinal recovery after abdominal surgery. In addition, international Enhanced Recovery After Surgery (ERAS) guidelines and consensus statements were incorporated due to their clinical applicability and influence on contemporary perioperative practice. Eligible studies included those focusing on mechanisms of POI development, perioperative risk factors, preventive strategies, and therapeutic interventions across general and colorectal surgery settings. Literature addressing both open and minimally invasive abdominal procedures was considered relevant for inclusion.

Exclusion criteria comprised case reports, small case series, and studies lacking generalizable clinical applicability. Publications focused exclusively on pediatric populations were excluded to maintain adult perioperative relevance. Likewise, literature addressing postoperative ileus in non-abdominal surgical contexts was not considered. Articles published in languages other than English or Spanish without accessible full translation were also excluded from review. Following application of these criteria, a total of 15 high-yield references were selected to provide a focused yet comprehensive narrative synthesis aligned with the scope of this mini-review.

PATHOPHYSIOLOGY OF POSTOPERATIVE ILEUS

POI is a multifactorial process resulting from the interplay of neurogenic, inflammatory, pharmacologic, and fluid-related mechanisms that collectively impair coordinated gastrointestinal motility following surgery. While transient dysmotility is considered physiologic after abdominal procedures, prolonged POI reflects sustained disruption of enteric function beyond expected recovery timelines.

The neurogenic component represents the earliest phase. Surgical incision and visceral manipulation activate inhibitory sympathetic spinal reflexes, which suppress parasympathetic-driven peristalsis. This neural inhibition affects gastric, small bowel, and colonic motility to varying degrees, explaining the segmental recovery pattern typically observed postoperatively.^{1,2}

A second and more sustained phase is mediated by inflammation. Mechanical handling of the intestine induces activation of resident macrophages within the muscularis externa. This triggers the release of pro-inflammatory cytokines, nitric oxide, and prostaglandins,

promoting leukocyte infiltration and smooth muscle dysfunction. The resulting inflammatory milieu contributes to prolonged dysmotility even after neural reflexes subside.^{2,3} Pharmacologic factors, particularly opioid analgesics, further exacerbate POI. Activation of peripheral μ -opioid receptors inhibits acetylcholine release in the myenteric plexus, reducing propulsive contractions while increasing fluid absorption and sphincter tone.¹ This opioid-induced gut dysfunction represents one of the most modifiable contributors to prolonged ileus.

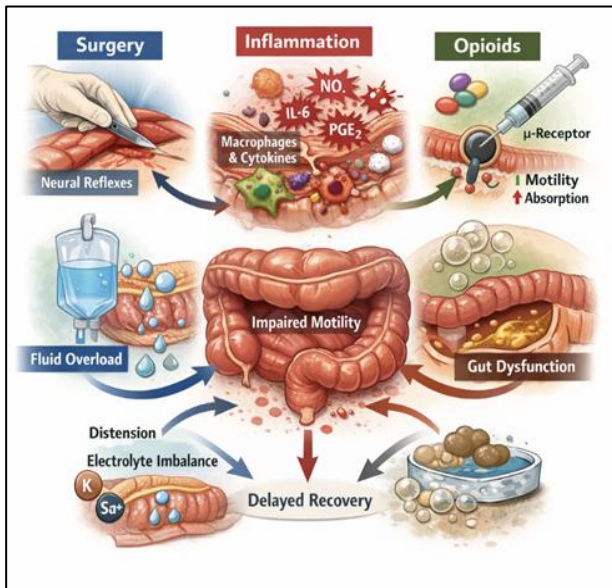


Figure 1: Pathophysiology of postoperative ileus: multifactorial mechanisms impairing gastrointestinal motility.

Additional mechanisms include bowel wall edema secondary to perioperative fluid overload, electrolyte imbalances, and hormonal stress responses. Collectively, these processes create a self-perpetuating cycle of impaired motility, luminal distension, and delayed gastrointestinal recovery. This illustrative diagram summarizes the principal pathophysiological mechanisms involved in the development of postoperative ileus (POI). Surgical incision and bowel manipulation initiate inhibitory neurogenic reflexes that suppress parasympathetic-mediated peristalsis. Concurrently, intestinal handling triggers an inflammatory cascade characterized by macrophage activation and the release of cytokines, nitric oxide, and prostaglandins, leading to smooth muscle dysfunction. Pharmacologic factors, particularly opioid analgesics, further exacerbate dysmotility through peripheral μ -opioid receptor activation, reducing propulsive contractions while increasing fluid absorption. Additional contributors include perioperative fluid overload, bowel wall edema, electrolyte imbalances, and luminal distension. The interaction of these mechanisms culminates in impaired gastrointestinal motility and delayed postoperative recovery.

EPIDEMIOLOGY AND CLINICAL BURDEN

The incidence of POI varies depending on surgical type, patient comorbidities, and definitions used across studies. It is most frequently reported following colorectal resections, major oncologic procedures, and operations requiring extensive bowel manipulation.⁵ Clinically significant POI has been associated with delayed return of bowel function, inability to tolerate oral intake, increased nasogastric tube utilization, and higher postoperative complication rates. Importantly, POI contributes substantially to prolonged hospital length of stay.

From a health systems perspective, the economic burden is considerable. Increased hospitalization days, supportive care requirements, and readmissions translate into markedly higher costs per surgical episode. Analyses from large healthcare databases estimate thousands of dollars in excess expenditure per patient affected by POI.⁴ Given rising surgical volumes worldwide, mitigation of POI has become a priority target within perioperative quality improvement initiatives.

RISK FACTORS

Risk factors for POI are multifactorial and can be broadly categorized into patient-related, surgical, and perioperative management variables. Patient-related factors include advanced age, diabetes mellitus, malnutrition, electrolyte disturbances, and preexisting gastrointestinal dysmotility. These variables may impair baseline enteric nervous system responsiveness and delay recovery. Surgical factors remain among the strongest predictors. Open abdominal surgery is consistently associated with higher POI incidence compared with minimally invasive approaches. Prolonged operative time, extensive bowel handling, intraoperative blood loss, and peritoneal contamination further increase risk.^{6,7}

Colorectal surgery carries particular susceptibility due to direct intestinal resection and anastomosis. Studies comparing laparoscopic and open colorectal procedures demonstrate significantly faster gastrointestinal recovery in minimally invasive cohorts.⁷ Perioperative pharmacologic exposure also plays a critical role. High-dose opioid analgesia, anticholinergic medications, and excessive intravenous fluid administration have all been linked to delayed bowel function. Recognition of these risk factors enables targeted preventive strategies and perioperative optimization.

PREVENTION STRATEGIES AND ERAS PROTOCOLS

Preventive care represents the most effective approach to POI mitigation. Enhanced Recovery After Surgery (ERAS) pathways integrate multimodal perioperative strategies designed to attenuate surgical stress, preserve

physiologic function, and accelerate postoperative recovery.⁸

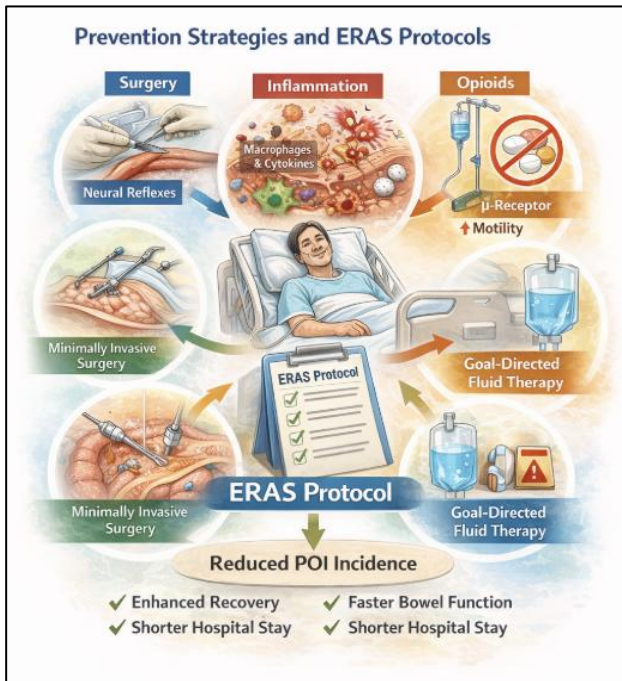


Figure 2: Prevention strategies and enhanced recovery after surgery (ERAS) protocols in the reduction of postoperative ileus.

Key ERAS elements impacting gastrointestinal motility include early enteral nutrition, which stimulates gut hormone release and peristalsis; early mobilization, which enhances autonomic function; and opioid-sparing multimodal analgesia. Minimally invasive surgical techniques reduce inflammatory response and bowel manipulation, thereby shortening ileus duration. Goal-directed fluid therapy also plays a pivotal role by preventing bowel wall edema associated with liberal crystalloid administration. Implementation of ERAS protocols has demonstrated consistent reductions in POI incidence, time to first flatus, and hospital length of stay across multiple surgical specialties.⁸⁻¹⁰

This schematic illustration summarizes the principal preventive strategies incorporated within ERAS pathways to mitigate POI. Multimodal perioperative interventions include early enteral nutrition to stimulate gastrointestinal hormone release and peristalsis, early mobilization to enhance autonomic and gastrointestinal function, and opioid-sparing analgesic protocols to minimize μ -opioid receptor-mediated gut inhibition. Minimally invasive surgical techniques reduce bowel manipulation and inflammatory response, thereby accelerating intestinal recovery. Goal-directed fluid therapy prevents bowel wall edema associated with excessive crystalloid administration. Collectively, these ERAS components synergistically contribute to reduced POI incidence, faster return of bowel function, enhanced postoperative recovery, and shorter hospital length of stay.

PHARMACOLOGIC MANAGEMENT

Pharmacologic interventions primarily target opioid-mediated gastrointestinal inhibition and motility dysfunction. Alvimopan, a peripherally acting μ -opioid receptor antagonist, selectively blocks opioid effects within the gastrointestinal tract without reversing central analgesia. Randomized controlled trials in bowel resection populations have shown that alvimopan reduces time to gastrointestinal recovery and hospital discharge readiness.¹¹ Other pharmacologic agents have been investigated with variable success. Prokinetic drugs such as metoclopramide and erythromycin aim to stimulate upper gastrointestinal motility, though evidence supporting their routine use in POI remains limited. Cholinergic agents such as neostigmine may be beneficial in refractory cases but require close monitoring due to cardiovascular side effects.¹² Overall, pharmacologic therapy is best considered adjunctive to preventive perioperative strategies rather than standalone treatment.

NON-PHARMACOLOGIC INTERVENTIONS

Non-pharmacologic adjuncts offer low-risk strategies to promote gastrointestinal recovery. Chewing gum, often described as “sham feeding,” activates cephalic-vagal pathways and stimulates gastrointestinal hormone secretion. Meta-analyses demonstrate modest but statistically significant reductions in time to flatus and bowel movement following abdominal surgery.¹³⁻¹⁵

Thoracic epidural analgesia may reduce opioid requirements while enhancing parasympathetic tone. Similarly, laparoscopic approaches consistently demonstrate faster return of bowel function compared with open surgery.

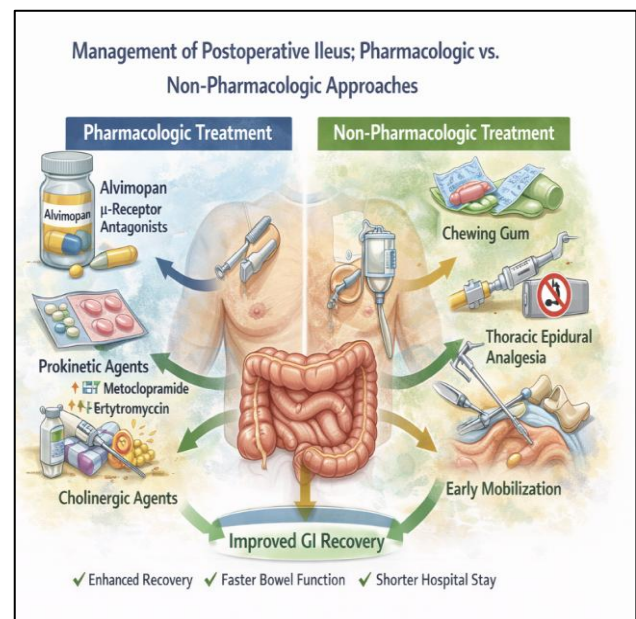


Figure 3: Risk factors associated with the development of postoperative ileus.

Collectively, these interventions contribute to a multimodal framework aimed at minimizing ileus duration. This schematic illustration summarizes the principal risk factors associated with the development of postoperative ileus (POI), categorized into patient-related, surgical, and perioperative management variables. Patient-related factors include advanced age, metabolic comorbidities such as diabetes mellitus, malnutrition, electrolyte imbalances, and baseline gastrointestinal dysmotility, all of which may impair enteric nervous system recovery. Surgical contributors

encompass open abdominal approaches, prolonged operative time, extensive bowel manipulation, intraoperative blood loss, and colorectal resections, which are particularly associated with higher POI incidence.

Perioperative factors include high-dose opioid analgesia, anticholinergic medication exposure, and excessive intravenous fluid administration leading to bowel wall edema. Recognition of these risk determinants is essential for perioperative risk stratification and implementation of targeted preventive strategies.

Table 1: Pharmacologic and non-pharmacologic interventions for the prevention and management of postoperative ileus.

Intervention type	Agent / strategy	Mechanism of action	Clinical effect on POI	Evidence level	Key considerations
Pharmacologic	Alvimopan	Peripheral μ -opioid receptor antagonist; blocks opioid effects in the GI tract without affecting central analgesia	Reduces time to bowel function recovery and hospital discharge readiness	Randomized controlled trials	Approved for bowel resection; cost and access may limit use. ¹¹
Pharmacologic	Metoclopramide	Dopamine receptor antagonist; enhances upper gastrointestinal motility	Modest effect; limited impact on colonic motility	Heterogeneous clinical data	More useful for gastric emptying than ileus resolution. ¹²
Pharmacologic	Erythromycin	Motilin receptor agonist; stimulates gastric contractions	Variable benefit; inconsistent evidence in POI	Limited trials	Tachyphylaxis limits prolonged efficacy. ¹²
Pharmacologic	Neostigmine	Acetylcholinesterase inhibitor; increases cholinergic activity and peristalsis	May improve motility in refractory ileus	Small studies / selective use	Requires cardiac monitoring (bradycardia risk). ¹²
Non-pharmacologic	Chewing gum (sham feeding)	Activates cephalic-vagal reflexes; stimulates GI hormone secretion	Shortens time to flatus and bowel movement	Meta-analyses	Low cost, low risk, widely applicable. ¹³⁻¹⁵
Non-pharmacologic	Early enteral nutrition	Stimulates peristalsis and gut hormone release	Accelerates gastrointestinal recovery	ERAS guidelines	Must be protocolized. ⁸⁻¹⁰
Non-pharmacologic	Early mobilization	Enhances autonomic function and gastrointestinal motility	Reduces ileus duration	ERAS-based evidence	Dependent on patient compliance. ⁸⁻¹⁰
Non-pharmacologic	Thoracic epidural analgesia	Reduces opioid use; enhances parasympathetic tone	Improves bowel function recovery	Comparative perioperative studies	Requires anesthetic expertise. ⁸⁻¹⁰
Non-pharmacologic	Minimally invasive surgery	Reduces bowel manipulation and inflammatory response	Lower POI incidence vs open surgery	Comparative surgical studies	Procedure-dependent feasibility. ⁷⁻¹⁰
Non-pharmacologic	Goal-directed fluid therapy	Prevents bowel wall edema from fluid overload	Facilitates earlier gastrointestinal recovery	ERAS protocols	Requires hemodynamic monitoring. ⁸⁻¹⁰

Limitations and future directions

This narrative mini-review is limited by its focused design and selective reference inclusion, which may not capture the entirety of emerging POI literature. Heterogeneity in POI definitions across studies also complicates comparative interpretation of outcomes. Future research should prioritize standardized diagnostic criteria, biomarker development for early prediction, and integration of artificial intelligence-based perioperative risk modeling. Investigation into novel prokinetic agents and optimization of ERAS compliance metrics also represents promising avenues.

CONCLUSION

Postoperative ileus remains one of the most prevalent and clinically impactful complications following abdominal surgery, representing a major determinant of delayed recovery, prolonged hospitalization, and increased healthcare utilization. Its pathogenesis is inherently multifactorial, encompassing neurogenic inhibition, inflammatory activation, opioid-mediated dysmotility, and perioperative fluid and metabolic disturbances that collectively disrupt coordinated gastrointestinal function. Contemporary evidence underscores that the most effective strategy for POI mitigation lies not in isolated therapeutic interventions, but in comprehensive preventive perioperative care. ERAS pathways have redefined postoperative management by integrating multimodal approaches, including minimally invasive surgery, opioid-sparing analgesia, early enteral nutrition, goal-directed fluid therapy, and early mobilization, all of which synergistically accelerate gastrointestinal recovery.

Pharmacologic therapies, particularly peripherally acting μ -opioid receptor antagonists such as alvimopan, provide additional benefit in selected surgical populations, though their role remains adjunctive to standardized recovery protocols. Similarly, low-risk non-pharmacologic measures, including sham feeding and neuraxial analgesia, contribute to multimodal recovery frameworks. Despite meaningful advances, variability in POI definitions, heterogeneity in perioperative practices, and inconsistent protocol adherence continue to limit outcome optimization. Future research should prioritize standardization of diagnostic criteria, development of predictive risk models, and exploration of novel prokinetic and anti-inflammatory therapies.

Ultimately, reducing the burden of postoperative ileus requires a paradigm shift from reactive treatment to proactive, protocol-driven perioperative care, positioning gastrointestinal recovery as a central metric of surgical quality and patient-centered outcomes.

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