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REVIEW

# Postoperative ileus: Pathophysiology, incidence, and prevention



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## KEYWORDS

Postoperative ileus;  
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**Summary** Postoperative ileus (POI) is a major focus of concern for surgeons because it increases duration of hospitalization, cost of care, and postoperative morbidity. The definition of POI is relatively consensual albeit with a variable definition of interval to resolution ranging from 2 to 7 days for different authors. This variation, however, leads to non-reproducibility of studies and difficulties in interpreting the results. Certain risk factors for POI, such as male gender, advanced age and major blood loss, have been repeatedly described in the literature. Understanding of the pathophysiology of POI has helped combat and prevent its occurrence. But despite preventive and therapeutic efforts arising from such knowledge, 10 to 30% of patients still develop POI after abdominal surgery. In France, pharmacological prevention is limited by the unavailability of effective drugs. Perioperative nutrition is very important, as well as limitation of preoperative fasting to 6 hours for solid food and 2 hours for liquids, and virtually no fasting in the postoperative period. Coffee and chewing gum also play a preventive role for POI. The advent of laparoscopy has led to a significant improvement in the recovery of gastrointestinal function. Enhanced recovery programs, grouping together all measures for prevention or cure of POI by addressing the mechanisms of POI, has reduced the duration of hospitalization, morbidity and interval to resumption of transit.

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### Key points

- There is no consensual definition of a normal interval to resumption of transit resulting in non-reproducible results in studies of postoperative ileus.
- Postoperative ileus occurs following 10 to 30% of abdominal surgeries.
- The main risk factors are male gender, advanced age and the volume of blood loss.
- Ileus occurs in three phases: a neurological phase, an inflammatory phase, and a phase of activation of the vagal nervous system.
- In France, pharmacological prevention is limited by the non-availability of effective drugs.
- Enhanced recovery after surgery programs make use of several measures aimed at the different phases of ileus to reduce the interval to ROT.

## Introduction

Postoperative ileus (POI) has become a public health problem because of its role in postoperative morbidity and increased hospital stay [1–3]. Its reported rate of incidence varies among different authors and specialties, but is generally between 10 and 30% for abdominal surgery [4–11]. The consequences of POI can be severe since it causes gastrointestinal stasis with a risk of nausea and vomiting, which can be complicated by pulmonary aspiration. Besides this extremely serious complication, POI may also cause dehydration, electrolyte imbalance, or sepsis.

Recent recommendations for perioperative management (initially proposed by the ERAS group [12] and thereafter by the GRACE Association [13]) have enabled a net decrease in hospital stay and morbidity, but also a decrease in the interval to resumption of transit (ROT) [14–17]. ERAS management protocols include preoperative measures (patient information, sweetened oral liquids, no bowel preparation, avoidance of routine anxiolytic premedication, reduction of preoperative fasting period to 2 hours for liquids and 6 hours for solids), intraoperative measures (preference for laparoscopic approach, avoidance of bladder, gastric and abdominal drains, optimal fluid replacement based on suitable monitoring, avoidance of long-acting opioids, active measures to combat hypothermia, nausea and vomiting), and postoperative measures (immediate postoperative removal of the nasogastric tube, feeding on the evening of the intervention, a multimodal analgesic program, mobilization on the evening of surgery, removal of the bladder catheter on day 1 [D1], limitation of postoperative intravenous fluids, thromboprophylaxis, digestive stimulation by gum chewing, and carbohydrate loading [18,19]). The purpose of enhanced recovery programs is to reduce perioperative stress, in hope of facilitating the return of patient autonomy.

The mechanisms that reduce the interval to ROT are beginning to be understood, but much more remains to be determined. It is probably for this reason that no author has managed to propose a consensual cut-off interval for defining POI and that treatment and prevention of POI are only partially effective.

This review is intended to update knowledge with regard to POI, and to describe each measure used to combat POI as it derives from our pathophysiological understanding of the

condition. Better understanding of POI provides insight into clinical studies in a context where there is no consensual definition.

## Definition and risk factors

POI is a physiological arrest of gastrointestinal transit in response to surgical stress. In 2005, Kelhet et al. underscored the need for a consensual definition of POI, especially regarding what constitutes a normal time interval to ROT [20]. In 2016, several authors have noted the persistent lack of such a definition [17,21].

In the literature, various qualifiers have been applied to POI: “pathological” or “prolonged” (longer than the presumed normal duration), or “secondary” (linked to extrinsic causes such as postoperative peritonitis...).

In 2013, Vather et al., in their conclusions to a meta-analysis, proposed a clinical definition of POI [10] defined by the combination of at least two of the following five signs on or after the fourth postoperative day, with no improvement since surgery:

- nausea and vomiting;
- an inability to tolerate solid or semi-liquid diet during the preceding 24 hours;
- no gas or stool for the preceding 24 hours;
- abdominal distension;
- radiological evidence of ileus.

These data were confirmed in the works of van Bree et al. [22] who considered the best endpoint to define ROT to be the combination of passage of stool and tolerance of solid food.

However, there is still no real consensus for a “normal” interval that would distinguish between pathological POI and physiological POI. The cut-off limit used by various authors to describe pathological POI varies from 1 to 7 days (Table 1) and this variable limit leads to non-reproducibility of studies dealing with POI because their rates vary from one to threefold for different teams. For example, in the same patient population and depending on the cut-off interval selected, we found enormous variation in the rate of POI ranging from 2% for a cut-off of 7 days and 60% for a cut-off of 1 day [17].

A physiological study, published in 1990, concluded that gastric motility recovered within 24–48 hours, small intestinal motility within 12–24 hours, and colonic motility in 3–5 days [23]. Advances in management have probably reduced these physiological durations since several teams have reported a median ROT (using the endpoint of Van Bree et al. [22]) of 24–48 hours.

## Risk factors

Several risk factors have been identified in the literature but the studies are not reproducible for the reasons cited above. In fact, the low reliability of the data does not allow this problem to be effectively addressed. Table 1 reports the various reported risk factors, and the definition of “normal” interval to ROT used for data analysis. Despite this lack of reproducibility, various authors have repeatedly identified several risk factors, such as male gender, advanced age or significant blood loss [4,5,7,9,10].

Similarly, ROT is affected by the surgical approach, i.e., decreased for laparoscopy compared to laparotomy [24,25]. However, “hand-assisted” laparoscopy and robotic surgery do not appear to provide similar benefit compared

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