BMJ Best Practice

lleus

Straight to the point of care



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Overview

Summary

lleus is a slowing of gastrointestinal motility that is not associated with mechanical obstruction.

Most commonly presents following surgery and usually lasts 2-4 days.

Prolonged postoperative ileus contributes significantly to longer hospitalization and increased healthcare costs.

Treatment includes bowel rest, supportive care, and treatment of any underlying exacerbating factors.

Prevention requires a multimodal approach, including the substitution of postoperative opioid analgesia with nonsteroidal anti-inflammatory drugs and thoracic epidural analgesia, early enteral feeding, early ambulation, and the use of laparoscopy rather than laparotomy whenever possible.

Definition

Ileus is a slowing of gastrointestinal (GI) motility accompanied by distention in the absence of a mechanical intestinal obstruction.[1] It is a diagnosis of exclusion after bowel obstruction has been ruled out. It usually occurs in response to physiologic stress, including surgery, sepsis, metabolic derangements, and GI diseases.

This topic covers the diagnosis and management of ileus in adults.

Epidemiology

Ileus is commonly seen in the postoperative setting. Prevalence is difficult to assess because ileus is often considered a normal consequence of surgery so is not always reported as a complication. Furthermore, the various definitions in the literature are inconsistent, making the incidence even more difficult to quantify.[5] [6]

About 22 million inpatient surgical procedures are performed each year in the US, and about 2.7 million of these patients develop postoperative ileus lasting more than one day.[7] Laparotomy is reported to be associated with up to 10% rate of ileus.[8] Postoperative ileus occurs in up to 1 in 8 patients undergoing abdominal surgery but it can also occur following other types of surgery such as cardiac or orthopedic procedures.[9] [10] [11] [12] [13]

Postoperative ileus is responsible for a significant prolongation of hospital stay, 30-day readmission, and for significant healthcare costs.[14] [15] Approximately 10% of patients are readmitted to hospital after undergoing major abdominal surgery, and approximately half of these readmissions are due to delayed onset of postoperative ileus.[16] Ileus also increases hospital costs due to necessary testing, such as computed tomographic scans, when the patients are readmitted, which means postoperative ileus results in costs comparable to those for other more serious postoperative complications.[17]

Risk factors

Strong

abdominal surgery

This is a major risk factor.

The stress responses to incision of the peritoneum, to bowel manipulation, and to general anesthesia, and postoperative factors such as immobilization, use of analgesics, pain, and bowel rest, contribute to the development of ileus.[3]

acute/systemic illness (e.g., myocardial infarction, pneumonia, acute cholecystitis, pancreatitis, sepsis, multi-organ trauma)

Caused by a combination of the local and systemic release of inflammatory cytokines and other stressrelated hormones.[19] [23] [24] Poor cardiac output or hypotension from critical illness of any cause can result in gut ischemia with associated gastrointestinal dysfunction.[25] [26]

Weak

nonabdominal surgery

Thoracic, cardiac, or extremity surgery and general anesthesia, coupled with postoperative factors such as immobilization, use of analgesics, pain, and bowel rest, contribute to the development of ileus.[18] [19]

electrolyte imbalance

Particularly sodium, potassium, chloride, magnesium, and calcium.

May be a consequence of ileus or an exacerbating factor.

Patients who are "nil per os" (nil by mouth), and who may have a nasogastric tube in place or are vomiting, are predisposed to abnormalities such as hypochloremia or hypokalemia.

In turn, these or other electrolyte problems may interfere with the normal motility of the bowel, exacerbating the condition.

opioid analgesics, anticholinergics, or anesthetic gases

Opioid-based analgesics interfere with gastrointestinal motility.[3] This often manifests as severe constipation, but may also present as ileus.

Some anticholinergic and anesthetic agents (e.g., atropine, halothane, enflurane) affect motility, contributing to the development of postoperative ileus.[27]

comorbidities (e.g., diabetes mellitus, cardiovascular insufficiency, Chagas disease, scleroderma)

Gastroparesis can be a complication of diabetes mellitus.

Autoimmune or infectious diseases, such as scleroderma or Chagas disease, are associated with motility disorders and may exacerbate ileus.

Etiology

The etiology is multifactorial and is related to a disruption in the normal motility of the intestine. Predisposing factors include:

- Electrolyte imbalances
- · Release of inflammatory agents
- · Deregulation of the sympathetic and parasympathetic input to the gastrointestinal (GI) tract
- · Exogenous compounds, such as analgesics and anesthetics.

Predisposing factors are most likely to occur after GI surgery, but may also occur with:

- Nonabdominal surgery (thoracic, cardiac, or extremity)[18] [19]
- Other retroperitoneal pathology such as aortic or urinary disorders[3]
- Acute or systemic illness (e.g., myocardial infarction, acute cholecystitis, pancreatitis, peritonitis, sepsis)
- Pharmacologic agents (e.g., opioids, anticholinergics)
- Multi-organ trauma
- Cardiopulmonary bypass.[10] [19]

Pathophysiology

Gastrointestinal motility is controlled by neurogenic, hormonal, and inflammatory factors.[20] During the postoperative period, catecholamine levels are higher than usual, which is believed to contribute to decreased GI motility. This also occurs in other nonsurgical conditions, including systemic illnesses, sepsis, and trauma. GI motility is inhibited by nitric oxide, vasoactive intestinal peptide, calcitonin gene-related peptide, and substance P.[3] [21] Studies in animals have shown that antagonists to these substances may improve postoperative ileus, although this has not been substantiated in humans.

In addition, corticotropin-releasing factor levels rise as part of the stress response, causing a delay in gastric emptying. The macrophages in the wall of the intestine are activated by bowel manipulation and secrete various substances (nitric oxide, prostaglandins, COX-2, interleukin-6, tissue necrosis factor alpha) that contribute to the decreased motility of the GI tract.[21] [22]

Classification

Classification according to type of ileus

Postoperative ileus

- The normal slowing of bowel motility in response to the trauma of surgery. This usually follows GI surgery but is also associated with nonabdominal surgery.
- Gastric motility recovers first, followed by small bowel motility (in 24 to 48 hours) then colon motility (in about 48 to 72 hours).[2]
- Prolonged postoperative ileus is defined as two or more of the following occurring on or after day 4 postsurgery without prior resolution of postoperative ileus: vomiting, abdominal distension, inability to tolerate oral feeding, absence of flatus.[3] [4] Definitions across literature for return of bowel function after GI surgery are very varied, with the most commonly reported outcome measure being "time to passage of flatus".[5]

lleus with systemic illness

• Paralysis of bowel motility accompanying certain acute illnesses, such as myocardial infarction, acute pancreatitis, sepsis, and GI disorders.

Narcotic ileus

• Slowing of bowel motility associated with opioid use, thought to be caused by opioid action on mu receptors.[3]

Case history

Case history #1

A 52-year-old man undergoes an elective sigmoid resection with primary colorectal anastomosis for chronic diverticulitis. The operative course is routine. Postoperatively, he starts on a clear-liquid diet and receives morphine via patient-controlled analgesia pump. On the second postoperative day, he has a distended abdomen, is nauseated, and has not passed flatus. He vomits repeatedly and requires nasogastric decompression.

Other presentations

lleus may also occur with acute systemic illness, such as myocardial infarction, metabolic derangements, sepsis, and gastrointestinal diseases.

Recommendations

Key Recommendations

Clinical diagnosis is based on the history and physical exam. The goals of further diagnostic evaluation are to identify any reversible conditions and to differentiate between ileus and mechanical bowel obstruction. Mechanical obstruction can be excluded with the following tests.[77]

- Computed tomographic (CT) scan of the abdomen and pelvis.
- · Water-soluble small bowel series and/or contrast enema.

History

Patients typically complain of nausea, vomiting, hiccups, constipation (which may be severe), or failure to pass flatus, and discomfort from gaseous distention and cramping, usually without significant pain.[3] [78]

History of postoperative ileus, gastrointestinal (GI) motility disorders, and recent surgery, and current medications and comorbidities should be evaluated.

Most patients presenting with ileus will have recently undergone surgery, and the surgeon should have an understanding of potential intra-operative complications (e.g., bowel resection should raise concern of possible technical problems with the anastomosis; recent cardiac surgery may be associated with low-flow-state intestinal ischemia). The current medication history is helpful, as many sedatives and analgesics slow down GI motility.[3] Hospitalized patients are often placed on several of these types of medications concurrently.

It is important to find out about other risk factors for ileus including history of recent acute systemic illnesses (e.g., myocardial infarction, pneumonia, acute cholecystitis, pancreatitis, sepsis).[24]

Physical exam

The abdominal examination reveals distention but without significant tenderness to palpation. The abdomen should be examined for any evidence of mechanical obstruction such as hernias, and for any evidence of peritoneal inflammation.

Vital signs should be evaluated as the patient may be hypovolemic or hemodynamically unstable due to underlying conditions. A hypovolemic patient may be expected to present with mild tachycardia or hypotension, though severe abnormalities could indicate a different diagnosis. Hypovolemia may also manifest as low urine output (normal urine output for an adult is above 0.5 mL/kg/hour).

Initial tests

Electrolytes, complete blood count, and abdominal and pelvic CT scan are the initial tests to perform in anyone with a clinical diagnosis of ileus.^[77] Contrast-enhanced CT acquisition is sufficient for the assessment of possible small bowel obstruction (SBO); unenhanced images do not add diagnostic information.^[79]

Ileus and obstruction may be accompanied by hypokalemia and hypochloremia. Hypermagnesemia may be present. Alkalosis may be present in dehydrated states, and acidosis may be present in intestinal ischemia. Alkalosis and/or acidosis can be inferred from the carbon dioxide level that is found on a standard chemistry panel. A significantly elevated white blood cell level is an unexpected finding in a patient with ileus, and another cause should be considered.

For those on parenteral nutrition, electrolytes should be checked daily to identify electrolyte abnormalities associated with postoperative intravenous feeding and the nothing by mouth state.

Further investigations

Liver function tests as well as amylase and lipase are useful when causes for ileus other than postsurgery, such as cholecystitis or pancreatitis, are suspected.

In postoperative patients, a CT scan should be performed if the presumed ileus has not resolved in 5-7 days, or the clinical condition of the patient worsens.[32] CT scan of the abdomen may be performed with intravenous contrast and oral water-soluble contrast. In the immediate postoperative period, CT scan with oral contrast is the method of choice in differentiating prolonged ileus and mechanical obstruction.[80] [81] This may help to identify a transition zone in a mechanical obstruction, and exclude any intra-abdominal fluid collections or anastomotic complications. Contrast-enhanced CT acquisition is sufficient for the assessment of possible SBO; use of unenhanced CT alongside contrast-enhanced imaging does not add diagnostic information and should be avoided.[79]

In cases of prolonged ileus (occurring on or after day 4 postsurgery without prior resolution of postoperative ileus), a small bowel series may be done to evaluate for any evidence of mechanical obstruction that may have been missed on a CT scan.[3] [4]

Rarely, in patients with other risk factors for gastroparesis or gastric outlet obstruction, a gastric emptying study may be considered.



CT scan with intravenous and oral contrast showing fluid-filled small intestine and cecum in ileus From the personal collection of Dr Paula I. Denoya



CT scan with intravenous and oral contrast showing fluid-filled small intestine in ileus From the personal collection of Dr Paula I. Denoya



Small bowel series showing dilated small bowel loops in ileus; nasogastric tube is seen curled in the stomach From the personal collection of Dr Paula I. Denoya



Small bowel series showing dilated contrast-filled small bowel loops in ileus; some contrast is visible in the right colon From the personal collection of Dr Paula I. Denoya

In patients with renal insufficiency, caution should be exercised prior to administering intravenous contrast, which can be avoided if necessary. Water-soluble contrast should be used in place of barium, as barium contrast preparations are contraindicated in patients with suspected GI tract perforation. Barium peritonitis is associated with a high mortality. Also, barium may become inspissated in the bowel if it remains there for a significant amount of time, as may happen in an ileus or obstruction.

History and exam

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Key diagnostic factors

nausea and vomiting (common)

Nausea is present in almost all patients.

Vomiting may not be present but may be an indication for placement of a nasogastric tube for decompression.[3][32]

abdominal distention (common)

Almost always present but nonspecific.[3]

no features of mechanical obstruction or peritoneal inflammation (e.g., abdominal hernia, peritoneal signs) (common)

It is important to look for any evidence of mechanical obstruction (e.g., hernia) as the treatment differs and a delay in diagnosis and treatment can have serious consequences.

Evidence of peritoneal inflammation, such as peritonitis and rebound tenderness, is an unusual finding and should alert as to other serious intra-abdominal disease processes.

Increasing amounts of pain or opioid requirements is another sign that the patient may have an acute bowel obstruction or other intra-abdominal disease rather than a simple ileus.

Other diagnostic factors

obstipation (severe constipation with no passage of stool or flatus) (common)

Decreased flatus and passage of stool is a common finding.

However, the presence of bowel movements does not exclude ileus.

discomfort and abdominal cramping (common)

Usually without significant pain.

decreased or hypoactive bowel sounds (common)

Decreased bowel sounds are a nonspecific sign but are typically found in ileus. This is different from small bowel obstruction, where hyperactive bowel sounds may be found.

hypovolemia (uncommon)

Not specific but may be present in patients with limited oral intake and vomiting.

Tachycardia, hypotension, and oliguria are specific findings in this condition.

Tests

1st test to order

Test	Result
 serum electrolytes Performed to evaluate severity and to guide supportive treatment. A nonspecific test. Elevated BUN and creatinine may be present in the dehydrated patient. 	hypokalemia, hypochloremia, alkalosis; elevated blood urea and serum creatinine may occur with dehydration
serum magnesium Electrolyte imbalance, particularly hypermagnesemia, has been associated with ileus.[82]	hypermagnesemia may be present
 CBC Performed to evaluate for evidence of infection. A significantly elevated WBC, especially if accompanied by abdominal tenderness or peritoneal signs, is a sign that a more severe condition (e.g., sepsis, peritonitis) is present. 	normal or slightly elevated WBC
abdomen and pelvis CT scan (with intravenous contrast and oral water soluble contrast) Performed to exclude other causes of distention and obstipation, and to exclude a mechanical obstruction.[77] [80] [81] CT scan shows fluid-filled intestines and no evidence of transition zone indicating mechanical bowel obstruction, bowel perforation, intra-abdominal abscess, or other gastrointestinal pathology.	fluid-filled intestines; distended stomach

Diagnosis



CT scan with intravenous and oral contrast showing fluid-filled small intestine and cecum in ileus From the personal collection of Dr Paula I. Denoya



CT scan with intravenous and oral contrast showing fluid-filled small intestine in ileus From the personal collection of Dr Paula I. Denoya

Result

Diagnosis

Test	Result
In postoperative patients, a CT scan should be performed if the presumed ileus has not resolved in 5-7 days, or the clinical condition of the patient worsens.[32]	
In the immediate postoperative period, CT scan with oral contrast is the method of choice in differentiating prolonged ileus and mechanical obstruction.[80] [81]	
Contrast-enhanced CT acquisition is sufficient for the assessment of possible small bowel obstruction; use of unenhanced CT alongside contrast-enhanced imaging does not add diagnostic information and should be avoided.[79]	
In patients with renal insufficiency, caution should be exercised prior to administering intravenous contrast, which can be avoided if necessary.	
Water-soluble contrast should be used in place of barium, which is contraindicated if there is a possible perforation.	

Other tests to consider

Test	Result
serum LFTs To exclude other conditions that may contribute to ileus, such as cholecystitis or pancreatitis.	normal in ileus
serum amylase To exclude other conditions that may contribute to ileus, such as cholecystitis or pancreatitis.	normal in ileus
serum lipase To exclude other conditions that may contribute to ileus, such as cholecystitis or pancreatitis.	normal in ileus
small bowel series Performed if CT scan is not diagnostic but there is still suspicion of intestinal obstruction. To exclude a point of mechanical obstruction in patients with prolonged postoperative ileus.	no evidence of obstruction or bowel leak

Small bowel series showing dilated small bowel loops in ileus; nasogastric tube is seen curled in the stomach From the personal collection of Dr Paula I. Denoya

Test	Result
<image/> <image/> <text></text>	
gastric emptying study Consider performing this test in cases of prolonged ileus, especially in patients with comorbidities such as long-standing diabetes mellitus, which is associated with gastroparesis	delayed gastric emptying
miento abboliator mai gabiloparobio.	

Differentials

Condition	Differentiating signs / symptoms	Differentiating tests	
Mechanical bowel obstruction	Localized pain; symptoms start acutely.	 Shares many of the same signs and symptoms as ileus, so differentiating can be challenging. Obstructive series shows step-wise airfluid levels and very dilated loops of small bowel. CT scan shows a transition zone (dilated loops leading up to collapsed loops of bowel), and oral contrast does not reach distal to the point of obstruction. 	
Pseudo-obstruction (Ogilvie syndrome)	 Crampy abdominal pain, anorexia. Typically seen in bed-bound, older or chronically ill patients with polypharmacy.[17][83] [84] 	 X-rays show isolated large bowel dilatation. CT scan or Gastrografin® enema will show no evidence of mechanical obstruction. 	
Gastroenteritis	 History should indicate a likely gastroenteritis, along with symptoms of diarrhea. It is generally self-limited. A patient with no risk factors for ileus and who has diarrhea is likely to have gastroenteritis. 	Clinical diagnosis. Further testing may be nonspecific and unhelpful.	
Pancreatitis	Acute abdominal pain.	 Elevated amylase and lipase. May have gallstones on right upper quadrant ultrasound. Abdominal CT scan shows diffuse or segmental enlargement of the pancreas with irregular contour and obliteration of the peripancreatic fat, necrosis, or pseudocysts. 	
Acute cholecystitis	 Pain in the epigastrum and right upper quadrant of the abdomen. 	 Distended gallbladder, thickened gallbladder wall, and presence of gallstones on right upper quadrant ultrasound. Abdominal CT scan shows gallbladder wall inflammation; linear high density areas in pericholecystic fat tissue. 	

Condition	Differentiating signs / symptoms	Differentiating tests
Bowel perforation	 Severe abdominal pain, fever. 	 Abdominal x-ray demonstrates free intraperitoneal air. A CT scan demonstrates bowel perforation.
Intra-abdominal abscess	 Fever, anorexia, crampy abdominal pain and tenderness. 	A CT scan demonstrates abscess.
Peritonitis	 Pain and tenderness of the abdominal wall. History and physical examination to evaluate for risk factors and elicit signs of peritonitis. 	A CT scan demonstrates peritonitis.
Intestinal pneumatosis	 Diarrhea, bloody stools, abdominal pain. 	A CT scan demonstrates pneumatosis.

Criteria

Duration of postoperative ileus

Typical or physiologic postoperative ileus

- The normal and expected slowing of bowel motility in response to the trauma of surgery.
- Gastric motility recovers first, followed by small bowel motility in 24 to 48 hours, and colon motility in about 48 to 72 hours.[2]

Prolonged postoperative ileus

• Defined as two or more of the following occurring on or after day 4 postsurgery without prior resolution of postoperative ileus: vomiting, abdominal distension, inability to tolerate oral feeding, absence of flatus.[3] [4]

DIAGNOSIS

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Recommendations

Key Recommendations

The treatment of ileus focuses on supportive care and correction of any underlying or predisposing conditions.

General management in all patients

All patients with ileus are made nothing by mouth (NPO) and require intravenous hydration. The initial choice of intravenous solution will depend on the baseline hydration state of the patient and the presence of comorbidities. A significantly hypovolemic patient may benefit from a bolus of several liters of normal saline. Following this initial hydration, the maintenance intravenous solution should be physiologic and provide some glucose. Fluids should be administered at a maintenance rate according to body weight. This rate should be tailored to the patient's urine output and hemodynamics.

Once ileus begins to resolve, as seen by passage of flatus and resolution of abdominal distention and nausea, the patient can be started on a liquid diet and advanced as tolerated.

Postoperative ileus

Attempts to prevent postoperative ileus should begin in the perioperative setting, including appropriate intra-operative fluid management and avoidance of opioid analgesia. Enhanced recovery after surgery (ERAS) pathways are increasingly utilized in an attempt to expedite recovery of intestinal function and shorten hospital length of stay.[3] [28] [32] The mainstays of ERAS pathways include minimally invasive surgery, avoiding opioids, multimodal pain control, early ambulation, and early intake of oral fluids and solids.[3] [28] [31] [32]

In patients undergoing surgery and requiring opioid analgesia, decreasing the use of systemically administered opioid analgesics helps to prevent postoperative ileus.[28] Patient-controlled analgesia pumps are beneficial as they reduce the overall amount of opioid given compared with round-the-clock analgesic dosing administered by a nurse.[33] Useful adjuncts for pain management include nonsteroidal anti-inflammatory drugs (NSAIDs) such as ketorolac, other nonopioid analgesics such as acetaminophen, and local anesthetics administered via epidural.[3] [34] [35] [36] [37] [38] [39] [40] [41] [42] [53] [86]

Several randomized controlled trials and meta-analyses have shown decreased duration of postoperative ileus in patients given chewing gum after surgery.[60] [68] [69] [70] [71] [72] [73] [74] [75] It is a safe and easy modality that can be utilized in most patients; however, it is not routinely recommended because the quality of evidence is very low.[28] [76]

Patients with significant abdominal distention and repeated vomiting should have a nasogastric (NG) tube placed.[3] [32] Gastric output should be measured and lost volume should be replaced with an intravenous physiologic saline solution. The decision to remove the NG tube is based on measured gastric output over time and clinical resolution of ileus. The patient is assessed for absence of abdominal distention and cramping, decreasing NG tube output, and passage of flatus and stool with a view to removal of the NG tube. The NG tube may require reinsertion if the patient again displays evidence of ongoing ileus with abdominal distention and vomiting. Studies have shown that routine NG decompression is unnecessary and may be detrimental.[87] Therefore, routine NG decompression is reserved for selective use.[87] Often, orogastric decompression is performed intra-operatively, but the tube is removed at the completion of surgery.[28]

Patients with prolonged postoperative ileus (ileus on or after day 4 postsurgery without prior resolution of postoperative ileus) may not have any oral intake for several weeks. Parenteral nutrition is recommended for patients who do not have any oral intake for more than 7 days.[3] [78] It is beneficial in patients who are on bowel rest for more than 14 days or who have underlying malnutrition.[88] Electrolytes should be checked daily to identify electrolyte abnormalities associated with postoperative intravenous feeding and the NPO state. The benefits of starting parenteral nutrition earlier than 7 days are fewer than the risks associated with parenteral nutrition and central venous access. In most patients, the postoperative "starvation" state is not associated with increased morbidity or mortality. Insertion of a central venous line is associated with increased risk of iatrogenic injury to nearby vessels, pneumothorax, deep vein thrombosis, and central line-associated bacteremia.



CT scan showing significantly dilated stomach From the personal collection of Dr Paula I. Denoya





Nasogastric tube From the personal collection of Dr Paula I. Denoya

Management of underlying causes

Underlying conditions, such as sepsis, intra-abdominal infections, or other acute/systemic illnesses should be treated.

Some pharmacologic agents (e.g., opioids, anticholinergics) reduce gastrointestinal motility and can cause ileus, so these should be discontinued or reduced. Chronic opioid use contributes to ileus, but cessation or reduction of opioids should be managed carefully in these patients due to the risk of withdrawal symptoms.[89] [90]

Electrolyte imbalance, particularly hypermagnesemia, has been associated with ileus.[82] Electrolytes should be monitored and corrected as necessary.

Other evaluated therapies

In patients with acute small bowel obstruction as a result of adhesions, there is some evidence that watersoluble contrast agents (e.g., diatrizoate meglumine/diatrizoate sodium solution [Gastrografin®]) are an effective treatment, avoiding surgery, as well as correlating with a reduction in hospital stay.[3] [91] However, two small double-blind placebo-controlled trials of patients with prolonged postoperative ileus after elective colorectal surgery suggest that Gastrografin® is of limited clinical utility in these patients, and the therapeutic value of these treatments remains controversial and uncertain.[77] [92] [93]

Promotility agents have been used to treat ileus with limited success.[64] While metoclopramide is helpful in treating delayed gastric emptying, it has not proved useful in postoperative ileus when evaluated in randomized controlled trials.[94] [95] Intravenous erythromycin has been found not to be beneficial for the treatment of postoperative ileus, and the evidence is insufficient to recommend the use of cholecystokinin-like drugs, cisapride, dopamine agonists, propranolol, or vasopressin.[64] [95] [96]

(summary

Treatment algorithm overview

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: <u>see disclaimer</u>

Acute			(summary)
postoperat	tive ileus		
		1st	nothing by mouth (NPO) and intravenous hydration
		plus	reduction in opioid analgesia ± replacement with nonopioid analgesia
•••••	with significant repeated vomiting and distention or at high risk for aspiration	plus	nasogastric (NG) decompression
nonsurgic	al cause		
		1st	NPO and intravenous hydration
		plus	management of the underlying condition(s)
	with significant repeated vomiting and distention or at high risk for aspiration	consider	NG decompression
	aspiration		

Ongoing

ileus lasting longer than 3 days or prolonging the postoperative recovery

1st parenteral nutrition

Treatment algorithm

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: <u>see disclaimer</u>

Acute

postoperative ileus 1st nothing by mouth (NPO) and intravenous hydration » All patients with ileus should be made NPO and will require intravenous hydration. » The initial choice of intravenous solution will depend on the baseline hydration state of the patient and comorbidities. » A significantly hypovolemic patient may benefit from a bolus of several liters of normal saline. » Following this initial hydration, the maintenance intravenous solution should be physiologic and provide some glucose. » This rate should be tailored to the patient's urine output and hemodynamics. » Electrolytes should be monitored and replaced as necessary during this period. plus reduction in opioid analgesia ± replacement with nonopioid analgesia Treatment recommended for ALL patients in selected patient group **Primary options** » acetaminophen: <50 kg body weight: 15 mg/kg intravenously every 6 hours when required, or 12.5 mg/kg intravenously every 4 hours when required, maximum 75 mg/ kg/day; ≥50 kg body weight: 1000 mg intravenously every 6 hours when required, or 650 mg intravenously every 4 hours when required, maximum 4000 mg/day OR » ketorolac: adults <65 years of age and/or ≥50 kg: 30 mg intramuscularly/intravenously every 6 hours when required, maximum 120 mg/day; adults ≥65 years of age and/or <50 kg: 15 mg intramuscularly/intravenously every 6 hours when required, maximum 60 mg/day » Opioid analgesics have been shown to slow down bowel motility.[3]

Acute		
		» Decreasing the use of systemically administered opioid analgesics has shown to help prevent the development of postoperative ileus.[28] Patient-controlled opioid analgesia reduces the overall amount of opioid given compared with round-the-clock analgesic dosing administered by a nurse.[33]
		 » Useful adjuncts for pain management include nonsteroidal anti-inflammatory drugs (NSAIDs) such as ketorolac, and other nonopioic analgesics such as acetaminophen.[38] [39] [40] [41] [42] [85] [86]
		» Local anesthetic administered via the epidural route is another alternative to opioid analgesia.[3] [34] [35] [36] [37] [53]
		» For more information on perioperative measures to prevent postoperative ileus, see Prevention.
with significant repeated	plus	nasogastric (NG) decompression
vomiting and distention or at high risk for aspiration		Treatment recommended for ALL patients in selected patient group
		» The NG tube should be placed so the tip is in the stomach, secured, and connected to suction
		» Gastric output should be measured and lost volume should be replaced with an intravenous physiologic saline solution.
		» The decision to remove the NG tube is based on measured gastric output over time and clinica resolution of ileus. The patient is assessed for absence of abdominal distention and cramping, decreasing NG tube output, and passage of flatus and stool with a view to removal of the NG tube. The NG tube may require reinsertion if the patient again displays evidence of ongoing ileus with abdominal distention and vomiting.
		» Studies have shown that routine NG decompression is unnecessary and may be detrimental. Therefore, NG decompression is reserved for selective use.[87]
		» Often, orogastric decompression is performed intra-operatively, but the tube is removed at the completion of surgery.[28]
onsurgical cause		
	1st	NPO and intravenous hydration
		» All patients with ileus should be made NPO and will require intravenous hydration.
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Acute

» The initial choice of intravenous solution will depend on the baseline hydration state of the patient and comorbidities.

» A significantly hypovolemic patient may benefit from a bolus of several liters of normal saline.

» Following this initial hydration, the maintenance intravenous solution should be physiologic and provide some glucose.

» Fluids should be administered at a maintenance rate according to body weight. This rate should be tailored to the patient's urine output and hemodynamics.

» In patients receiving pharmacologic treatment that may exacerbate ileus (e.g., opiates, anticholinergics), discontinuing or reducing such medications aids resolution of ileus.

» Electrolyte abnormalities (hypokalemia, hypochloremia, alkalosis, and hypermagnesemia) may be a consequence of ileus or an exacerbating factor. Electrolytes should be monitored and replaced as necessary during this period.

management of the underlying plus condition(s)

NG decompression

Treatment recommended for ALL patients in selected patient group

» Underlying conditions such as sepsis, intraabdominal infections, or other systemic illnesses should be treated.

» Systemic diseases associated with intestinal hypomotility include diabetes mellitus, Chagas disease, scleroderma, and neurologic diseases.

» Chronic opioid use contributes to ileus, but cessation or reduction of opioids should be managed carefully in these patients due to the risk of withdrawal symptoms.[89] [90]

Treatment recommended for SOME patients in selected patient group

» The NG tube should be placed so the tip is in the stomach, is secured, and is connected to suction.

» Gastric output should be measured and lost volume should be replaced with an intravenous physiologic saline solution.

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consider

MANAGEMENT

with significant repeated vomiting and distention or at high risk for aspiration

Acute

» The decision to remove the NG tube is based on measured gastric output over time and clinical resolution of ileus. The patient is assessed for absence of abdominal distention and cramping, decreasing NG tube output, and passage of flatus and stool with a view to removal of the NG tube. The NG tube may require reinsertion if the patient again displays evidence of ongoing ileus with abdominal distention and vomiting.

» Studies have shown that routine NG decompression is unnecessary and may be detrimental. Therefore, NG decompression is reserved for selective use.[87]

Ongoing

ileus lasting longer than 3 days or prolonging the postoperative recovery

1st parenteral nutrition

» These patients may be kept NPO for several weeks.

» Parenteral nutrition is recommended for patients who do not have any oral intake for more than 7 days.[3] [78] It is beneficial in patients who are on bowel rest for more than 14 days or who have underlying malnutrition.[88] Electrolytes should be checked daily to identify electrolyte abnormalities associated with postoperative intravenous feeding and the NPO state.

» The benefits of starting parenteral nutrition earlier than 7 days are less than the risks associated with parenteral nutrition and central venous access.

» In most patients the postoperative "starvation" state is not associated with increased morbidity or mortality.

» Insertion of a central venous line is associated with increased risk of iatrogenic injury to nearby vessels, pneumothorax, deep vein thrombosis, and central line-associated bacteremia.



CT scan showing significantly dilated stomach From the personal collection of Dr Paula I. Denoya

Ongoing



Nasogastric tube From the personal collection of Dr Paula I. Denoya

Primary prevention

Attempts to prevent postoperative ileus should begin in the perioperative setting, including appropriate intraoperative fluid management and avoidance of opioid analgesia. Enhanced recovery after surgery (ERAS) pathways are increasingly utilized in an attempt to expedite recovery of intestinal function and shorten hospital length of stay.[28] [29] [30] The mainstays of ERAS pathways include minimally invasive surgery, avoiding opioids, multimodal pain control, early ambulation, and early intake of oral fluids and solids.[3] [28] [31] [32]

In patients undergoing surgery and requiring opioid analgesia, decreasing the use of systemically administered opioid analgesics helps to prevent postoperative ileus. Patient-controlled analgesia pumps are beneficial as they reduce the overall amount of opioid given compared with round-the-clock analgesic dosing administered by a nurse.[33] Useful adjuncts for pain management include nonsteroidal anti-inflammatory drugs (NSAIDs) such as ketorolac, other nonopioid analgesics such as acetaminophen, and local anesthetics administered via epidural.[3] [28] [34] [35] [36] [37] [38] [39] [40] [41] [42]

Recommendations for primary prevention of prolonged postoperative ileus include:

- The use of laparoscopy instead of laparotomy, using minimally invasive surgical techniques and with minimal bowel manipulation[3] [28] [43] [44] [45]
- Reduction in the routine use of nasogastric tubes perioperatively, or removal of orogastric or nasogastric tubes immediately at the completion of surgery[28] [32]
- · Restriction of intravenous fluids (goal-directed fluid administration)[28]
- · Gentle handling of tissues and minimizing intra-operative bleeding[46]
- Early enteral feeding[28] [47] [48] [49]
- Ambulation on the first postoperative day
- Use of NSAIDs and patient-controlled analgesia[22] [27] [28] [42] [50] [51]
- Reducing parenteral opioid administration via the use of epidural analgesia.[3] [28] [49] [52] [53] Epidural analgesia (thoracic epidural) and regional analgesia (transverse abdominis plane blocks [TAP]) are both effective in reducing incidence of postoperative ileus and providing enhanced postoperative analgesia.[53]
- Intravenous lidocaine administration during and after general anesthesia, which may reduce opiate requirements postoperatively, though the effect on gastrointestinal (GI) recovery remains uncertain.[28]
 [49] [54] [55]

Other interventions to prevent or reduce postoperative ileus include peripherally acting mu-opioid receptor antagonists, chewing gum, bisacodyl, magnesium oxide, daikenchuto, and coffee consumption all have some indications in affecting an established ileus, though they are not routinely recommended.[3] [28] [32] [49] [56]

Alvimopan is a highly selective mu-opioid receptor antagonist that may reduce the incidence of postoperative ileus.[56] [57] [58] It is indicated for short-term hospital use only (maximum of 15 doses) in adults who have undergone or are undergoing small or large bowel resection.[59] In patients receiving alvimopan, GI function returned 15 to 22 hours earlier and hospital discharge occurred approximately 16 to 20 hours earlier compared with those receiving placebo.[32] [57] [60] [61] [62] [63] [64] [65] [66] [67] Short-term administration was associated with minimal adverse events.

The majority of published studies have included only open abdominal surgery, and strong data are lacking regarding the benefit of alvimopan in laparoscopic surgery. One nonrandomized trial showed that alvimopan was successful in avoiding postoperative ileus after laparoscopic right colectomy, but larger randomized prospective trials are needed before it can be recommended in laparoscopic surgery.[66]

Several randomized controlled trials and meta-analyses have shown decreased duration of postoperative ileus in patients given chewing gum after surgery.[60] [68] [69] [70] [71] [72] [73] [74] [75] [76] The available evidence suggests that gum chewing in the immediate postoperative period after a cesarean section is well tolerated and may enhance early recovery of bowel function, though the quality of the evidence is very low.[28] [32] [76]

Patient discussions

Preoperative patient education about the expected postoperative course is helpful, as it allows patients to participate in their own recovery. Prior to surgery, patients are instructed in the importance of early ambulation and appropriate postoperative pain management. They are informed that they will be offered a clear liquid diet after surgery and that ileus is expected after surgery.

Monitoring

Monitoring

Close monitoring is recommended in prolonged postoperative ileus. Electrolytes should be checked daily to identify electrolyte abnormalities associated with postoperative intravenous feeding and the nothing by mouth state.

Complications

Complications	Timeframe	Likelihood	
prolonged postoperative hospital stay	variable	high	
Postoperative ileus is responsible for a significant prolongation o	f hospital stay.		
It is estimated to add approximately \$750 million to \$1 billion to h	nealthcare costs in the	US.[7] [27]	
delayed wound healing	variable	low	
Patients with poor nutritional status may have more wound-healing	ng problems.[22]		
aspiration pneumonia	variable	low	
Patients who are vomiting, have gastric distention, or a nasogastric tube in place are at higher risk for aspiration pneumonia.[22]			
atelectasis	variable	low	
Patients who are vomiting, have gastric distention, or a nasogastric tube in place are at higher risk for atelectasis.[22]			
deep vein thrombosis (DVT)	variable	low	
Patients are more likely to have limited mobility during hospitalization, which puts them at risk for DVT.[22]			
pulmonary embolism	variable	low	
Patients are more likely to have limited mobility during hospitalization, which puts them at risk of pulmonary embolism.[22]			
sepsis	variable	low	
Patients receiving parenteral nutrition are at higher risk for sepsis via central line bloodstream infection.[22]			
nosocomial infections	variable	low	
The increased length of hospitalization puts patients at risk for nosocomial infections.[22]			

Prognosis

Postoperative ileus usually resolves spontaneously with no serious clinical consequences. Many of the complications associated with this condition stem from the prolonged hospitalization (e.g., thromboembolic events aggravated by prolonged immobilization) or from treatment methods (e.g., central line-related complications in patients receiving parenteral nutrition).

Diagnostic guidelines

International

ACR appropriateness criteria: suspected small-bowel obstruction [77]

Published by: American College of Radiology

Last published: 2019

Treatment guidelines

International

American Society for Enhanced Recovery and Perioperative Quality Initiative joint consensus statement on postoperative gastrointestinal dysfunction within an enhanced recovery pathway for elective colorectal surgery [32]

Guidelines for perioperative care in elective colorectal surgery [28]

 Published by:
 Enhanced Recovery After Surgery (ERAS®) Society
 Last published: 2018

Key articles

- Wattchow D, Heitmann P, Smolilo D, et al. Postoperative ileus- an ongoing conundrum. Neurogastroenterol Motil. 2021 May;33(5):e14046. Abstract
- Gustafsson UO, Scott MJ, Hubner M, et al. Guidelines for perioperative care in elective colorectal surgery: Enhanced Recovery After Surgery (ERAS(®)) Society recommendations: 2018. World J Surg. 2019 Mar;43(3):659-95. Full text Abstract
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Images



Figure 1: CT scan with intravenous and oral contrast showing fluid-filled small intestine and cecum in ileus From the personal collection of Dr Paula I. Denoya



Figure 2: CT scan with intravenous and oral contrast showing fluid-filled small intestine in ileus

From the personal collection of Dr Paula I. Denoya

IMAGES



Figure 3: Small bowel series showing dilated small bowel loops in ileus; nasogastric tube is seen curled in the stomach

From the personal collection of Dr Paula I. Denoya



Figure 4: Small bowel series showing dilated contrast-filled small bowel loops in ileus; some contrast is visible in the right colon

From the personal collection of Dr Paula I. Denoya



Figure 5: CT scan showing significantly dilated stomach From the personal collection of Dr Paula I. Denoya



Figure 6: Nasogastric tube

From the personal collection of Dr Paula I. Denoya

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Figure 1 – BMJ Best Practice Numeral Style

5-digit numerals: 10,000

4-digit numerals: 1000

numerals < 1: 0.25

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This approach is in line with the guidance of the International Bureau of Weights and Measures Service.

Contact us

+ 44 (0) 207 111 1105 support@bmj.com

BMJ BMA House Tavistock Square London WC1H 9JR UK

BMJ Best Practice

Contributors:

// Expert Advisers:

Steven D. Wexner, MD, PhD (Hon), FACS, FRCS (Eng), FRCS (Ed), FRCSI (Hon)

Director

Digestive Disease Center, Professor and Chair, Department of Colorectal Surgery, Cleveland Clinic, Weston, FL

DISCLOSURES: SDW has received consulting fees, stock options, and royalties from the following companies. These relationships are ongoing. Consulting: ICON Language Services, Intuitive Surgical, Stryker, Medtronic, Takeda, ARC/Corvus, Astellas, Baxter, Olympus, AIS Channel, Livsmed. Royalties: Medtronic, Intuitive Surgical, Karl Storz Endoscopy-America, Unique Surgical Innovations. Stock Options: Regentys, LifeBond, Pragma/GibLib, and Renew Medical.

Sameh Hany Emile Rizkalla, MBBCh, MSc, MD, FACS

Research associate, Colorectal Surgery Department Digestive Disease Center, Professor and Chair, Department of Colorectal Surgery, Cleveland Clinic, Weston, FL DISCLOSURES: SHER declares that he has no competing interests.

// Peer Reviewers:

David J. Hackam, MD, PhD

Associate Professor of Pediatric Surgery University of Pittsburgh School of Medicine, Pittsburgh, PA DISCLOSURES: DJH declares that he has no competing interests.

John Jenkins, MB CHB, FRCP

Consultant Colorectal Surgeon St. Mark's Hospital, Harrow, UK DISCLOSURES: JJ declares that he has no competing interests.

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