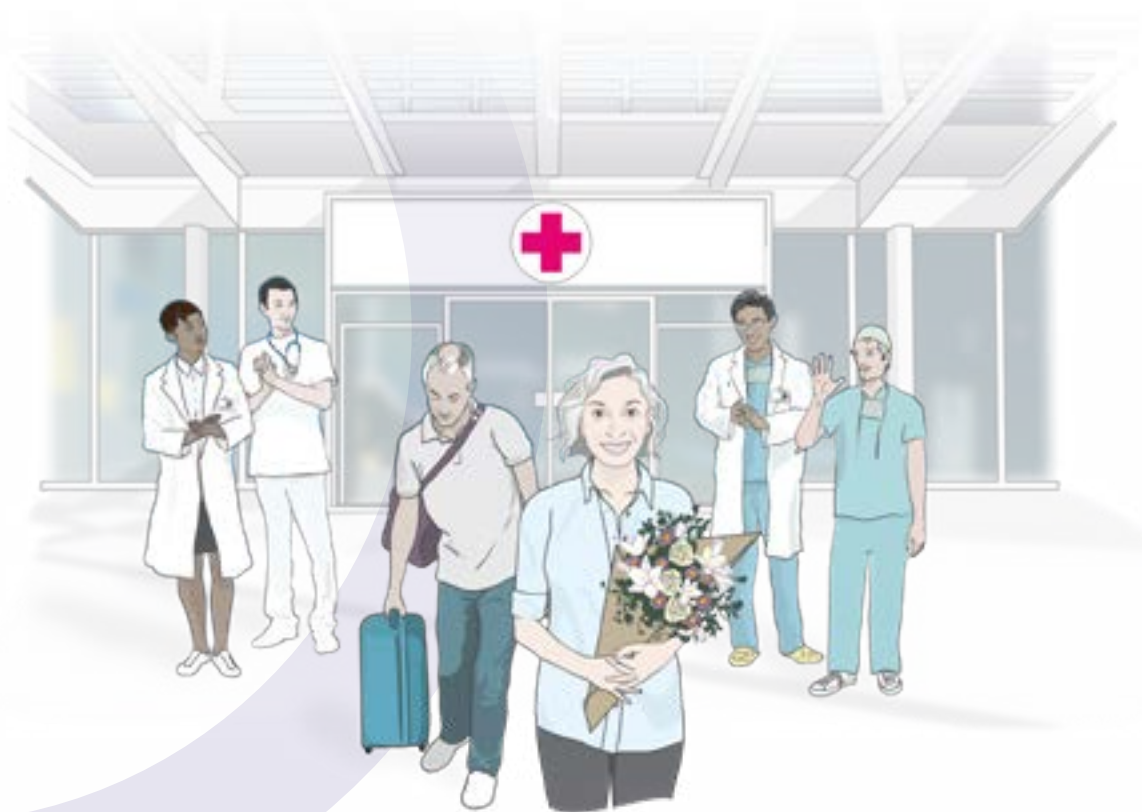


Clinical Pathway for Colorectal Surgery

Enhanced Recovery Canada:

A collaborative to improve surgical care



by Healthcare Excellence Canada and partners



CANADIAN ANESTHESIOLOGISTS' SOCIETY
SOCIÉTÉ CANADIENNE DES ANESTHÉSIOLOGISTES

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Disclaimer:

The recommendations made in this document are a synthesis of currently accepted approaches based on a review of relevant scientific literature. HEC has no obligation to update such information or advise on further developments concerning topics mentioned in this document. Clinicians using this resource should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care. The views expressed in this document are those of the authors and do not necessarily represent the views of HEC or Health Canada. This information is provided “AS IS” without any representations, warranties, or conditions of any kind, express or implied including without limitation implied warranties or conditions of fitness for a particular purpose or use or non-infringement.

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About ERC Clinical Pathways

Scope and purpose

The purpose of this clinical pathway is to provide practitioners in Canada with evidence-based strategies to improve surgical outcomes in colorectal patients. The pathway is organized in a stepwise approach according to the patients' continuum of care and includes variables for clinical audit and quality improvement purposes.

The clinical pathway is based on six core principles applicable to all surgeries, including:

- patient, family and caregiver engagement
- pain management
- surgical best practices
- fluid management
- nutrition management, and
- mobility

Target population

This clinical pathway applies to adult patients undergoing elective colorectal surgery performed with either open or minimally invasive routes (laparoscopic, robotic and trans-anal).

Target audience

Surgeons, anesthesiologists, nurses, dietitians, physiotherapists, other providers involved in the delivery of care of patients undergoing elective colorectal surgery and healthcare leaders.

Stakeholder involvement

The original clinical pathway was developed by a diverse group of experts from various healthcare fields and patients from across the country. A patient and family engagement working group developed the original patient resources complementary to the clinical pathway, ensuring the patient perspective was integrated and prioritized throughout.

Development and revision history

In 2017, a knowledge management specialist completed a systematic search of the literature for all clinical practice guidelines and consensus statements about enhanced recovery after surgery (ERAS) in patients undergoing colorectal surgery. Relevant publications were reviewed by the experts for quality, currency, content and applicability within the Canadian context to form the original clinical pathway published in 2019. In June 2022, the same knowledge management specialist conducted a systematic search of the literature for key evidence (for example meta-analyses, randomized controlled trials, systematic reviews) that might change the recommendations. Proposed updates were reviewed by Dr. Tom Wallace, MD MSc FRCSC FACS and the original pathway clinical leads.

This resource includes some common approaches for incorporating enhanced recovery principles in your clinical pathway but there may be other approaches that are also appropriate. While for various reasons clinical pathways will vary from hospital to hospital, it is important to reduce variation and adhere to as many of the principles as possible.




About ERC Clinical Pathways

NOTE: Drugs and dosages are provided as examples. Please consult with a pharmacist when developing your clinical pathway. All medications have side effects that should be taken into consideration on an individual patient basis prior to administration.

Overarching Recommendations

- 1.** Local champions should be identified from each discipline (surgery, anesthesiology, nursing, etc.) to lead implementation and address discipline-specific issues and concerns. An individual(s) with quality improvement training should also be involved to help facilitate the quality improvement process. Finally, a champion in hospital administration should be identified to support organizational buy-in and help to secure resources for the pathway.¹
- 2.** Pre-set order sets should be used as part of ERAS pathways.
- 3.** Implementation success requires assessment of adherence to ERAS processes through ongoing process and outcome measurement. This may require utilizing a database for various procedures and patient populations.
- 4.** Patients and families or caregivers are engaged as active partners in their care. As such, a pre-admission discussion of milestones, discharge criteria and the patient's role in the recovery process should take place with the patient and their family or caregiver prior to surgery. This discussion should begin in the surgeon's office and continue in the pre-admission unit by either a registered nurse (RN) involved in ERC Clinical Pathways or an anesthesiologist, depending on patient factors and the complexity of the proposed surgery.
- 5.** Patient and family or caregiver education should be presented using a variety of formats and delivery styles, including:
 - printed material (booklets, pictograms)
 - individual and group counselling
 - webinars
 - videos
 - apps or software (tablet, phone, or computer)
- 6.** All healthcare professionals involved in the care of elective colorectal surgery patients should be familiar with the ERC clinical pathway for colorectal surgery.

- 
- Phase **1** Patient optimization
 - Phase **2** Preoperative
 - Phase **3** Intraoperative
 - Phase **4** Postoperative
 - Phase **5** Discharge

1 Patient optimization

The patient optimization process should begin as soon as the need for surgery is determined. The [British Columbia Surgical Prehabilitation Toolkit](#) is a comprehensive toolkit that may be used to improve patients' surgical outcomes and experiences through mental and physical preparation before surgery.

Patient and family or caregiver engagement

Patient and family engagement strategies²⁻⁸



Recommendations

- To enhance the patient and family or caregiver experience of ERAS we recommend that healthcare professionals:
 - Have an awareness and understanding of health literacy; assess and address patient and family's health literacy as needed.
 - Use strategies to communicate effectively (for example slow down and listen, avoid interruptions, use plain language, use the teach-back method).



Tools and equipment

- [Patients as partners in ERAS](#)
- [Meaningful and effective patient engagement](#)
- [Engaging Patients in Patient Safety – a Canadian Guide](#)
- [ABC Life Literacy Canada](#)
- [Validated health literacy testing tools](#)
- [Health literacy tips](#)
- [What is teach-back?](#)

Patient and family or caregiver education⁹⁻¹²



Recommendations

- Patients and families or caregivers should receive preoperative information, ideally a combination of verbal, written or digital about the surgical procedure and components of the enhanced recovery clinical pathway in which the patient is expected to participate, including:
 - reduced fasting
 - carbohydrate loading
 - early ambulation
 - early oral (PO) intake
 - surgical site infection (SSI) and venous thromboembolism (VTE) prophylaxis
 - possible use of regional anesthesia
 - avoiding or minimizing opioid pain medication, and
 - discharge planning
- Ensure patients and their family or caregiver receive consistent information from all members of the healthcare team.
- Refer patients and their family or caregiver to reliable websites for health information.

1 Patient optimization

Tools and equipment

- Link to [A Guide to Colorectal Surgery \(Hard copy\)](#)
- Link to [A Guide to Colorectal Surgery \(Digital booklet\)](#)
- Link to [Precare colorectal surgery patient animation](#)
- [Website evaluation tool](#)



Additional information

Perioperative information and guidance are important factors in ERAS care and have been associated with significantly shorter length of hospital stay.



Data collection

Patient education

Pain management

Pain management expectations



Recommendations

- Patients and their family or caregiver should receive preoperative counselling about the patient's pain management expectations, modalities of pain control, and the risks and side effects of opioid medications and other analgesics.

Tools and equipment

- Link to [A Guide to Colorectal Surgery \(Hard copy\)](#)
- Link to [A Guide to Colorectal Surgery \(Digital booklet\)](#)
- Link to [Precare colorectal surgery patient animation](#)



Additional information

- Patient education about the process to achieve optimal analgesia for functional recovery needs to continue into the post anesthesia care unit (PACU) and the postoperative ward.
- Careful consideration should be given to informing opioid-dependent patients and their family or caregiver about the potential for increased postoperative pain and effective pain management strategies.

1 Patient optimization

Opioid tolerance¹³⁻¹⁵



Recommendations

- A medication assessment should be conducted preoperatively to help identify opioid-tolerant patients, and to modify the pain management plan accordingly.
- Opioid-tolerant patients may require closer follow-up postoperatively, and referral to acute pain services or clinicians specializing in pain management after surgery.



Additional information

- Inflammatory bowel disease (IBD) patients (especially Crohn's disease) use preoperative opioids at high rates and are at high-risk for postoperative pain.

Surgical best practices

Preadmission counselling¹⁶⁻¹⁸



Recommendations

- Preadmission counselling should include education about the planned surgery, its rationale and expected recovery phases, as well as anticipated limitations following surgery.
- Patients undergoing ostomy surgery should receive preoperative stoma site marking and education about how to monitor and care for their stoma.



Tools and equipment

- Link to [A Guide to Colorectal Surgery](#) (Hard copy)
- Link to [A Guide to Colorectal Surgery](#) (Digital booklet)
- Link to [Precare colorectal surgery patient animation](#)

Risk assessment^{10,19-28}



Recommendations

- Patients should undergo a thorough, evidence-informed preoperative assessment prior to surgery. This may include but is not limited to an assessment of allergies, medications, diabetes, cardiorespiratory status, frailty, risk for postoperative delirium and thrombosis and bleeding.
- Patients should be screened for anemia and attempts to correct anemia prior to surgery using intravenous (IV) iron should be made. Blood transfusion has long-term effects and should be avoided if possible.



Tools and equipment

- Consider using screening tools like:
 - [Edmonton Frail Scale](#) for a frailty assessment.
 - [Caprini score](#) for a VTE risk assessment.
 - [BC Surgical Prehabilitation Toolkit](#).

1 Patient optimization

Anxiety screening^{10,29-33}



Recommendations

- Patients should be screened for anxiety using a validated self-assessment screening tool.
- A short-acting anxiolytic might be proposed in patients with high levels of anxiety.



Tools and equipment

- Generalized anxiety disorder 7-item ([GAD-7](#)) scale
- Hospital anxiety and depression scale ([HADS](#))



Additional information

- Melatonin might be considered to reduce anxiety

Smoking and alcohol use³⁴⁻⁴⁰



Recommendations

- Identify current smokers and patients who engage in high-risk drinking by self-reporting.
- Four weeks or more of abstinence from smoking is recommended.
- Patients with high alcohol intake should receive an alcohol cessation intervention and remain abstinent for four weeks or more.
- Neither smoking nor drinking status should delay surgeries required of an urgent nature.



Tools and equipment

- Nicotine replacement therapy
- [QuitNow.ca](#)
- Brief intervention for high-risk drinking



Additional information

- Current smoker includes daily, and occasional smokers determined from the response to the question, “At the present time do you smoke cigarettes every day, occasionally or not at all?”
- High-risk drinking is defined as:
 - women: more than two standard drinks per day and more than 10 standard drinks per week
 - men: more than three standard drinks per day and more than 15 standard drinks per week

1 Patient optimization

Fluid management

Hydration^{16,41-43}



Recommendations

- The importance of staying hydrated before surgery should be emphasized during the preadmission discussion. Specific guidance on fasting and hydration recommendations should be provided to patients, including the potential harm from prolonged preoperative fasting (for example nothing by mouth [NPO] after midnight).
- Patients should be encouraged to consume clear fluids, including oral carbohydrate drinks (in patients without delayed gastric emptying), up until two hours before initiation of anesthesia.



Tools and equipment

- Link to [A Guide to Colorectal Surgery](#) (Hard copy)
- Link to [A Guide to Colorectal Surgery](#) (Digital booklet)
- Link to [Precare colorectal surgery patient animation](#)



Additional information

- Discuss and explain the role of preoperative carbohydrate drinks
- Normal daily water requirement is 25-30 ml/kg (on average 2 L of water per day)

Nutrition management

Nutrition education^{5,44}



Recommendations

- Prior to hospitalization all patients and their family or caregiver should receive information describing expectations around nutrition and surgery.
- Patients and their family or caregiver should understand the goals of nutrition therapy and how they can support their recovery through adequate food intake and optimization of their nutritional status.



Tools and equipment

- Link to [A Guide to Colorectal Surgery](#) (Hard copy)
- Link to [A Guide to Colorectal Surgery](#) (Digital booklet)
- Link to [Precare colorectal surgery patient animation](#)

1 Patient optimization

Nutrition screening^{10,45-53}

Recommendations

- Patients should be screened for nutritional risk as early as possible prior to surgery. Screening can occur in the surgeon's office, the preoperative assessment clinic, the prehabilitation clinic or through the telephone.
- Systematic screening and monitoring for nutritional risk will determine the need for assessment and treatment to address factors impacting adequate food and nutrition intake.
- If there is a clinical concern for chronic malnutrition, refer to a dietitian for optimization.

Tools and equipment

- Use a screening tool like the Canadian Nutrition Screening Tool ([CNST](#)). The CNST tool asks two questions:
 1. Have you lost weight in the past six months without trying to lose this weight?
 2. Have you been eating less than usual for more than a week?

Data collection

Malnutrition screening

Nutrition assessment^{46,54}

Recommendations

- Patients identified as being at risk for malnutrition should be assessed by a dietitian before being admitted to the hospital.
- Results of the nutrition assessment should be available at hospital admission to facilitate care continuity.

Tools and equipment

- Use a validated tool like the subjective global assessment ([SGA](#)), or a comprehensive nutrition assessment completed by a dietitian as soon as possible to facilitate nutrition optimization prior to surgery.

Nutrition therapy^{10,46,47}

Recommendations

- Patients assessed as malnourished (SGA B or C) should receive an individualized treatment plan, based on a comprehensive nutritional assessment by a dietitian that may include therapeutic diets (such as high energy, high protein diet), oral nutritional supplements (ONS), enteral nutrition (EN) and parenteral nutrition (PN).
- Nutrition therapy should be started a minimum of seven days before surgery. The decision to delay surgery to optimize nutritional status should be undertaken by the patient, dietitian and surgeon.

1 Patient optimization



Additional information

- Prioritize and optimize adequate food and nutrition intake and thus nutritional status for recovery throughout the patient journey.

Mobility and physical activity

Mobility^{10,55,56}

Evidence for early mobility and physical activity following colorectal surgery is limited. Thus, recommendations and implementation approaches presented throughout this clinical pathway are based on expert consensus obtained in 2018 using the Delphi technique.



Recommendations

- The negative impact of prolonged bed rest and the importance of early and progressive mobilization after surgery should be discussed with the patient and family or caregiver.
- Pre-surgical activity should not be restricted. Patients should be encouraged to be physically active.



Implementation approaches

- Education about early mobilization should be provided by a nurse, physiotherapist or kinesiologist.
- Discussions should take place with family or caregivers to understand how they can encourage and facilitate early mobilization.
- The benefits of early mobilization should be reinforced throughout the hospital stay.



Tools and equipment

- Link to [A Guide to Colorectal Surgery](#) (Hard copy)
- Link to [A Guide to Colorectal Surgery](#) (Digital booklet)
- Link to [Precare colorectal surgery patient animation](#)

2 Preoperative

Patient and family or caregiver engagement

Engagement strategies

Recommendations

- Include patients and family or caregiver in conversations.
- Encourage the patient and family or caregiver to bring back the Guide to Colorectal Surgery booklet on the day of surgery and refer to it during their hospital stay.

Multidisciplinary team meeting and the surgical safety checklist

Recommendations

- Prior to surgery, the multidisciplinary team should discuss elements of the surgical procedure with the patient including type of surgery (open versus minimally invasive), risk of opening (if laparoscopic), plan for anesthetic technique, analgesia plan, location and length of incisions, potential complications, and anticipated length of stay (LOS).
- Use a surgical safety checklist to discuss important details about each case with the multidisciplinary team; engage with patients on relevant items.

Tools and equipment

- [World Health Organization \(WHO\) surgical safety checklist](#)

Pain management

Preanesthetic medication^{10,31,32,57}

Recommendations

- Patients should not routinely receive long- or short-acting sedative medication from midnight prior to surgery and immediately before surgery.
- A short-acting anxiolytic administered at the time of epidural placement (in open surgery) is acceptable in patients with high levels of anxiety.
- Midazolam should be avoided except at epidural placement or in patients with high levels of anxiety.
- As part of foundational opioid-sparing analgesia, patients may receive a combination of acetaminophen, nonsteroidal anti-inflammatory agents (NSAIDs, after discussion with the surgical team), tramadol and gabapentinoids (for major surgeries only).
- In opioid-dependent patients, an adequate opioid dose (such as close to the dose used preoperatively) needs to be maintained throughout the perioperative period to prevent opioid withdrawal.

2 Preoperative



Additional information

- Sedative premedication delays immediate postoperative recovery by impairing mobility and oral intake.
- Melatonin may be equally as effective as standard treatment with midazolam.
- The degree of pain after surgery will vary based on the surgical approach and planned analgesia (epidural, abdominal wall blocks). This will need to be considered.

Antiemetic prophylaxis^{10,16,58-62}



Recommendations

- All patients should receive postoperative nausea and vomiting (PONV) prophylaxis. The number of medications used should be determined by the number of modifiable and non-modifiable risk factors.
 - Patients with 1-2 risk factors should receive a two-drug combination using first line antiemetics (such as dopamine antagonists, serotonin antagonists, corticosteroids).
 - Patients with ≥ 2 risk factors should receive two to three antiemetics.
- Medications used should represent different mechanisms of action to achieve multimodal benefit.
- Use a validated score to identify high-risk patients for PONV.



Tools and equipment

- [Apfel scoring system](#)



Additional information

- Risk factors for PONV are common in the colorectal surgery population and include female sex, non-smoker, history of PONV, and postoperative use of opioids.
- All members of the multidisciplinary team should be aware of patients at risk for PONV.



Data collection

Use of antiemetics

2 Patient optimization

Multimodal opioid-sparing pain management^{16,31,38,58,63-66}

Recommendations

- A multimodal pain management plan with active strategies to minimize the use of opioids should be developed before surgery covering ALL phases of perioperative care.
 - The following preoperative interventions are acceptable in a pain management plan (see the algorithm in Appendix B for guidance):
 - IV or oral analgesia
 - NSAIDs or cyclo-oxygenase-2 (COX2) (after a discussion with the surgical team)
 - Acetaminophen
 - Tramadol
 - Gabapentinoids (opioid-tolerant patients undergoing major surgery only)
 - Neural blockades
 - Thoracic epidural analgesia (TEA) is recommended for planned open surgeries, surgeries where there is a high-risk of conversion from laparoscopic to open, and for patients with previous pulmonary disease or at high risk of pulmonary complications.
 - Regional analgesia techniques are recommended for laparoscopic surgery and administered as either:
 - Single shot: transversus abdominis plane (TAP) block, rectal sheath (RS) block, subarachnoid block (SAB) +/- opioid, wound infiltration.
 - Continuous block: TAP/RS catheter, preperitoneal wound catheter infiltration.
 - Intrathecal morphine can be considered prior to general anesthesia.
 - IV opioids titrated to minimize the risk of unwanted effects.
 - Start analgesic adjuvant early in anesthesia.
 - Lidocaine (1-1.5 mg/kg at induction of anesthesia and 1-1.5 mg/kg/hr. for maintenance during surgery, especially for laparoscopic surgery)
 - Ketamine (bolus 0.25-0.5 mg/kg then 0.25 mg/kg/hr. during surgery)
 - +/- IV magnesium sulfate
 - +/- IV clonidine or dexmedetomidine
- Optimal multimodal analgesia should be started the morning of surgery. If this is not possible, it should be started after the induction of general anesthesia.

Tools and equipment

- Multimodal opioid-sparing pain management plan



Additional information

- Minimizing opioid analgesia reduces the adverse effects of opioid use during and after surgery.
- Number and combination of components that should be selected to maximize pain control, reduce opioid burden, and avoid the side effects of all analgesics used is unknown.

2

Preoperative

- Risk of leakage may preclude the use of NSAIDs. Ask the surgeon about the quality of the bowel tissues and the anastomosis. The use of NSAIDs should be avoided in patients with IBD or risk factors for renal failure.
- Gabapentinoids decrease opioid requirements but increase sedation.
- Mid-TEA is recommended to prevent postoperative ileus in open surgery.

Surgical best practices

Mechanical bowel preparation (MBP)^{16,58,67-74}



Recommendations

- MPB using a combined iso-osmotic mechanical preparation and oral antibiotic should be considered for all colorectal procedures.
- MBP should not be used without concurrent oral antibiotics.



Tools and equipment

- Sodium picosulfate or polyethylene glycol-based electrolyte solutions



Additional information

Data about bowel preparation are mixed.



Data collection

- Preoperative MBP
- Preoperative oral antibiotics

Antimicrobial prophylaxis^{38,75-77}



Recommendations

- IV antibiotics should be administered immediately preoperatively within the recommended time.
- Skin disinfection should be performed using chlorohexidine-alcohol-based preparations.
- Antibiotic selection should be based on SSI pathogens commonly associated with the specific procedure type, local antimicrobial resistance patterns and a balance of benefits versus potential risks associated with the antibiotic (for example risk for *Clostridium difficile* [C. diff] infection or emergence of multi-drug resistant organisms).
- Weight-based dosing should follow guideline recommendations.
- Antibiotics with short half-lives (such as <2 hours) should be re-dosed every three to four hours during surgery if the operation is prolonged (>4 hours) or bloody (1000 cc).
- Postoperative doses of antibiotics covering aerobic and anaerobic bacteria given in the preoperative phase are not needed.

2 Preoperative

Tools and equipment

- Refer to your local institutional antimicrobial stewardship guidelines.

Hypothermia prevention^{10,78,79}

Recommendations

- Patients should be prewarmed for 20-30 minutes before induction of anesthesia.
- Each facility should have a formal protocol to follow to maintain perioperative normothermia.

Tools and equipment

- [Guidelines to the Practice of Anesthesia – Perioperative Temperature Management](#)

Venous thromboembolism (VTE) prophylaxis^{10,19,80}

Recommendations

- Patients should receive mechanical thromboprophylaxis using compression stockings or intermittent pneumatic compression during hospitalization or until they begin to mobilize.
- Patients should receive pharmacological prophylaxis with low molecular weight heparin (LMWH).
- Use a VTE risk assessment model to guide the recommended thromboprophylaxis intervention.

Tools and equipment

- [Caprini risk assessment model for VTE](#)



Additional information

- Risk factors for VTE are numerous. Most patients will have one or more risk factors, and as many as 40 percent will have three or more risk factors.



Data collection

Preoperative VTE chemoprophylaxis

Glycemic control^{10,81}

Recommendations

- Glucose control should be considered in all patients regardless of diabetic status, beginning in the immediate preoperative period and continuing until discharge to prevent hyperglycemia.
- For most non-critically ill hospitalized patients with diabetes, preprandial blood glucose targets should be 5.0 to 8.0 mmol/L, in conjunction with random blood glucose values <10.0 mmol/L if these targets can be safely achieved. For critically ill hospitalized patients with diabetes, blood glucose levels should be maintained between 6.0 and 10.0 mmol/L.
- Measures to optimize perioperative glycemic control should be included in SSI reduction bundles.

2 Preoperative



Additional information

Hyperglycemia is prevalent in both diabetic and non-diabetic hospitalized patients and has been associated with SSIs and complications.

Pre-existing medication management⁸²



Recommendations

- Medication reconciliation is a Health Standards Organization required organizational practice and should be completed with the patient and family as a part of the surgical intake process.



Tools and equipment

- Best possible medication history (BPMH)

Fluid management

Reduced fasting^{16,47,58}



Recommendations

- Prolonged preoperative fasting (NPO after midnight) should be abandoned.
- Patients should be encouraged to eat a normal meal the night before and a light snack up until six hours and drink clear fluids up until to two hours before initiation of anesthesia unless the patient has documented delayed gastric emptying or other factors that may increase risk of aspiration.



Additional information

- A light snack is a non-fatty meal such as dry toast.
- Clear fluid is a liquid that you can see through. Examples include water, electrolyte-containing sports drinks, non-pulp fruit juices and tea or coffee without milk or cream.
- The day before surgery, patients receiving MBP should only receive clear fluids.
- Risk factors for aspiration include:
 - documented gastroparesis
 - metoclopramide or domperidone used to treat gastroparesis
 - documented gastric outlet or bowel obstruction
 - achalasia
 - dysphagia
- Examples of patients with fluid restrictions include dialysis and congestive heart failure (CHF).



Data collection

Allow clear liquids up to two hours before induction

2 Preoperative

Complex carbohydrate loading^{10,83-87}

Recommendations

- Routine carbohydrate loading in the immediate preoperative period is recommended, though there is no consensus regarding the optimal regimen and formulation.



Additional information

- Maltodextrin may be used for carbohydrate loading to reduce insulin resistance.
- If maltodextrin is included, 50 g PO consumed over a maximum of five minutes ≥ 2 hours before surgery is recommended. Simple sugar (such as fructose) may be used instead of maltodextrin. However, it will not have the same metabolic effect.
- Maltodextrin should not be given to patients with gastric emptying disorders, other aspiration risks or with type 1 diabetes (efficacy and safety not studied).
- Administration of maltodextrin in type 2 diabetic patients and obese patients is controversial. Gastric emptying of type 2 diabetic patients and obese patients receiving maltodextrin is not prolonged (low quality of evidence). However, transient preoperative hyperglycemia is observed in type 2 diabetic patients (low quality of evidence).



Data collection

Allow maltodextrin up to two hours before induction

Effects of bowel preparation⁸³

Recommendations

- Avoid administration of IV fluids to replace preoperative fluid losses in patients who received iso-osmotic bowel preparation, provided there was unrestricted intake of clear fluids for up to two hours before induction of anesthesia.

Weight monitoring⁸⁸

Recommendations

- Measure preoperative weight the morning of surgery.



Tools and equipment

- Calibrated scales



Additional information

- Despite limitations in interpreting weight changes after surgery (for example metabolic response to surgery), and challenges in obtaining accurate weight measurements (for example weighing immobile patients), measuring weight changes remains one of the simplest strategies to guide fluid therapy.
- For accurate comparison, all perioperative weight measurements should be obtained with the patient wearing a hospital gown.

3 Intraoperative

Pain management

Standard anesthetic protocol^{89,90}

Recommendations

- Using propofol total intravenous anesthesia (TIVA) might reduce PONV.
- Using deep neuromuscular blockade might decrease intraoperative opioid usage and might improve the surgical conditions. If using deep neuromuscular blockade intraoperatively, an appropriate reversal with sugammadex should be used.
- Using depth of anesthesia monitors and nociception monitors might help decrease the total amount of hypnotic and analgesic drugs given during surgery and their related postoperative side-effects.

Multimodal opioid-sparing pain management^{31,38,91-98}

Recommendations

- Multimodal analgesia given in the preoperative period should be continued intraoperatively (see algorithm for guidance).
- Intraoperative IV lidocaine can be used in the case of laparoscopic surgery without TEA (see algorithm for guidance).
- Intraoperative considerations for TEA (if open surgery):
 - Use of epidural infusion during surgery is recommended and should be continued after surgery.
- Adjunct analgesics must be added to IV lidocaine or TEA including:
 - IV ketamine (bolus 0.25 mg/kg to 0.5 mg/kg then 0.25 mg/kg/hr. during surgery).
 - Dexamethasone (IV 4 mg)
 - Other adjuncts can be considered even if based on limited evidence to manage pain (for example IV magnesium sulfate, IV clonidine, dexmedetomidine).
 - Nitrous oxide is not recommended.
- Intraoperative considerations for neural blockades:
 - If not performed as a single shot after general anesthesia induction, TAP and RS blocks or continuous wound infusion (CWI) can be performed +/- postoperative continuous infusion at the end of the surgery prior to the patient's emergence from anesthesia.
 - In addition, adjuvant analgesics mentioned above must be added.
- Intraoperative consideration for IV opioids:
 - Doses must be titrated to minimize the risk of unwanted effects.
 - The use of nociception monitors might help to reduce the total amount of opioids administered intraoperatively.

Tools and equipment

- Nociception monitors can be used to compute real-time nociception level and analgesia nociception indices. These could be considered to help guide opioid administration if they are available and routinely used at your institution.

3 Intraoperative



Additional information

- Reducing the use of intraoperative opioids decreases postoperative pain and opioid consumption by reducing what is known as opioid-induced hyperalgesia.



Data collection

Use of regional anesthesia

Optional:

- type of surgery
- use of epidural anesthesia
- use of nerve trunk blocks
- use of multimodal analgesia and adjuvants
- use of nociception monitors

Surgical best practices

Surgical approach^{10,16,58}



Recommendations

- A minimally invasive surgical approach (laparoscopic, robotic, trans-anal) should be employed whenever the expertise is available and clinically appropriate.



Additional information

- Factors that may increase the possibility of selecting or converting to an open surgery include obesity, prior abdominal surgery and locally invasive cancers.

Normothermia^{10,99,100}



Recommendations

- Patients' core temperature should be monitored during cases of general and neuraxial regional anesthesia lasting 30 minutes or longer.
- Active patient warming systems, control of the operating room ambient temperature, and other methods, should be used to target a central core temperature of 36 to 37°C.



Tools and equipment

- Heated IV fluids, under-body warming mattresses, or upper body forced air heating covers may help to maintain normothermia.



Additional information

- Up to 90 percent of patients undergoing surgery develop hypothermia.

3 Intraoperative



Data collection

Patient temperature at the end of surgery or on arrival to PACU

Surgical site infection prevention^{16,73,101}



Recommendation

- Infection prevention strategies (also called bundles) should be routinely implemented.



Tools and equipment

- [Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection](#)

Drains and tubes^{10,16,58}



Recommendations

- The routine use of drains and nasogastric (NG) tubes should be avoided. If a NG tube is required intraoperatively, it should be removed before reversal of anesthesia.
- Pelvic and peritoneal drains should not be routinely used.

Fluid management

Euvolemia^{43,102-105}



Recommendations

- Intraoperative fluid management should be individualized to minimize fluid and maintain euvolemia. When available, goal-directed fluid therapy is recommended for high-risk patients (presence of significant comorbidities such as CHF) or when there is large blood loss.
- Very restrictive or liberal fluid regimens should be avoided in favour of euvolemia. IV fluid maintenance with balanced crystalloid solution should be used to ensure water and electrolyte homeostasis with the goal of achieving 1.0 to 2.0 L positive fluid balance at the end of surgery (6-8 ml/kg/hr).
- Goal-directed volume therapy to replace intravascular loss:
 - In major open surgery and for high-risk patients where there is >500 mL anticipated estimated blood loss (EBL), or a systemic inflammatory response syndrome response, the use of advanced hemodynamic monitoring to facilitate individualized fluid therapy and optimize oxygen delivery through the perioperative period is recommended.
 - Replace fluid loss with balanced crystalloid solution of colloids and determine the absolute amount based on hemodynamic response.
 - Advanced hemodynamic monitoring (stroke volume variation [SVV], pulse volume variation [PVV], stroke volume [SV], cardiac output [CO], velocity time integral [VTI] and end-tidal carbon dioxide [ETCO₂]) should be used for high-risk patients and for major surgeries associated with large amounts of blood loss or fluid shifts.
 - Replace urine output (UO) and gastrointestinal loss (if measurable) with balanced crystalloid solution.

3

Intraoperative

- When patients leave the operating room or the PACU, intravascular volume status should be estimated based on physiologic parameters (such as blood pressure, heart rate) and quantitative measures (such as blood loss, UO). Fluid balance measurements should be reported and reviewed.



Tools and equipment

- Volumetric pumps for maintenance infusion
- Advanced hemodynamic monitoring
- Intraoperative fluid balance chart



Additional information

- Acute kidney injury (AKI) can have a significant negative impact on patient prognosis. Adequate fluid management is a valuable strategy to avoid prerenal failure.
- Maintenance infusion ≤ 5 ml/kg/hr. can be used if goal-directed volume therapy is supported by advanced hemodynamic monitoring to minimize the risk of organ hypoperfusion.
- Acknowledge clinical and technical limitations of the advanced hemodynamic measures and monitors used.



Data collection

Volume of IV fluid administration

Optional:

- balanced crystalloid solution
- duration of surgery
- fluid balance
- advanced hemodynamic monitoring
- use of volumetric pumps

Hemodynamic instability management^{47,106}



Recommendations

- Establish causation. Rather than treat every instance of clinical anomaly (for example hypotension, tachycardia, oliguria) with bolus IV fluids, causation should be established based on available information about the patient and the clinical context.
- Treat the underlying problem. IV fluid, vasopressors and inotropes can be used to attempt to reverse the most likely cause of a hemodynamic derangement.
- Administer IV fluid when appropriate. Assess the patient's fluid status and fluid responsiveness, when possible, before administering IV fluids; then determine the most appropriate fluid type and volume.
- Evaluate the hemodynamic response to the initial treatment.
- Unless indicated, central line use should be avoided to reduce the risk of a bloodstream infection. If a central line is used, remove it as soon as possible.

3 Intraoperative

Tools and equipment

- Conventional or advanced hemodynamic monitoring equipment

Additional information

- Absolute hypovolemia may or may not be responsible for hemodynamic abnormalities. For example, stroke volume variation >13 percent soon after the induction of anesthesia and with the institution of mechanical ventilation, or after an epidural bolus, should prompt consideration of vasodilation (relative hypovolemia) rather than as the cause of fluid responsiveness. The patient may require vasoconstrictors rather than fluid bolus provided the patient had unrestricted intake of clear fluids and iso-osmotic bowel preparation was used.
- Agents needing centrally mediated infusion necessitate central venous catheter (CVC) placement.

4 Postoperative

Patient and family or caregiver engagement

Involving patients and family or caregiver in their care^{7,107}

Recommendations

- Consider using whiteboards in patient rooms to improve communication between healthcare providers and patients and their family or caregiver.
- Remind patients and their family or caregiver to refer to their Guide to Colorectal Surgery booklet for goals of each postoperative day. Recovery goals and schedule for the day is important for hospitalized patients to know.
- Consider involving patients and their family or caregiver in the end of shift report.

Pain management

Multimodal opioid-sparing pain management^{31,66,108-111}

Recommendations

- A multimodal pain management plan (acetaminophen, NSAIDs, tramadol) with active strategies to minimize the use of opioids should be used.
- Postoperative considerations for IV or oral analgesia:
 - NSAIDs are useful for pain control but may increase the risk of anastomotic leak. Caution should be exercised, particularly in high-risk patients (a discussion with the surgical team is needed).
 - Transition from IV to PO as soon as possible.
- Postoperative considerations for TEA:
 - Patient age and cognitive function should guide the use of patient-controlled epidural analgesia (PCEA), or epidural continuous infusion managed by a nurse.
 - Low-dose bupivacaine (0.05 percent) is recommended to avoid hemodynamic side effects, motor blocks and increased LOS (5-14 ml/hr.).
 - Low doses of opioids can be added to the epidural (for example fentanyl 2 mcg/ml or morphine 5-10 mcg/ml); rate between 5-14 ml/hr. based on local anesthetic concentration used in the solution.
 - TEA should be removed shortly after bowel functioning; use epidural stop test (see glossary).
 - NSAIDs (when appropriate), acetaminophen (4 g/day), and tramadol (50 mg four times a day [QID]) should be used regularly to decrease the need for oral opioids when transitioning from TEA.
- Postoperative considerations for neural blockades (when no TEA used; laparoscopic surgery):
 - Abdominal trunk blocks with continuous infusion (for example TAP block) can be used, or
 - CWI (subfascial administration) with local anesthetic agents should probably be recommended if TEA and IV lidocaine are not used.
- Postoperative IV opioids (patient-controlled analgesia [PCA] for laparoscopic surgery) should be discontinued and replaced by oral opioids as soon as possible).

4

Postoperative

- Continuous infusion of lidocaine can be used intraoperatively and in early and intermediate postoperative hours if an epidural was not placed. This intravenous continuous infusion of lidocaine might be continued (up to 48 hrs) after PACU only in patients who remained with high pain levels in PACU (if not, discontinue the lidocaine infusion at PACU discharge).



Tools and equipment

- Use epidural stop test at 48 hours



Additional information

- There is controversy over whether the use of NSAIDs administered postoperatively will increase the anastomotic leak rate. Hence, the importance of a discussion between the surgeon and anesthesiologist that considers both patient-related and surgical procedure-related factors.
- Evidence of effect for IV lidocaine on reduction of postoperative pain at early (1-4 hours) and intermediate (24 hours) time points, but not at late time points (48 hours).
- Non-anesthesia providers should be educated about the possible hazards of lidocaine use (local anesthetic systemic toxicity).
- Tramadol should be used cautiously in patients >75 years old, ASA 3 or 4, and with impaired mobility or frailty.
- IV ketamine might be continued for 48 hours in patients with a high level of postoperative pain.
- Pregabalin and gabapentin are not recommended.



Data collection

Use of multimodal pain management

Optional:

- use of epidural anesthesia
- use of PCA opioid

Pain assessment⁶⁴



Recommendations

- Suboptimal analgesia should be assessed promptly by staff members trained in acute pain management.
- Measurement of analgesia and the side effects of analgesics, as well as measurement of anxiety should occur through a system that accounts for patient experience, function, and quality of life.
- Consider the use of patient-directed visual analog pain scales to assess level of pain.

4 Postoperative

Breakthrough pain management⁶⁴

Recommendations

- The use of all appropriate non-opioid options from the treatment algorithm should be confirmed.
- Add oral opioids if tolerated, as needed. If not tolerated orally, use IV or subcutaneous opioids (for example hydrocodone, oxycodone, morphine, hydromorphone). Carefully titrate for the lowest effective opioid dosage.

Surgical best practices

Glycemic control¹⁰

Recommendations

- Blood glucose should be maintained within the recommended range for patients with diabetes or elevated preoperative HbA1c.
- Care must be taken to avoid hypoglycemia caused by aggressive insulin treatment.



Additional information

- Target blood glucose range should generally be 6-10 mmol/L.

Urinary catheters¹⁰

Recommendations

- Patients at low risk for urinary retention should have routine removal of catheter on the first day after surgery. Patients at moderate to high risk require catheterization for up to three days.
- For patients who fail trial of void, clean intermittent catheterization for 24 hours should be considered.



Additional information

- Risk factors for retention include male gender, epidural analgesia, and pelvic surgery.



Data collection

Urinary catheter removal

4 Postoperative

Venous thromboembolism prophylaxis^{9,10}

Recommendations

- Combined mechanical and chemoprophylaxis for VTE is recommended for the duration of hospitalization.
- Thromboprophylaxis with LMWH can be considered for up to 28 days in all patients.

Tools and equipment

- Consider using validated screening tools like the [Caprini score](#) for a VTE risk assessment

Fluid management

Fluid maintenance^{10,16,43,88,112-114}

Recommendations

- At the end of surgery, or at least by postoperative day (POD) 1, IV fluids should be discontinued in the absence of physical signs of dehydration or hypovolemia and provided patients tolerate oral fluid intake.
- Patients tolerating oral intake should consume a minimum of 25-30 ml/kg of water/day.
- In patients not tolerating oral fluid intake (for example postoperative ileus), a maintenance infusion of 1.5 ml/kg/hr. of IV fluids should be started.
- Potassium, sodium, and chloride should be monitored to ensure patients meet daily electrolyte needs (approximately 1 mmol/kg/day each). Electrolyte deficiencies can be replaced via oral route.

Tools and equipment

- Careful monitoring of all patients should be undertaken using clinical examination, hydration status and regular weighing, when possible, until tolerating oral diet.
- Postoperative fluid balance chart, including oral fluid intake.



Additional information

- Postoperative weight gain >2.5 kg has been associated with increased morbidity. See previous statement about the limitations and challenges of weight measurements.



Data collection

IV fluid discontinuation

Daily weights

4 Postoperative

Management of hemodynamic instability¹¹⁵⁻¹¹⁷

Recommendations

- In patients in whom volume expansion is indicated to correct a clinical anomaly (for example hypotension, tachycardia, oliguria) the likelihood of fluid responsiveness should be estimated before giving a bolus of IV fluids.
 - In the high dependency unit (HDU) and intensive care unit (ICU), advanced hemodynamic monitoring should be used to determine fluid responsiveness, either after a fluid challenge or a passive leg raise (PLR) maneuver.
 - If advanced hemodynamic monitoring is unavailable (for example surgical wards and PACU), a rapid (15-30 minutes) IV fluid bolus of 3 ml/kg of balanced salt solution should be used and the patient reevaluated.
 - The effectiveness of each fluid bolus should be reevaluated before it is repeated. If there is not a beneficial response, further fluid boluses are unlikely to be effective and may cause harm.
- Vasopressors should be considered for managing vasodilatory states such as epidural-induced hypotension provided the patient is euvolemic.
- Anuria warrants immediate attention.

Tools and equipment

- Volumetric pump for maintenance infusion and fluids boluses except in critical situations (for example hemorrhage, resuscitation)
- Advanced hemodynamic equipment
- PLR maneuver + SV/CO/VTI/ETCO₂ monitoring when possible (PACU, ICU, HDU)



Additional information

- Complete a physical assessment of the patient to decide if more IV fluids are needed; avoid consultation by phone.
- The goal of IV fluid bolus is to increase venous return, which in turn increases SV.
- On surgical wards consider assessing arterial pulse pressure (PP) response following a PLR maneuver to determine whether stroke volume will increase with volume expansion. An increase in PP of >10 percent after a PLR maneuver can be considered clinically significant and indicate that SV is significantly increased. However, diagnostic accuracy of measuring the arterial PP response following the PLR maneuver (as an indicator of fluid responsiveness) is poor compared to SV or CO response. Even if arterial PP is positively correlated with stroke volume, it also depends on arterial compliance and pulse wave amplification.

4 Postoperative

Postoperative ileus prevention^{10,83,118-123}

Recommendations

- Combined elements of this pathway such as limited opioid use, minimally invasive surgery, omission of nasogastric tubes, fluid therapy and early feeding will help to minimize the development of postoperative ileus.
- Selective opioid antagonists, bisacodyl, magnesium oxide, and coffee or caffeine may be offered to reduce the duration of postoperative ileus.



Additional information

- There is no evidence to support the use of gum chewing to prevent postoperative ileus

Nutrition management

Nutrition therapy^{10,16,46,47,53,58,124-127}

Recommendations

- Patients should be offered food and fluid as early as day of surgery and by POD 1. ONS should be included. “Clear liquid” or “full liquid” diets should not be used routinely.
- Food intake should be self-monitored by patients to identify those who do not consume >50 percent of their food. Patients consistently eating ≤50 percent of their food for 72 hours, or as soon as clinically indicated, should receive a comprehensive nutrition assessment. Specialized nutrition care is personalized and includes use of therapeutic diets, fortified foods, ONS, EN, and PN.
- Patients assessed as malnourished (SGA B or C) before surgery should receive a high protein, high energy diet postoperatively and be followed by a dietician. If they are not anticipated to meet nutritional goals within 72 hours through oral intake, they should receive supplemental peripheral parenteral nutrition (PPN), PN, or EN. Nutrition support should be discontinued when the patient is able to take in ≥60 percent of their protein/kcal requirements via the oral route.



Tools and equipment

- Use a system to monitor food and fluid intake that works for your hospital and involves patients. For example: [My Meal Intake](#)



Additional information

- Perioperative immunonutrition (formula enriched with arginine, omega-3-fatty acids, ribonucleotides) has been recommended for malnourished patients undergoing major cancer surgery. However, currently, no such product is available in Canada.
- To encourage adequate intake in hospital, offer:
 - Small servings for the first meals (POD 0 and POD 1).
 - High-protein ONS targeting 250-500 kcal/day. Med Pass program can be used to deliver 60 ml up to QID.

4

Postoperative

- Nutrient dense snacks and high protein ONS made freely available and offered throughout the day (especially after the evening meal).
- Information on how to optimize in-hospital oral intake (for example signs noting that the fridge in the care area is stocked with ONS).
- Encouragement to family and friends to bring in favourite foods from home to stimulate appetite; provide education on optimal food choices.



Data collection

Date tolerating diet

Mobility

Patient assessment prior to early mobilization¹²⁸



Recommendations

- Nurses should be responsible for the initial assessment prior to first mobilization attempt.
- If mobility issues are identified (for example postoperative conditions or surgical complications that result in difficulty mobilizing after surgery) patients should be further assessed by a physiotherapist who should assist and supervise mobilization during hospital stay according to an individually prescribed exercise plan.



Implementation approaches

- Patients should be assessed for the following:
 - level of consciousness
 - levels of pain
 - symptoms of PONV
 - signs of cardiovascular dysfunction
 - signs of respiratory dysfunction
 - lower body strength
- To ensure patient safety, mobilization should not be started and further assessment and action by the healthcare team may be required to ensure safe early mobilization if:
 - Patient is severely somnolent or disoriented.
 - Patient reports severe pain.
 - Severe nausea or vomiting present.
 - Severe tachycardia, low blood pressure or abnormal electrocardiography present.
 - Severe tachypnea or low oxygen present.
 - Lower limb weakness because of residual motor block present.
- Patients may be assessed for functional lower body strength using tests such as the 30 second sit to stand; six-minute walk and timed up and go.

4 Postoperative

In-hospital mobilization¹²⁹



Recommendations

- If no mobility issues are identified in the initial assessment, patients should start mobilizing as soon as it is safety possible; ideally on POD 0.
- The first mobilization attempt should always be assisted and supervised by clinical staff (for example nurse, nursing assistant, physiotherapist, or kinesiologist).
- Throughout the hospital stay, patients should be encouraged to mobilize independently or with assistance from family or friends.
- All members of the healthcare team should encourage early, progressive mobilization during hospital stay.



Implementation approaches

- On POD 0 patients should be encouraged to mobilize out of bed (for example sit on a chair) and, if possible, walk short distances.
- From POD 1 until hospital discharge, patients should be encouraged to mobilize out of bed as much as possible according to their tolerance. Out of bed activities may include, but are not limited to, sitting on a chair, walking in the corridor, and climbing hospital stairs.
- Throughout the hospital stay patients should be encouraged to:
 - perform foot and ankle pumping and quad setting (ideally every hour while awake)
 - perform deep breathing and coughing exercises
 - exercise in bed if walking is not feasible



Data collection

First postoperative mobilization

5 Discharge

Patient and family or caregiver engagement

Recommendations

- Providers should address or answer any questions that patients and their family or caregiver may have related to the patient's condition or concerns with their discharge and follow-up.
- Encourage patients and their family or caregiver to review the "At home" section of their Guide to Colorectal Surgery booklet prior to discharge.
- Encourage patients and their family or caregiver to ask questions as needed and use the teach-back method, as required.
- Ensure relevant members of the healthcare team are available to respond to questions or concerns patients or family or caregiver may have about the discharge plan.

Pain management

Recommendations¹³⁰

- Discharge planning should begin well before surgery and involve all members of the multidisciplinary team and the patient and family or caregiver.
- Multimodal analgesics prescriptions can be suggested to the surgical team. Non-opioid therapies should be encouraged as primary treatment (for example acetaminophen, NSAIDs if approved by the surgical team).
- Titrate discharge medication based on what patients are taking in the hospital.
- Non-pharmacologic therapies should be encouraged (for example ice, elevation, physical therapy).
- Avoid prescribing opioids with other sedative medications (for example benzodiazepines).
- Short-acting opioids should not be prescribed for more than three- to five-day courses (for example morphine, hydromorphone, oxycodone).
- Educate patient on tapering of opioids as surgical pain resolves.
- Fentanyl or long-acting opioids (for example methadone, OxyContin) should not be prescribed to opioid naïve patients.
- Educate patients about safe use of opioids, potential side effects, overdose risks, and developing dependence or addiction.
- Promote safe storage and disposal of opioids and all medications.
- Refer and provide resources for patients who have or are suspected to have a substance use disorder after surgery.

Surgical best practices

Recommendations¹³¹⁻¹³³

- Emerging data supports the implementation of same-day discharge after minimally invasive colectomy in select patients who are receiving care at centers with well-established ERAS programs that can offer post-discharge remote supports.

5 Discharge

Nutrition management

Recommendations⁴⁶

- All patients should be made aware of the relevance of nutrition to recovery. Patients who are well nourished should receive education to optimize nutrition and monitor for challenges that could impact nutritional status.
- Malnourished patients (for example SGA B or SGA C) who do not fully recover from their nutritional status during hospitalization require ongoing care in the community. Patients, family, and caregivers should be educated on key aspects of the nutrition care plan to support continued recovery in the community, as well as key community resources that support access to food (for example meal programs, grocery shopping services).
- Ileostomy patients should receive specific guidelines from a dietitian to reduce the risk of dehydration and blockages.
- Primary caregivers and other practitioners involved in post-discharge care should be provided with details about the patient's nutritional status (for example, SGA rating, body weight), treatment provided during hospitalization and recommendations for continued care. When rehabilitation of nutritional status is ongoing, or there are opportunities to discuss secondary disease prevention, consider a referral for prioritized nutrition treatment by a dietitian.

Mobility and physical activity

Patient education prior to discharge

Recommendations

- Before hospital discharge, all patients should receive education about the negative impact of sedentary behavior and the importance of physical activity for health.



Implementation approaches

- Family members should be educated about how they can facilitate and encourage post-discharge physical activity.
- Should physical restrictions beyond that of typically expected be indicated, education regarding post-discharge physical activity should be delivered prior to discharge by a nurse, physiotherapist or kinesiologist.

Patient assessment prior to initiation of post-discharge physical activity¹²⁸

Recommendations

- A patient mobility assessment should be conducted prior to discharge.
- If mobility issues are identified, patients should be further assessed by a rehabilitation or exercise professional (physiotherapist, occupational therapist, kinesiologist, as appropriate), if possible, who should prescribe and supervise physical activities according to an individually prescribed exercise plan.

5 Discharge



Implementation approaches

- Patients should be asked about baseline (preoperative) level of function and physical activity, as well as levels of pain and presence of other symptoms while mobilizing in the hospital.

Post-discharge physical activity^{134,135}



Recommendations

- Patients should be encouraged not to stay in bed and resume activities of daily living (ADLs, such as light housework and running errands) progressively after hospital discharge.
- Criteria for safe resumption of physical activity should be considered: patients should initially avoid strenuous physical effort including core exercise (for example crunches, sit-ups) and lift weights only according to previous [consensus-based recommendations](#) (avoid lifting >5 kg for 1-2 weeks and >15 kg for 3-4 weeks).
- All members of the healthcare team should be accountable for encouraging postoperative physical activity after hospital discharge.
- All patients should have access to members of the healthcare team in case they have questions or require guidance regarding post-discharge physical activity.



Implementation approaches

- Patients should be encouraged to follow recommendations for physical activity established by the [WHO](#) as soon as it is safely possible (for example at least 150 minutes of moderate-intensity physical activity throughout the work week; muscle-strengthening activities of major muscle groups for two or more days a week).
- Ideally, patients should be encouraged to walk (at least three times per day) and climb stairs if available (daily or every two days).
- Ideally, patients should receive a self-managed home exercise program with set progression goals. Coaching may be provided (for example over the phone) with a rehabilitation or exercise professional (where possible).
- A “step count” system may be used to set activity goals and facilitate progression.



Data collection

Outcome measures:

- acute LOS
- complication rate
- visits to emergency department within 30 days after discharge
- readmission within 30 days after discharge

Colorectal Surgery

Term	Definition
Delphi method	A method of systematically surveying a group of experts to reach consensus opinion on a specific topic.
Dietitian	Includes the following protected titles: registered dietitian, professional dietitian, diététiste professionnel(le), dietitian, registered nutritionist, nutritionist. See Dietitians of Canada for the full list of protected titles and initials. ¹³⁶
Diet therapy	A broad term for the practical application of nutrition as a preventative or corrective treatment of disease.
Early mobilization	Mobilization out of bed starting on the day of surgery (POD 0) or within 12 hours after arrival on the ward.
Enteral nutrition (EN)	Also referred to as tube feeding. Tube feeding is when a special liquid nutrient mixture containing protein, carbohydrates (sugar), fats, vitamins and minerals, is given through a tube into the stomach or small bowel. ¹³⁷
Epidural stop test	A process that generally occurs on POD 2 (6 a.m.) whereby the epidural infusion is stopped, subcutaneous heparin is withheld and multimodal oral analgesia and opioids or tramadol are started as needed. If the patient is OK (for example optimal analgesia achieved) at noon (12 p.m.) the catheter is removed from the epidural space and oral analgesia is continue.
Exercise	Physical activity that is planned, structured, repetitive and intended to maintain or improve physical fitness. ¹³⁸
High protein oral nutritional supplements (ONS)	A ready-made liquid, powder, or pudding with macronutrients and micronutrients, containing >20 percent of energy provided from protein.
Kinesiologist	A professional trained in the science of human movement and exercise physiology. Scope of practice involves a broad range of subdisciplines intended to educate individuals about physical activity and exercise. Kinesiologists focus on modifying lifestyle behaviors, preventing injury and illness, optimizing health status and performance and preservation of quality of life.
Malnutrition	For the purposes of this document, malnutrition is defined as the deficiency (or imbalance) of energy, protein and other nutrients. ¹³⁹
Mobility	The ability to move freely and easily. ¹⁴⁰
Mobilization	The commencement of upright activities after a period of reduced mobility to resume activities of daily living.
Nutrition assessment	An in-depth, specific, and detailed evaluation of nutritional status. ¹⁴¹

Term	Definition
Nutrition screening	A quick and easy procedure using a valid screening tool, designed to identify those who are malnourished or at risk of malnutrition and may benefit from nutrition assessment. ¹²⁵
Optimal analgesia	A technique that optimizes patient comfort and facilitates recovery of physical function including the bowel, mobilization, cough, and normal sleep, while minimizing adverse effects of analgesics.
Opioid-induced hyperalgesia	Increased sensitivity to noxious stimuli.
Passive leg raise (PLR)	The PLR test measures the hemodynamic effects of a leg elevation up to 45°. To perform the postural maneuver, transfer the patient from the semi-recumbent posture to the PLR position by using the automatic motion of the bed. ¹¹⁷
Parenteral nutrition (PN)	IV administration of nutrition, which may include protein, carbohydrate, fat, minerals and electrolytes, vitamins and other trace elements for patients who cannot eat or absorb enough food through the gastrointestinal tract to maintain good nutrition status. ¹⁴²
Patient journey	Begins at time of diagnosis and continues through treatment and recovery.
Physical activity	Any bodily movement produced by skeletal muscles that requires energy expenditure. ¹³⁵
Pre-admission clinic	A multidisciplinary clinic designed to ensure patients due to be admitted are well prepared and informed about their surgery and forthcoming hospital stay.
Pulse pressure (PP)	The difference between systolic and diastolic pressure.
Subjective global assessment (SGA)	A nutrition assessment tool that is a gold standard for diagnosing malnutrition.
Therapeutic exercise	Bodily movement that is prescribed to correct an impairment or injury, improve physical function, or maintain a state of well-being.

Colorectal Surgery

1. Feldman LS, Delaney CP, Ljungqvist O, Carli F. *The SAGES/ERAS Society Manual of Enhanced Recovery Programs for Gastrointestinal Surgery*. 1 ed. Springer International Publishing; 2015.
2. Bellows M, Kovacs Burns K, Jackson K, Surgeoner B, Gallivan J. Meaningful and effective patient engagement: What matters most to stakeholders. *Patient Experience Journal*. 2015;2(1):18-28.
3. Kessels RP. Patients' memory for medical information. *J R Soc Med*. May 2003;96(5):219-22.
4. Wizowski L, Harper T, Hutchings T. Writing health information for patients and families. Hamilton Health Sciences. Accessed November 11, 2022. https://www.muhclibraries.ca/Documents/Writing_HI_Edition4.pdf
5. Gillis C, Gill M, Marlett N, et al. Patients as partners in Enhanced Recovery After Surgery: A qualitative patient-led study. *BMJ Open*. Jun 24 2017;7(6):e017002.
6. Houts PS, Doak CC, Doak LG, Loscalzo MJ. The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence. *Patient Educ Couns*. May 2006;61(2):173-90.
7. Caligtan CA, Carroll DL, Hurley AC, Gersh-Zaremski R, Dykes PC. Bedside information technology to support patient-centered care. *Int J Med Inform*. Jul 2012;81(7):442-51. 5
8. Dorvil B. The secrets to successful nurse bedside shift report implementation and sustainability. *Nurs Manage*. Jun 2018;49(6):20-25.
9. Agency for Healthcare Research and Quality. Improving surgical care and recovery - colorectal pathway worksheet. 2021.
10. 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*. Mar 2019;43(3):659-695.
11. Forsmo HM, Erichsen C, Rasdal A, Tvinnereim JM, Körner H, Pfeffer F. Randomized controlled trial of extended perioperative counseling in enhanced recovery after colorectal surgery. *Dis Colon Rectum*. Jun 2018;61(6):724-732.
12. Roberts L. Health information and the Internet: The 5 Cs website evaluation tool. *Br J Nurs*. Mar 11-24 2010;19(5):322-5.
13. Kaplan MA, Korelitz BI. Narcotic dependence in inflammatory bowel disease. *J Clin Gastroenterol*. Jun 1988;10(3):275-8.
14. Cross RK, Wilson KT, Binion DG. Narcotic use in patients with Crohn's disease. *Am J Gastroenterol*. Oct 2005;100(10):2225-9.
15. Crocker JA, Yu H, Conaway M, Tuskey AG, Behm BW. Narcotic use and misuse in Crohn's disease. *Inflamm Bowel Dis*. Dec 2014;20(12):2234-8.
16. Carmichael JC, Keller DS, Baldini G, et al. Clinical practice guideline for enhanced recovery after colon and rectal surgery from the American Society of Colon and Rectal Surgeons (ASCRS) and Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). *Surg Endosc*. Sep 2017;31(9):3412-3436.

Colorectal Surgery

17. de Neree Tot Babberich MPM, Detering R, Dekker JWT, et al. Achievements in colorectal cancer care during 8 years of auditing in the Netherlands. *Eur J Surg Oncol*. Sep 2018;44(9):1361-1370.
18. Zwiép TM, Helewa RM, Robertson R, et al. Preoperative stoma site marking for fecal diversions (ileostomy and colostomy): position statement of the Canadian Society of Colon and Rectal Surgeons and Nurses Specialized in Wound, Ostomy and Continence Canada. *Can J Surg*. May-Jun 2022;65(3):E359-e363.
19. Fleming F, Gaertner W, Ternent CA, et al. The American Society of Colon and Rectal Surgeons clinical practice guideline for the prevention of venous thromboembolic disease in colorectal surgery. *Dis Colon Rectum*. Jan 2018;61(1):14-20.
20. Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. *Circulation*. Sep 7 1999;100(10):1043-9.
21. Robinson TN, Wu DS, Pointer L, Dunn CL, Cleveland JC, Jr., Moss M. Simple frailty score predicts postoperative complications across surgical specialties. *Am J Surg*. Oct 2013;206(4):544-50.
22. National Guideline C. National Institute for Health and Care Excellence: Guidelines. *Preoperative Tests (Update): Routine Preoperative Tests for Elective Surgery*. National Institute for Health and Care Excellence (NICE) Copyright © National Institute for Health and Care Excellence 2016.; 2016.
23. Caprini JA. Thrombosis risk assessment as a guide to quality patient care. *Dis Mon*. Feb-Mar 2005;51(2-3):70-8.
24. Chow WB, Rosenthal RA, Merkow RP, Ko CY, Esnaola NF. Optimal preoperative assessment of the geriatric surgical patient: a best practices guideline from the American College of Surgeons National Surgical Quality Improvement Program and the American Geriatrics Society. *J Am Coll Surg*. Oct 2012;215(4):453-66.
25. Gustafsson UO, Thorell A, Soop M, Ljungqvist O, Nygren J. Haemoglobin A1c as a predictor of postoperative hyperglycaemia and complications after major colorectal surgery. *Br J Surg*. Nov 2009;96(11):1358-64.
26. Muñoz M, Acheson AG, Auerbach M, et al. International consensus statement on the peri-operative management of anaemia and iron deficiency. *Anaesthesia*. Feb 2017;72(2):233-247.
27. Hughes CG, Boncyk CS, Culley DJ, et al. American Society for Enhanced Recovery and Perioperative Quality Initiative joint consensus statement on postoperative delirium prevention. *Anesth Analg*. Jun 2020;130(6):1572-1590.
28. Trentino KM, Mace H, Symons K, et al. Associations of a preoperative anemia and suboptimal iron stores screening and management clinic in colorectal surgery with hospital cost, reimbursement, and length of stay: a net cost analysis. *Anesth Analg*. Feb 1 2021;132(2):344-352.
29. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. May 22 2006;166(10):1092-7.
30. Elkins G, Rajab MH, Marcus J, Staniunas R. Prevalence of anxiety among patients undergoing colorectal surgery. *Psychol Rep*. Oct 2004;95(2):657-8.

Colorectal Surgery

31. McEvoy MD, Scott MJ, Gordon DB, et al. American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on optimal analgesia within an enhanced recovery pathway for colorectal surgery: part 1-from the preoperative period to PACU. *Perioper Med (Lond)*. 2017;6:8.
32. Hansen MV, Halladin NL, Rosenberg J, Gögenur I, Møller AM. Melatonin for pre- and postoperative anxiety in adults. *Cochrane Database Syst Rev*. Apr 9 2015;2015(4):Cd009861.
33. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. Jun 1983;67(6):361-70.
34. Lindström D, Sadr Azodi O, Wladis A, et al. Effects of a perioperative smoking cessation intervention on postoperative complications: a randomized trial. *Ann Surg*. Nov 2008;248(5):739-45.
35. Sorensen LT, Karlsmark T, Gottrup F. Abstinence from smoking reduces incisional wound infection: a randomized controlled trial. *Ann Surg*. Jul 2003;238(1):1-5.
36. Tonnesen H, Rosenberg J, Nielsen HJ, et al. Effect of preoperative abstinence on poor postoperative outcome in alcohol misusers: randomised controlled trial. *BMJ*. May 15 1999;318(7194):1311-6.
37. Tonnesen H, Kehlet H. Preoperative alcoholism and postoperative morbidity. *Br J Surg*. Jul 1999;86(7):869-74.
38. Gustafsson UO, Scott MJ, Schwenk W, et al. Guidelines for perioperative care in elective colonic surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *Clin Nutr*. Dec 2012;31(6):783-800.
39. Government of Canada. Tobacco use terminology. Accessed November 11, 2022. <https://www.canada.ca/en/health-canada/services/health-concerns/tobacco/research/tobacco-use-statistics/terminology.html>
40. Government of Canada. Low-risk alcohol drinking guidelines. Accessed November 11, 2022. <https://www.canada.ca/en/health-canada/services/substance-use/alcohol/low-risk-alcohol-drinking-guidelines.html>
41. Messaris E, Sehgal R, Deiling S, et al. Dehydration is the most common indication for readmission after diverting ileostomy creation. *Dis Colon Rectum*. Feb 2012;55(2):175-80.
42. Hayden DM, Pinzon MC, Francescatti AB, et al. Hospital readmission for fluid and electrolyte abnormalities following ileostomy construction: preventable or unpredictable? *J Gastrointest Surg*. Feb 2013;17(2):298-303.
43. Myles PS, Andrews S, Nicholson J, Lobo DN, Mythen M. Contemporary approaches to perioperative IV fluid therapy. *World J Surg*. Oct 2017;41(10):2457-2463.
44. Sibbern T, Bull Sellevold V, Steindal SA, Dale C, Watt-Watson J, Dihle A. Patients' experiences of enhanced recovery after surgery: a systematic review of qualitative studies. *J Clin Nurs*. May 2017;26(9-10):1172-1188.
45. Laporte M, Keller HH, Payette H, et al. Validity and reliability of the new Canadian nutrition screening tool in the 'real-world' hospital setting. *Eur J Clin Nutr*. May 2015;69(5):558-64.

Colorectal Surgery

46. Keller H, Laur C, Atkins M, et al. Update on the Integrated Nutrition Pathway for Acute Care (INPAC): post implementation tailoring and toolkit to support practice improvements. *Nutr J*. Jan 5 2018;17(1):2.
47. Wischmeyer PE, Carli F, Evans DC, et al. American Society for Enhanced Recovery and Perioperative Quality Initiative joint consensus statement on nutrition screening and therapy within a surgical enhanced recovery pathway. *Anesth Analg*. Jun 2018;126(6):1883-1895.
48. Gillis C, Nguyen TH, Liberman AS, Carli F. Nutrition adequacy in enhanced recovery after surgery: a single academic center experience. *Nutr Clin Pract*. Jun 2015;30(3):414-9.
49. Burden ST, Hill J, Shaffer JL, Todd C. Nutritional status of preoperative colorectal cancer patients. *J Hum Nutr Diet*. Aug 2010;23(4):402-7.
50. Jie B, Jiang ZM, Nolan MT, Zhu SN, Yu K, Kondrup J. Impact of preoperative nutritional support on clinical outcome in abdominal surgical patients at nutritional risk. *Nutrition*. Oct 2012;28(10):1022-7.
51. Martin L, Gillis C, Atkins M, et al. Implementation of an Enhanced Recovery After Surgery program can change nutrition care practice: a multicenter experience in elective colorectal surgery. *JPEN J Parenter Enteral Nutr*. Feb 2019;43(2):206-219.
52. Hasil L, Fenton TR, Ljungqvist O, Gillis C. From clinical guidelines to practice: The nutrition elements for enhancing recovery after colorectal surgery. *Nutr Clin Pract*. Apr 2022;37(2):300-315.
53. Weimann A, Braga M, Carli F, et al. ESPEN practical guideline: Clinical nutrition in surgery. *Clin Nutr*. Jul 2021;40(7):4745-4761.
54. Detsky AS, McLaughlin JR, Baker JP, et al. What is subjective global assessment of nutritional status? *JPEN J Parenter Enteral Nutr*. Jan-Feb 1987;11(1):8-13.
55. Greysen SR, Patel MS. Web exclusive. Annals for hospitalists inpatient notes - Bedrest is toxic-why mobility matters in the hospital. *Ann Intern Med*. Jul 17 2018;169(2):Ho2-ho3.
56. Teo JYK, Turner R, Self M. Effect of exercise prehabilitation on functional status of patients undergoing bowel resection: a systematic review. *ANZ J Surg*. May 2020;90(5):693-701.
57. Hårdemark Cedborg AI, Sundman E, Bodén K, et al. Effects of morphine and midazolam on pharyngeal function, airway protection, and coordination of breathing and swallowing in healthy adults. *Anesthesiology*. Jun 2015;122(6):1253-67.
58. Hedrick TL, McEvoy MD, Mythen MMG, et al. 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. *Anesth Analg*. Jun 2018;126(6):1896-1907.
59. Apfel CC, Kranke P, Eberhart LH, Roos A, Roewer N. Comparison of predictive models for postoperative nausea and vomiting. *Br J Anaesth*. Feb 2002;88(2):234-40.
60. Srinivasa S, Kahokehr AA, Yu TC, Hill AG. Preoperative glucocorticoid use in major abdominal surgery: systematic review and meta-analysis of randomized trials. *Ann Surg*. Aug 2011;254(2):183-91.

Colorectal Surgery

61. Gupta R, Soto R. Prophylaxis and management of postoperative nausea and vomiting in enhanced recovery protocols: Expert opinion statement from the American Society for Enhanced Recovery (ASER). *Perioper Med (Lond)*. 2016;5:4.
62. Gan TJ, Belani KG, Bergese S, et al. Fourth consensus guidelines for the management of postoperative nausea and vomiting. *Anesth Analg*. Aug 2020;131(2):411-448.
63. Wu CT, Jao SW, Borel CO, et al. The effect of epidural clonidine on perioperative cytokine response, postoperative pain, and bowel function in patients undergoing colorectal surgery. *Anesth Analg*. Aug 2004;99(2):502-9, table of contents.
64. Scott MJ, McEvoy MD, Gordon DB, et al. American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on optimal analgesia within an enhanced recovery pathway for colorectal surgery: Part 2-from pacu to the transition home. *Perioper Med (Lond)*. 2017;6:7.
65. Albrecht E, Kirkham KR, Liu SS, Brull R. Peri-operative intravenous administration of magnesium sulphate and postoperative pain: a meta-analysis. *Anaesthesia*. Jan 2013;68(1):79-90.
66. Safety and efficacy of non-steroidal anti-inflammatory drugs to reduce ileus after colorectal surgery. *Br J Surg*. Jan 2020;107(2):e161-e169.
67. Cao F, Li J, Li F. Mechanical bowel preparation for elective colorectal surgery: updated systematic review and meta-analysis. *Int J Colorectal Dis*. Jun 2012;27(6):803-10.
68. Courtney DE, Kelly ME, Burke JP, Winter DC. Postoperative outcomes following mechanical bowel preparation before proctectomy: a meta-analysis. *Colorectal Dis*. Oct 2015;17(10):862-9.
69. Dahabreh IJ, Steele DW, Shah N, Trikalinos TA. Oral mechanical bowel preparation for colorectal surgery: systematic review and meta-analysis. *Dis Colon Rectum*. Jul 2015;58(7):698-707.
70. Güenaga KF, Matos D, Wille-Jørgensen P. Mechanical bowel preparation for elective colorectal surgery. *Cochrane Database Syst Rev*. Sep 7 2011;2011(9):Cd001544.
71. Rollins KE, Javanmard-Emamghissi H, Lobo DN. Impact of mechanical bowel preparation in elective colorectal surgery: A meta-analysis. *World J Gastroenterol*. Jan 28 2018;24(4):519-536.
72. Zhu QD, Zhang QY, Zeng QQ, Yu ZP, Tao CL, Yang WJ. Efficacy of mechanical bowel preparation with polyethylene glycol in prevention of postoperative complications in elective colorectal surgery: a meta-analysis. *Int J Colorectal Dis*. Feb 2010;25(2):267-75.
73. Holubar SD, Hedrick T, Gupta R, et al. American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on prevention of postoperative infection within an enhanced recovery pathway for elective colorectal surgery. *Perioper Med (Lond)*. 2017;6:4.
74. Rollins KE, Lobo DN. The controversies of mechanical bowel and oral antibiotic preparation in elective colorectal surgery. *Ann Surg*. Jan 1 2021;273(1):e13-e15.
75. Alcoholic chlorhexidine skin preparation or triclosan-coated sutures to reduce surgical site infection: a systematic review and meta-analysis of high-quality randomised controlled trials. *Lancet Infect Dis*. Aug 2022;22(8):1242-1251.

Colorectal Surgery

76. Alfonsi P, Slim K, Chauvin M, Mariani P, Faucheron JL, Fletcher D. French guidelines for enhanced recovery after elective colorectal surgery. *J Visc Surg*. Feb 2014;151(1):65-79.
77. Nelson RL, Gladman E, Barbateskovic M. Antimicrobial prophylaxis for colorectal surgery. *Cochrane Database Syst Rev*. May 9 2014;2014(5):Cd001181. doi:10.1002/14651858.CD001181.pub4
78. Connelly L, Cramer E, DeMott Q, et al. The Optimal Time and Method for Surgical Prewarming: A Comprehensive Review of the Literature. *J Perianesth Nurs*. Jun 2017;32(3):199-209.
79. Roberson MC, Dieckmann LS, Rodriguez RE, Austin PN. A review of the evidence for active preoperative warming of adults undergoing general anesthesia. *Aana j*. Oct 2013;81(5):351-6.
80. Kakkos SK, Caprini JA, Geroulakos G, et al. Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thromboembolism. *Cochrane Database Syst Rev*. Sep 7 2016;9(9):Cd005258.
81. Diabetes Canada Clinical Practice Guidelines Expert Committee. In-hospital management of diabetes. Accessed November 12, 2022. <https://guidelines.diabetes.ca/cpg/chapter16#:~:text=For%20the%20majority%20of%20noncritically,targets%20can%20be%20safely%20achieved>
82. Health Standards Organization. HSO 3001:2019 (E) Medication management. Accessed November 12, 2022. <https://healthstandards.org/standard/medication-management-3/>
83. Thiele RH, Raghunathan K, Brudney CS, et al. American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on perioperative fluid management within an enhanced recovery pathway for colorectal surgery. *Perioper Med (Lond)*. 2016;5:24.
84. Smith MD, McCall J, Plank L, Herbison GP, Soop M, Nygren J. Preoperative carbohydrate treatment for enhancing recovery after elective surgery. *Cochrane Database Syst Rev*. Aug 14 2014;(8):Cd009161.
85. Gustafsson UO, Nygren J, Thorell A, et al. Pre-operative carbohydrate loading may be used in type 2 diabetes patients. *Acta Anaesthesiol Scand*. Aug 2008;52(7):946-51.
86. Jenkins DJ, Wolever TM, Ocana AM, et al. Metabolic effects of reducing rate of glucose ingestion by single bolus versus continuous sipping. *Diabetes*. Jul 1990;39(7):775-81.
87. Karimian N, Moustafa M, Mata J, et al. The effects of added whey protein to a pre-operative carbohydrate drink on glucose and insulin response. *Acta Anaesthesiol Scand*. May 2018;62(5):620-627.
88. Brandstrup B, Tønnesen H, Beier-Holgersen R, et al. Effects of intravenous fluid restriction on postoperative complications: comparison of two perioperative fluid regimens: a randomized assessor-blinded multicenter trial. *Ann Surg*. Nov 2003;238(5):641-8.
89. Richebé P, Bousette N, Fortier LP. A narrative review on the potential benefits and limitations of deep neuromuscular blockade. *Anaesth Crit Care Pain Med*. Aug 2021;40(4):100915.
90. Renaud-Roy E, Morisson L, Brulotte V, et al. Effect of combined intraoperative use of the nociception level (NOL) and bispectral (BIS) indexes on desflurane administration. *Anaesth Crit Care Pain Med*. Jun 2022;41(3):101081.

Colorectal Surgery

91. Angst MS. Intraoperative use of remifentanyl for TIVA: Postoperative pain, acute tolerance, and opioid-induced hyperalgesia. *J Cardiothorac Vasc Anesth.* Jun 2015;29 Suppl 1:S16-22.
92. Joly V, Richebe P, Guignard B, et al. Remifentanyl-induced postoperative hyperalgesia and its prevention with small-dose ketamine. *Anesthesiology.* Jul 2005;103(1):147-55.
93. Fletcher D, Martinez V. Opioid-induced hyperalgesia in patients after surgery: a systematic review and a meta-analysis. *Br J Anaesth.* Jun 2014;112(6):991-1004.
94. Cheung CW, Qiu Q, Ying AC, Choi SW, Law WL, Irwin MG. The effects of intra-operative dexmedetomidine on postoperative pain, side-effects and recovery in colorectal surgery. *Anaesthesia.* Nov 2014;69(11):1214-21.
95. Lee LH, Irwin MG, Lui SK. Intraoperative remifentanyl infusion does not increase postoperative opioid consumption compared with 70% nitrous oxide. *Anesthesiology.* Feb 2005;102(2):398-402.
96. Chen Y, Liu X, Cheng CH, et al. Leukocyte DNA damage and wound infection after nitrous oxide administration: a randomized controlled trial. *Anesthesiology.* Jun 2013;118(6):1322-31.
97. Guo BL, Lin Y, Hu W, et al. Effects of systemic magnesium on post-operative analgesia: is the current evidence strong enough? *Pain Physician.* Sep-Oct 2015;18(5):405-18.
98. Meijer F, Honing M, Roor T, et al. Reduced postoperative pain using nociception level-guided fentanyl dosing during sevoflurane anaesthesia: a randomised controlled trial. *Br J Anaesth.* Dec 2020;125(6):1070-1078.
99. Dobson G, Filteau L, Fuda G, et al. Guidelines to the practice of anesthesia - revised edition 2022. *Can J Anaesth.* Jan 2022;69(1):24-61. Guide d'exercice de l'anesthésie de la SCA – Édition révisée 2022.
100. Campbell G, Alderson P, Smith AF, Warttig S. Warming of intravenous and irrigation fluids for preventing inadvertent perioperative hypothermia. *Cochrane Database Syst Rev.* Apr 13 2015;2015(4):Cd009891.
101. Pop-Vicas AE, Abad C, Baubie K, Osman F, Heise C, Safdar N. Colorectal bundles for surgical site infection prevention: A systematic review and meta-analysis. *Infect Control Hosp Epidemiol.* Jul 2020;41(7):805-812.
102. Feldheiser A, Aziz O, Baldini G, et al. Enhanced Recovery After Surgery (ERAS) for gastrointestinal surgery, part 2: consensus statement for anaesthesia practice. *Acta Anaesthesiol Scand.* Mar 2016;60(3):289-334.
103. Hahn RG, Lyons G. The half-life of infusion fluids: An educational review. *Eur J Anaesthesiol.* Jul 2016;33(7):475-82.
104. Brienza N, Giglio MT, Marucci M, Fiore T. Does perioperative hemodynamic optimization protect renal function in surgical patients? A meta-analytic study. *Crit Care Med.* Jun 2009;37(6):2079-90.
105. Legrand M, Payen D. Case scenario: Hemodynamic management of postoperative acute kidney injury. *Anesthesiology.* Jun 2013;118(6):1446-54.

Colorectal Surgery

106. Bentzer P, Griesdale DE, Boyd J, MacLean K, Sirounis D, Ayas NT. Will this hemodynamically unstable patient respond to a bolus of intravenous fluids? *JAMA*. Sep 27 2016;316(12):1298-309.
107. Mardis T, Mardis M, Davis J, et al. Bedside shift-to-shift handoffs: A systematic review of the literature. *J Nurs Care Qual*. Jan-Mar 2016;31(1):54-60.
108. Brouquet A, Cudennec T, Benoist S, et al. Impaired mobility, ASA status and administration of tramadol are risk factors for postoperative delirium in patients aged 75 years or more after major abdominal surgery. *Ann Surg*. Apr 2010;251(4):759-65.
109. Kranke P, Jokinen J, Pace NL, et al. Continuous intravenous perioperative lidocaine infusion for postoperative pain and recovery. *Cochrane Database Syst Rev*. Jul 16 2015;(7):Cd009642.
110. Bakker N, Deelder JD, Richir MC, et al. Risk of anastomotic leakage with nonsteroidal anti-inflammatory drugs within an enhanced recovery program. *J Gastrointest Surg*. Apr 2016;20(4):776-82.
111. Modasi A, Pace D, Godwin M, Smith C, Curtis B. NSAID administration post colorectal surgery increases anastomotic leak rate: systematic review/meta-analysis. *Surg Endosc*. Mar 2019;33(3):879-885.
112. Myles PS, Bellomo R, Corcoran T, et al. Restrictive versus liberal fluid therapy for major abdominal surgery. *N Engl J Med*. Jun 14 2018;378(24):2263-2274.
113. National Clinical Guideline C. National Institute for Health and Clinical Excellence: Guidance. *Intravenous Fluid Therapy: Intravenous Fluid Therapy in Adults in Hospital*. Royal College of Physicians (UK) Copyright © 2013, National Clinical Guideline Centre.; 2013.
114. Powell-Tuck J, Gosling P, Lobo D, et al. *British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients*. Accessed February 12, 2023. https://www.bapen.org.uk/pdfs/bapen_pubs/giftasup.pdf
115. Monnet X, Teboul JL. Passive leg raising: five rules, not a drop of fluid! *Crit Care*. 2015;18. vol. 1.
116. Pickett JD, Bridges E, Kritek PA, Whitney JD. Passive leg-raising and prediction of fluid responsiveness: systematic review. *Crit Care Nurse*. Apr 2017;37(2):32-47.
117. Toscani L, Aya HD, Antonakaki D, et al. What is the impact of the fluid challenge technique on diagnosis of fluid responsiveness? A systematic review and meta-analysis. *Crit Care*. Aug 4 2017;21(1):207.
118. de Leede EM, van Leersum NJ, Kroon HM, van Weel V, van der Sijp JRM, Bonsing BA. Multicentre randomized clinical trial of the effect of chewing gum after abdominal surgery. *Br J Surg*. Jun 2018;105(7):820-828.
119. Yang TW, Wang CC, Sung WW, Ting WC, Lin CC, Tsai MC. The effect of coffee/caffeine on postoperative ileus following elective colorectal surgery: a meta-analysis of randomized controlled trials. *Int J Colorectal Dis*. Mar 2022;37(3):623-630.
120. McKechnie T, Anpalagan T, Ichhpuniani S, Lee Y, Ramji K, Eskicioglu C. Selective Opioid Antagonists

Colorectal Surgery

- Following Bowel Resection for Prevention of Postoperative Ileus: a Systematic Review and Meta-analysis. *J Gastrointest Surg*. Jun 2021;25(6):1601-1624.
121. Watanabe J, Miki A, Koizumi M, Kotani K, Sata N. Effect of postoperative coffee consumption on postoperative ileus after abdominal surgery: An updated systematic review and meta-analysis. *Nutrients*. Dec 8 2021;13(12).
 122. Chapman SJ, Pericleous A, Downey C, Jayne DG. Postoperative ileus following major colorectal surgery. *Br J Surg*. Jun 2018;105(7):797-810.
 123. Ashcroft J, Singh AA, Ramachandran B, et al. Reducing ileus after colorectal surgery: A network meta-analysis of therapeutic interventions. *Clin Nutr*. © 2021 Elsevier Ltd and European Society for Clinical Nutrition and Metabolism; 2021:4772-4782. vol. 7.
 124. Evans D, Collier B. Trauma, surgery, and burns. In: *The ASPEN Adult Nutrition Support Core Curriculum 3rd Ed. American Society for Parenteral and Enteral Nutrition*; 2017:473-488.
 125. McCullough J, Keller H. The My Meal Intake Tool (M-MIT): Validity of a patient self- assessment for food and fluid intake at a single meal. *J Nutr Health Aging*. 2018;22(1):30-37.
 126. Williams DGA, Ohnuma T, Krishnamoorthy V, et al. Impact of early postoperative oral nutritional supplement utilization on clinical outcomes in colorectal surgery. *Perioper Med (Lond)*. 2020;9:29.
 127. Herbert G, Perry R, Andersen HK, et al. Early enteral nutrition within 24 hours of lower gastrointestinal surgery versus later commencement for length of hospital stay and postoperative complications. *Cochrane Database Syst Rev*. Jul 22 2019;7(7):Cd004080.
 128. Rikli R, Jones C. *Senior Fitness Test Manual*. 2nd Edition ed. *Human Kinetics*; 2013.
 129. Fiore JF, Jr., Castelino T, Pecorelli N, et al. Ensuring early mobilization within an enhanced recovery program for colorectal surgery: A randomized controlled trial. *Ann Surg*. Aug 2017;266(2):223-231.
 130. OPEN: Opioid Prescribing Engagement Network. *Surgical Prescribing: Summary of Best Practices*. Accessed November 5, 2022. <https://michigan-open.org/resource/acute-care-opioid-treatment-and-prescribing-recommendations-surgical-department/>
 131. Lee L, Eustache J, Baldini G, et al. Enhanced Recovery 2.0 - Same day discharge with mobile app follow-up after minimally invasive colorectal surgery. *Ann Surg*. Dec 1 2022;276(6):e812-e818.
 132. Gignoux B, Gosgnach M, Lanz T, et al. Short-term outcomes of ambulatory colectomy for 157 consecutive patients. *Ann Surg*. Aug 2019;270(2):317-321.
 133. Lee L, McLemore E, Rashidi L. Same-day discharge after minimally invasive colectomy. *JAMA Surg*. Nov 1 2022;157(11):1059-1060.
 134. van Vliet DC, van der Meij E, Bouwsma EV, et al. A modified Delphi method toward multidisciplinary consensus on functional convalescence recommendations after abdominal surgery. *Surg Endosc*. Dec 2016;30(12):5583-5595.
 135. World Health Organization. Physical Activity. Accessed November 13, 2022. <https://www.who.int/news-room/fact-sheets/detail/physical-activity>

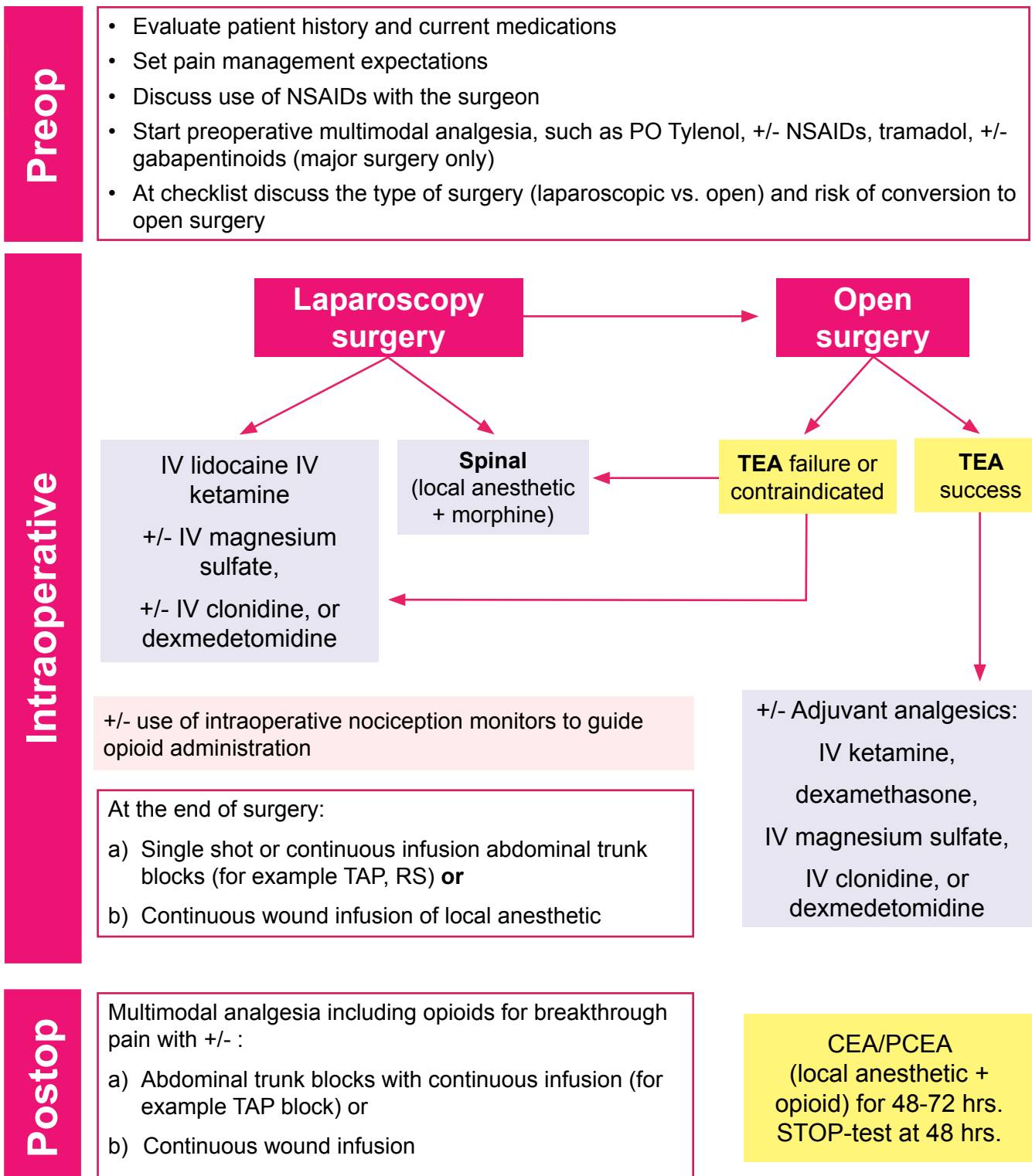
Colorectal Surgery

136. Dietitians of Canada. The difference between a dietitian and a nutritionist. Accessed November 5, 2022. <https://www.dietitians.ca/About/Learn-About-Dietitians/The-difference-between-a-dietitian-and-nutritionis>
137. Nutrition ASfPaE. What is Enteral Nutrition. Accessed November 5, 2022. https://www.nutritioncare.org/About_Clinical_Nutrition/What_is_Enteral_Nutrition/
138. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep.* Mar-Apr 1985;100(2):126-31.
139. Canadian Malnutrition Task Force. Malnutrition Overview. Accessed November 5, 2022. <https://nutritioncareincanada.ca/about-us/malnutrition-overview>
140. Cambridge University Press. Mobility. Accessed February 12, 2023. <https://dictionary.cambridge.org/dictionary/english/mobility>
141. Power L, Mullally D, Gibney ER, et al. A review of the validity of malnutrition screening tools used in older adults in community and healthcare settings - A MaNuEL study. *Clin Nutr ESPEN.* Apr 2018;24:1-13.
142. American Society for Parenteral and Enteral Nutrition. What is Parenteral Nutrition. Accessed November 5, 2022. https://www.nutritioncare.org/About_Clinical_Nutrition/What_is_Parenteral_Nutrition/

Abbreviations

ACS , American College of Surgeons	NPO , nothing by mouth
ADL , activities of daily living	NSAID , nonsteroidal anti-inflammatory drug
AHRQ , Agency for Healthcare Research and Quality	NSQIP , National Surgical Quality Improvement Program
AKI , acute kidney injury	ONS , oral nutritional supplement
ASA , American Society of Anesthesiologists'	PACU , post anesthesia care unit
BPMH , best possible medication history	PCA , patient-controlled analgesia
C. diff , Clostridium difficile	PCEA , patient-controlled epidural analgesia
CEA , continuous epidural anesthesia	PLR , passive leg raise
CHF , congestive heart failure	PN , parenteral nutrition
CNST , Canadian Nutrition Screening Tool	PO , by mouth
CO , cardiac output	POD , postoperative day
COX2 , cyclo-oxygenase-2	PONV , postoperative nausea and vomiting
CVC , central venous catheter	PP , pulse pressure
CWI , continuous wound infusion	PPN , peripheral parenteral nutrition
EBL , estimated blood loss	PPV , pulse volume variation
EN , enteral nutrition	RN , registered nurse
ERC , Enhanced Recovery Canada	QID , four times a day
ERAS , enhanced recovery after surgery	RS , rectus sheath
ETCO₂ , end-tidal carbon dioxide	SAB , subarachnoid
GAD , generalized anxiety disorder	SGA , subjective global assessment
HADS , hospital anxiety and depression scale	SSI , surgical site infection
HDU , high dependency unit	SV , stroke volume
HEC , Healthcare Excellence Canada	SVV , stroke volume variation
IBD , irritable bowel disease	TAP , transversus abdominis plane
ICU , intensive care unit	TEA , thoracic epidural analgesia
ISCR , Improving Surgical Care and Recovery	TIVA , total intravenous anesthesia
IV , intravenous	UO , urine output
LMWH , low molecular weight heparin	VTE , venous thromboembolism
LOS , length of stay	VTI , velocity time integral
MBP , mechanical bowel preparation	WHO , World Health Organization
NG , nasogastric tube	

Analgesia Algorithm



Data Collection and Measurement

Summary

This resource will guide clinicians through data collection and measurement to support the implementation of the Enhanced Recovery Canada™ (ERC) colorectal clinical pathway. It includes information about how to identify your study population, how to calculate the appropriate sample size, as well as identifies what specific data points to be collected on each patient.

Study population

It is helpful for teams to collect data on patients undergoing the same colorectal surgeries to allow for data aggregation and comparisons. This is possible because each Canadian acute care institution reviews patient's charts after discharge and classifies their surgeries based on a universal coding system.

The [Canadian Institute for Health Information](#) (CIHI) sets the national standard for morbidity data reporting in Canada. CIHI maintains, distributes, and supports the application of ICD-10-CA (the Canadian Modification of ICD-10). Canadian Classification of Health Interventions (CCI) is the national standard for classifying healthcare procedures.

ICD-10 (International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada) was developed by the World Health Organization (WHO) and enhanced by CIHI to meet Canadian morbidity data needs. CCI was developed by CIHI to accompany ICD-10-CA. It was designed to be service-provider and service-setting neutral and can be used comprehensively throughout Canada's health system.

ICD-10 Code	Description of procedure
1.NK.77	Bypass with exteriorization, small intestine
1.NK.82	Reattachment, small intestine
1.NK.87	Excision partial, small intestine
1.NM.77	Bypass with exteriorization, large intestine
1.NM.82	Reattachment, large intestine
1.NM.87	Excision partial, large intestine
1.NM.89	Excision total, large intestine
1.NM.91	Excision radical, large intestine
1.NQ.74	Fixation, rectum
1.NQ.87	Excision partial, rectum
1.NQ.89	Excision total, rectum
1.OW.89	Excision total, surgically constructed sites in digestive and biliary tract

Data Collection and Measurement

Sampling

A suggested sampling calculation is provided below.¹ This calculation recommends how many patient charts should be reviewed during the baseline period selected and the ongoing data collection through the implementation phase. This sampling is based on the number of colorectal surgeries performed monthly.

Average monthly population size “N”	Minimum required sample “n”
<20	No sampling; 100 percent of population required
100 percent of population required	
20 to 100	20
>100	15 to 20 percent of population size

1 Perla RJ, Provost LP, Murray SK. Sampling considerations for health care improvement. *Qual Manag Health Care*. Oct-Dec 2014;23(4):268-79.

Collection strategy

Before the initiation of a patient safety improvement project, specific data points must be identified for collection, which will demonstrate the success of the project. These data points should demonstrate both the process changes (process variables) and the impact of these changes (outcome variables). These data points must be obtained before any changes are made, then at scheduled time periods throughout the implementation to reflect the progress of the project.

Baseline data collection should occur over a three-month period to ensure an accurate reflection of the surgical care provided. Monthly data collection and reporting is recommended to reflect the process changes and improvements in postoperative patient outcomes. Data should continue to be collected monthly until the team has determined that a level of sustainability has been reached.

It is recommended to collect both outcome and process variables.

Process and Outcome Variables

Process variables

Enhanced recovery programs are the implementation of evidence-based recommendations in the preoperative, intraoperative and postoperative phases. Thus, there are various process variables to be collected along the surgical continuum to ensure compliance to these recommendations. A process variable evaluates whether the recommended intervention is being followed. For example, if an organization is trying to reduce the outcome of postoperative urinary tract infections, it may measure the process of removing urinary catheters.

It is anticipated that these process variables will be found via manual chart review, whether your organization documents on paper or electronically. The recommended process variables are summarized below, followed by full descriptions found in subsequent pages of Appendix D.

Surgical phase	Process variables
Patient optimization	Patient education Malnutrition screening
Preoperative	Use of antiemetics Preoperative mechanical bowel preparation Preoperative oral antibiotics Preoperative VTE chemoprophylaxis Allow clear liquids up to two hours before induction Allow maltodextrin up to two hours before induction
Intraoperative	Use of regional anesthesia Patient temperature at the end of surgery or on arrival to PACU Volume of IV fluid administration
Postoperative	Use of multimodal pain management Urinary catheter removal IV fluid discontinuation Daily weights Date tolerating diet First postoperative mobilization

*The enhanced recovery Canadian leaders who authored the ERC Clinical Pathways have recommendations for optional data points in the areas of fluid management and pain management. If your site would like to collect more specific information regarding these areas, please refer to the end of Appendix D and connect with your clinical team leader for further guidance.

Process and Outcome Variables

Many institutions with established enhanced recovery clinical pathways across Canada also subscribe to a database to measure their surgical healthcare quality, titled NSQIP. The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) is a nationally validated, risk-adjusted, outcomes-based program to measure and improve the quality of surgical care. This database uses standardized definitions to describe both process and outcome variables within enhanced recovery programs. To allow for comparisons between NSQIP and non-NSQIP participating hospitals, and with permission from ACS NSQIP, Enhanced Recovery Canada™ has adapted many of these definitions to ensure standardization across Canada. ERC would like to thank the ACS NSQIP and the Improving Surgical Care in Recovery (ISCR) program for sharing their content to allow for consistency of data collection.

Outcome variables

An outcome variable determines if a specific intervention is having the desired effect on a clinical measure, such as reducing postoperative infection rates. Recommended outcome variables are summarized below, with a full description found in subsequent pages in Appendix D.

- acute length of stay
- complication rate
- visits to emergency department (ED) within 30 days of discharge
- readmission within 30 days of discharge

As previously mentioned, patient charts are reviewed and coded on discharge. This information is entered into the Discharge Abstract Database (DAD), including postoperative complications, acute care length of stay and readmissions to hospital. It is suggested to liaise with your organization's Health Care Information Management and Technology department to extract this data, as it would significantly reduce data collection time and ensure consistency in collection methods between sites. By providing the Health Care Information Management and Technology department with the list of ICD-10-CA/CCI Codes used to define the colorectal surgery population, they can provide the number of colorectal surgeries and the patient outcomes from information which has already been collected in your organization.

Process and Outcome Variables

Patient optimization phase

Patient education

Intent of variable	To capture whether the patient received education about what to expect, before, during and after colorectal surgery.
Definition	Patient education refers to the provision of information (verbal, written, digital) about the surgical procedure and components of the clinical pathway in which patients are expected to participate, including, but not limited to reduced fasting, carbohydrate loading, early oral intake, early mobilization, avoidance or minimal use of opioid pain medication and discharge planning.
Options	<ul style="list-style-type: none"> • Yes: the patient received education about their colorectal surgery prior to surgery. • No: the patient did not receive education about their colorectal surgery prior to surgery. • Data missing
Notes	Institutions can meet these criteria by providing the ERC Patient Guide to Bowel Surgery, precare.ca colorectal surgery video, or having their own similar instructions which address the topics outlined in the definition.

Process and Outcome Variables

Malnutrition screening

Intent of variable	To capture whether the patient received malnutrition screening to determine whether intervention was necessary to nutritionally optimize a patient prior to surgery.
Definition	Malnutrition screening refers to the use of a screening tool like the Canadian Nutrition Screening Tool (CNST) as early as possible for nutrition risk, either at the initial surgical consult or at the preadmission clinic.
Options	<ul style="list-style-type: none"> • Yes: malnutrition screening tool was used prior to surgical intervention. • No: malnutrition screening tool was not used prior to surgical intervention. • <u>Data missing</u>
Notes	<p>The CNST tool asks two questions:</p> <ul style="list-style-type: none"> • Have you lost weight in the past six months without trying to lose this weight? • Have you been eating less than usual for more than a week?

Process and Outcome Variables

Preoperative phase

Use of antiemetics

Intent of variable	To capture whether two or more antiemetics were used .
Definition	Examples of antiemetics include: <ul style="list-style-type: none"> • dopamine antagonists (for example droperidol) • serotonin antagonists (for example ondansetron) • corticosteroids (for example dexamethasone)
Options	<ul style="list-style-type: none"> • Yes: Documentation that the patient received two or more antiemetics. • No: Patient received one antiemetic. • No: No documentation of antiemetic use. • <u>Data missing</u>

Preoperative mechanical bowel preparation

Intent of variable	To capture patients who underwent a complete mechanical bowel preparation prior to surgery.
Definition	A mechanical bowel preparation refers to a medication taken by mouth (for example polyethylene glycol with or without electrolytes) to clear fecal material from the bowel lumen.
Options	<ul style="list-style-type: none"> • Yes: Patient underwent and completed a mechanical bowel preparation prior to surgery. • No: Patient did not undergo a mechanical bowel preparation prior to surgery. • <u>Data missing</u>
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • Assign “No” if the patient received only an enema or suppository. • Assign “No” if there is no documentation of a bowel preparation that meets criteria. • Assign “No”, if the bowel preparation is started, but not completed in its entirety.

Process and Outcome Variables

Notes	<ul style="list-style-type: none"> • If there is no consistent documentation of this information at your site, we recommend following up with nursing or surgery to determine whether it is done and where it is documented. • The purpose of this variable is to identify patients who have completed the mechanical bowel preparation. This would not include patients who attempted but could not tolerate or complete the process.
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Preoperative oral antibiotics

Intent of variable	To capture patients who received oral antibiotics prior to surgery.
Definition	Preoperative oral antibiotics include erythromycin, neomycin, and metronidazole.
Options	<ul style="list-style-type: none"> • Yes: Patient received preoperative oral antibiotics within 24 hours prior to surgery. • No: Patient did not receive preoperative oral antibiotics. • <u>Data missing</u>
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • Assign “No” if prophylactic antibiotics were only administered intravenously at the time of surgery and no oral antibiotics were received within 24 hours prior to surgery. • Assign “No” if there is no documentation of preoperative oral antibiotics that meet criteria. • Assign “No”, if the preoperative oral antibiotics are prescribed or started, but not complete.
Notes	<ul style="list-style-type: none"> • If there is no consistent documentation of this information at your site, follow up with nursing or surgery to determine whether it is done and where it is documented. • The purpose of this variable is to identify patients who have completed preoperative oral antibiotics. This would not include patients who attempted but could not tolerate or complete the process. • If the patient is taking other antibiotics for other medical conditions and not specifically for surgery, do not assign this variable.

Process and Outcome Variables

Preoperative venous thromboembolism (VTE) chemoprophylaxis

Intent of variable	To capture whether patient received preoperative VTE chemoprophylaxis.
Definition	<p>VTE chemoprophylaxis agents include heparin, enoxaparin and fondaparinux administered subcutaneously immediately preoperatively or intraoperatively. High risk of bleeding is considered a contraindication to the administration of VTE chemoprophylaxis. Patients who are at high risk of bleeding complications have a contraindication to receiving VTE prophylaxis. Patients at high risk of bleeding include those with:</p> <ul style="list-style-type: none"> • Active gastrointestinal bleeding, cerebral hemorrhage, or retroperitoneal bleeding • Documented bleeding risk • Thrombocytopenia
Options	<ul style="list-style-type: none"> • Yes: Patient received a dose of chemoprophylaxis preoperatively or intraoperatively. • No: Patient did not receive chemoprophylaxis preoperatively or intraoperatively. • No, high bleeding risk: Patient did not receive chemoprophylaxis preoperatively or intraoperatively but has a documented contraindication to receiving VTE chemoprophylaxis (high risk of bleeding). • Data missing
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • Assign “no” if the first dose of VTE chemoprophylaxis is administered postoperatively.

Process and Outcome Variables

Allow clear liquids up to two hours before induction

Intent of variable	To capture whether patients take clear liquids up to two hours before surgery start time, rather than traditional fasting after midnight.
Definition	<p>Clear liquids refer to transparent liquids that are easily digested, and include: water, juices without pulp, lemonade, sport drinks, clear broth, clear sodas, ice pops, tea, and jello.</p> <p>Alternative fasting guidelines should be administered to those who are considered high risk for aspiration. High-risk patients include:</p> <ul style="list-style-type: none"> • delayed gastric emptying • gastroparesis • gastrointestinal obstruction • upper gastrointestinal malignancy <p>Alternative fasting guidelines should be administered to those who have fluid restrictions. Fluid restriction patients include:</p> <ul style="list-style-type: none"> • dialysis • congestive heart failure
Options	<ul style="list-style-type: none"> • Yes: documentation that the patient consumed clear liquids up to two hours prior to surgery. • No: there is no documentation that the patient consumed clear liquids up to two hours prior to surgery. • No: high-risk or fluid restriction patient • Data missing
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • Assign “No” if clear fluids have been exclusively used to take PO medications.

Process and Outcome Variables

Allow maltodextrin two hours before induction

Intent of variable	To capture whether patient consumed maltodextrin two hours before surgery start time.
Definition	<p>50 g of maltodextrin was administered and consumed over a maximum of five minutes ≥ 2 hours before surgery start time.</p> <p>Exclusion Criteria:</p> <ul style="list-style-type: none"> • Patients with diabetes mellitus, Type I • Patients given alternative fasting guidelines due to high risk of aspiration or fluid restriction (refer to previous process variable)
Options	<ul style="list-style-type: none"> • Yes: Patient received maltodextrin ≥ 2 hours before surgery start time • No: Patient did not receive maltodextrin ≥ 2 hours before surgery start time. • No, exclusion criteria: Patient did not receive maltodextrin two hours before surgery start time because of documented contraindication to consuming maltodextrin. • Data missing
Scenarios to clarify (assign variable)	<ul style="list-style-type: none"> • Assign “yes” if patient received maltodextrin 2 hours before surgery start time and it was consumed within a maximum of five minutes.
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • Assign “no” if maltodextrin was consumed over a time > 5 minutes. • Assign “no” if maltodextrin was consumed < 2 hours before surgery start time.

Process and Outcome Variables

Intraoperative phase

Use of regional anesthesia

Intent of variable	To capture whether a form of regional anesthesia was employed intraoperatively for postoperative pain control.
Definition	<p>Regional anesthesia includes epidural analgesia with anesthetics or opioids, intrathecal (spinal) opioid administration, and transversus abdominis plane (TAP) blocks.</p> <ul style="list-style-type: none"> • A thoracic epidural is placed in the T1-T12 levels and is used for infusion of anesthetics or opioids (for example bupivacaine, lidocaine, mepivacaine, fentanyl, morphine) into the epidural space for pain control during and after surgery. A thoracic epidural is indicated for an open case. • Intrathecal (spinal) anesthesia is a single dose of intrathecal opioid and or anesthetic (for example morphine, fentanyl or lidocaine, procaine, ropivacaine) administered once prior to surgery. • TAP blocks are performed under ultrasound guidance, where local anesthetic (for example ropivacaine, bupivacaine) is injected into the space between the internal oblique and transverse abdominis muscles to anesthetize the nerves supplying the anterior abdominal wall (T6 to L1). TAP blocks are performed at the end of the procedure and are indicated for laparoscopic surgery.
Options	<ul style="list-style-type: none"> • Yes (please indicate type administered): <ul style="list-style-type: none"> <input type="checkbox"/> Thoracic epidural <input type="checkbox"/> Spinal anesthesia OR <input type="checkbox"/> TAP block were administered • No: None of the above regional anesthesia methods were employed. • <u>Data missing</u>
Scenarios to Clarify (do NOT Assign Variable)	<ul style="list-style-type: none"> • Subcutaneous local wound injection of bupivacaine liposome injectable suspension bupivacaine or lidocaine, or disposable continuous local anesthetic infusion pump would not be included as a type of regional anesthesia.
Notes	<ul style="list-style-type: none"> • See examples per Analgesia Algorithm (see Appendix B)

Process and Outcome Variables

Patient temperature at the end of surgery or on arrival to PACU

Intent of variable	To capture whether the patient was normothermic at the end of surgery or on arrival to PACU.
Definition	Normothermia is defined as central core temperature 36.0°C.
Options	<ul style="list-style-type: none"> • Yes: patient's central core temperature was at or above 36.0°C at the end of surgery or on arrival to PACU. • No: patient's central core temperature was at or below 35.9°C at the end of surgery or on arrival to PACU. • Data missing

Volume of IV fluid administration

Intent of variable	To capture the volume of IV fluid administered intraoperatively.
Definition	IV fluid includes crystalloid and colloid solutions.
Options	<ul style="list-style-type: none"> • ___ ml (any numeric value ≥ 0 ml representing total volume of IV crystalloid and colloid fluid administered). • Data missing
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • Do not include volumes of blood products.

Process and Outcome Variables

Postoperative phase

Use of multi-modal pain management

Intent of variable	To capture whether multi-modal approaches to pain management were utilized postoperatively within 48 hours of surgery finish time.
Definition	<p>Multi-modal pain management refers to the use of non-opioid analgesics to reduce opioid-related side effects. Strategies or medications that would qualify include two or more of the following:</p> <ul style="list-style-type: none"> • NSAIDs (including ibuprofen, ketorolac, COX-2 inhibitors) • acetaminophen • tramadol • gabapentinoids (gabapentin or pregabalin) • ketamine • IV lidocaine (infusion) • regional anesthesia (refer to “Use of regional anesthesia” variable)
Options	<ul style="list-style-type: none"> • Yes: ≥ 2 of the above analgesics were administered (simultaneously) in the postoperative period within 48 hours of surgery finish time. • No: ≥ 2 of the above analgesics were not administered simultaneously in the postoperative period within 48 hours of surgery finish time. • Data missing
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • PRN orders for pain medication alone would not qualify.
Notes	<ul style="list-style-type: none"> • Combination opioid medications which include acetaminophen, do not count as a dose of acetaminophen.

Process and Outcome Variables

Postoperative phase

Urinary catheter removal

Intent of variable	To capture the date of urinary catheter removal following surgery.
Definition	Patients at low risk for urinary retention should have routine removal of catheter on the first day after surgery. Patients at moderate to high risk require catheterization for up to three days.
Options	<ul style="list-style-type: none"> • POD 0: immediately following procedure until 23:59 on day of surgery. • POD 1: from 00:00 on day following surgery until 23:59. • POD 2: from 00:00 two days following surgery until 23:59. • ≥ POD 3: documented date of urinary catheter removal after 00:00 on POD 3. • N/A: No urinary catheter placed pre- or intraoperatively. • <u>Data missing</u>
Scenarios to clarify (assign variable)	<p>Enter date of urinary catheter removal, even if urinary retention occurs and the patient requires intermittent catheterization or catheter reinsertion.</p> <p>If the urinary catheter is removed at the end of the case in the operating room, enter removal on POD 0.</p> <p>If patient is discharged from the hospital with a urinary catheter in place, enter ≥ POD 3.</p>

Process and Outcome Variables

IV fluid discontinuation

Intent of variable	To capture the date of maintenance IV fluid discontinuation following surgery.
Definition	Maintenance IV fluids are run at a continuous, steady rate (usually 50 – 150 cc/hour).
Options	<p>Indicate the date of maintenance IV fluid discontinuation:</p> <ul style="list-style-type: none"> • POD 0: immediately following procedure until 23:59 on day of surgery. • POD 1: from 00:00 on day following surgery until 23:59. • POD 2: from 00:00 two days following surgery until 23:59. • ≥POD 3: documented date of IV fluid discontinuation after 00:00 on POD 3. • No postoperative IV fluids administered • <u>Data missing</u>
Scenarios to clarify (assign variable)	<ul style="list-style-type: none"> • Enter date if maintenance rate IV fluids are stopped, even if the patient subsequently receives a bolus of a set volume of fluid (for example 500 cc or 1,000 cc). • Enter date if the maintenance rate IV fluids are stopped, even if fluids are subsequently resumed for a change in the patient's clinical status.

Process and Outcome Variables

Date tolerating diet

Intent of variable	To capture the date on which patient first tolerated a diet.
Definition	First date on which the patient took a diet including at least one solid meal and could drink liquids (800-1,000 cc) without need for IV fluids.
Options	<p>Indicate the first date on which the patient tolerated a diet.</p> <ul style="list-style-type: none"> • POD 0: immediately following procedure until 23:59 on day of surgery. • POD 1: from 00:00 on day following surgery until 23:59. • POD 2: from 00:00 two days following surgery until 23:59. • ≥ POD 3: first documented time of tolerating diet after 00:00 on POD 3.
Notes	<ul style="list-style-type: none"> • While vomiting may be a sign that a patient did not tolerate their diet, vomiting can be due to multiple factors, and there is no specific threshold defined for when vomiting indicates lack of tolerating diet. Documentation of emesis or vomiting by itself is not an indication that a patient did not tolerate the diet. However, if documentation indicates directly that a patient both was not tolerating a diet and had vomiting, then do not assign this variable. • Solid food indicates non-liquid, non-puree food (for example regular diet, low residue diet, cardiac or diabetic diet).

Process and Outcome Variables

Daily weights

Intent of variable	To capture whether a patient was weighed daily postoperatively for the first 48 hours after surgery (POD 1 or POD 2) as surrogate measure of fluid overload.
Definition	The patient was weighed daily as an additional vital sign to avoid fluid overload.
Options	<ul style="list-style-type: none"> • Yes: the patient was weighed on postoperative day one and two. • No: the patient was not weighed on postoperative day one and two. • <u>Data missing</u>
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • If a patient was not weighed preoperatively then do not assign this variable. • If a patient was not weighed on both POD 1 or POD 2, do not assign this variable.
Notes	<ul style="list-style-type: none"> • For accurate comparison, all perioperative weight measurements should be obtained with the patient wearing a hospital gown and using calibrated scales. • Some patients may not be able to mobilize to weigh scales or stand independently to gather accurate weight measurement. Make all efforts to place immobile patients in hospital beds which have the capacity for weight measurement.

Process and Outcome Variables

First postoperative mobilization

Intent of variable	To capture the date and time when a patient is first mobilized following surgery.
Definition	Mobilization is defined as ambulation (any distance or length of time), including with the assistance of a walking aid. A patient has been mobilized if they perform either of the following: <ul style="list-style-type: none"> • Ambulate for ≥ 10 feet • Ambulate for ≥ 2 minutes
Options	Specify the first documented date of patient ambulation following surgery. <ul style="list-style-type: none"> • POD 0: immediately following procedure until 23:59 on day of surgery. • POD 1: from 00:00 on day following surgery until 23:59. • POD 2: from 00:00 two days following surgery until 23:59. • \geq POD 3: first documented time of patient mobilization after 00:00 on POD 3 • <u>Data missing</u>
Scenarios to clarify (do NOT assign variable)	<ul style="list-style-type: none"> • Standing at bedside • Up to chair

Process and Outcome Variables

Optional process variables

Optional fluid management variables

Balanced chloride-restricted solution	Intent of variable	To capture whether the IV solutions administered as maintenance infusion are isotonic and chloride restricted.
	Definition	<p>Any IV solution administered with very similar physiologic plasma osmolarity and solute concentrations.</p> <ul style="list-style-type: none"> • examples of balanced chloride-restricted solutions include lactated ringer's and plasmalytes. • example of unbalanced solutions: 0.9 percent Na⁺Cl⁻ solution (normal saline).
	Options	<ul style="list-style-type: none"> • Yes: the patient received IV solutions that were isotonic AND chloride restricted. • No: the patient received IV solutions that were not isotonic AND chloride restricted. • Data missing
Duration of surgery	Intent of variable	To capture the time required to complete the procedure.
	Definition	Elapsed time between skin incision and skin closure.
	Criteria	Time required to complete surgery.
	Options	Elapsed time expressed in minutes.

Process and Outcome Variables

Fluid balance	Intent of variable	To capture the fluid balance of the patient.
	Definition	Absolute difference between fluid input and output (measurable losses). Inputs include: any IV fluids administered, blood products. Outputs include urine output, estimated blood loss, other outputs (for example gastrointestinal loss). Fluid balance calculated by subtracting the total output from the total input.
	Options	<ul style="list-style-type: none"> • ___ ml or L fluid balance [negative or positive] • Data missing
Advanced hemodynamic monitoring	Intent of variable	To capture whether advanced hemodynamic monitoring was used during the procedure.
	Definition	Serial assessment of hemodynamic variables that include, but are not limited to, cardiac output, stroke volume, systemic vascular resistance and dynamic indices (for example pulse pressure variation, stroke volume variation). Heart rate and blood pressure monitoring (invasive or non-invasive) are not considered advanced monitoring.
	Options	<ul style="list-style-type: none"> • Yes: an advanced hemodynamic monitor was used during the procedure. • No: an advanced hemodynamic monitor was not used during the procedure. • Data missing

Process and Outcome Variables

Use of volumetric pumps	Intent of variable	To capture whether volumetric pumps were used to administer IV fluids as maintenance infusion, to ensure that IV fluids will be administered in controlled amounts.
	Definition	Volumetric pumps were used for the administration of IV fluids as maintenance infusion.
	Options	<ul style="list-style-type: none"> • Yes: a volumetric pump was used during the procedure to administer IV fluids. • No: a volumetric pump was not used during the procedure to administer IV fluids. • <u>Data missing</u>

Process and Outcome Variables

Optional multi-modal pain management variables

Open or laparoscopic	Intent of variable	To capture whether the colorectal surgery performed was open or laparoscopic.
	Definition	An open procedure involves a large surgical incision in the abdomen (often vertical median incision). A laparoscopic procedure involves numerous smaller incisions and the use of a laparoscope and often a small sus-pubian incision (Pfannenstiel) to remove the colon.
	Options	<ul style="list-style-type: none"> • Open: The patient underwent an open surgical procedure • Laparoscopic: The patient underwent a laparoscopic surgical procedure +/- Pfannenstiel incision • Data missing
Epidural anesthesia	Intent of variable	To capture whether epidural anesthesia was used.
	Definition	A thoracic epidural is placed between the T9 to T12 levels and is used for infusion of anesthetics or opioids (for example bupivacaine, lidocaine, mepivacaine, fentanyl, morphine) into the epidural space for pain control during surgery. Epidural anesthesia is recommended in open surgeries, surgeries where there is a high risk of conversion from laparoscopic to open, for patients with previous pulmonary disease and for patients at high risk of pulmonary complication.
	Options	<ul style="list-style-type: none"> • Yes: The patient received epidural anesthesia. • No: The patient did not receive epidural anesthesia. • Data missing

Process and Outcome Variables

Optional multi-modal pain management variables (cont'd)

Intraoperative nerve trunk	Intent of variable	To capture whether the patient received intraoperative nerve trunk blocks.
	Definition	<p>Nerve trunk blocks are performed under ultrasound guidance, where local anesthetic (e.g., ropivacaine, bupivacaine) is injected to anesthetize the nerves supplying the anterior abdominal wall (T6 to L1). Intraoperative trunk blocks are recommended for laparoscopic surgery and administered as either:</p> <ul style="list-style-type: none"> • Single shot: TAP, RS, SAB +/- opioid, wound infiltration. • Continuous block: TAP or RS catheter, pre-peritoneal wound catheter infiltration.
	Options	<ul style="list-style-type: none"> • Yes: The patient received either single shot: TAP, RS, SAB, wound infiltration, OR continuous block: TAP or RS catheter, peritoneal wound catheter infiltration. • No: The patient did not receive either single shot: TAP, RS, SAB, wound infiltration, OR continuous block: TAP or RS catheter, peritoneal wound catheter infiltration. • Data missing
Intraoperative multimodal analgesia and adjuvants	Intent of variable	To capture whether patient received intraoperative multimodal analgesia and adjuvants.
	Definition	<p>Minimizing opioid analgesia reduces the adverse effects of opioid use during and after surgery. Examples of adjuvants include IV infusions of lidocaine, ketamine, +/- magnesium sulfate, +/- clonidine or dexmedetomidine.</p>
	Options	<p>Indicate whether intraoperative multimodal analgesia and adjuvants were used:</p> <ul style="list-style-type: none"> • Yes: The patient received either IV lidocaine, ketamine, magnesium sulfate, clonidine OR dexmedetomidine intraoperatively. • No: The patient did not receive either IV lidocaine, ketamine, magnesium sulfate, clonidine OR dexmedetomidine intraoperatively. • Data missing

Process and Outcome Variables

Optional multi-modal pain management variables (cont'd)

Use of intraoperative nociception monitors	Intent of variable	To capture whether intraoperative nociception monitors were used.
	Definition	A device used to monitor the sympathetic response to surgical noxious stimuli.
	Options	<ul style="list-style-type: none"> • Yes: A nociception monitor was used. • No: A nociception monitor was not used. • Data missing
Use of postoperative epidural for analgesia	Intent of variable	To capture whether epidural analgesia was used postoperatively.
	Definition	A multimodal pain management plan with active strategies to minimize the use of opioids should be used. Epidural analgesia placed for open surgeries should contain a concentration of low-dose bupivacaine (0.05 percent) and low dose opioids (for example fentanyl 2 mcg/ml or morphine 5-10 mcg/ml); rate between 5-14 ml/h based on local anesthetic concentration used in the solution. TEA should be removed shortly after bowel functioning; use epidural stop test at POD 2.
	Options	<ul style="list-style-type: none"> • Yes: Postoperative epidural analgesia was used. • No: Postoperative epidural analgesia was not used. • Data missing
Use of patient-controlled analgesia (PCA) opioid	Intent of variable	To capture whether PCA opioid was used postoperatively.
	Definition	PCA opioid is recommended for postoperative analgesia for laparoscopic surgery and should be discontinued and replaced by oral opioids as soon as possible.
	Options	<ul style="list-style-type: none"> • Yes: Postoperative PCA opioid was used. • No: Postoperative PCA opioid was not used. • Data missing

Process and Outcome Variables

Outcome variable

**Please note that all definitions below were provided through Canadian Coding Standards and apply to all data sets submitted to the Discharge Abstract Database (DAD).*

Outcome variable	Definition
Acute length of stay	Acute length of stay (LOS) is the calculated length of stay minus the number of alternate level of care (ALC) days. The ALC designation identifies a patient is occupying a bed in a facility and does not require the intensity of resources or services provided in that care setting.
Complication rate	<p>Complication: a post-intervention condition or symptom that is not attributable to another cause arises during an uninterrupted, continuous episode of care within 30 days following the intervention, or a cause or effect relationship is documented, regardless of timeline.</p> <p>*Note that the 30-day timeline does not apply when a patient has been discharged. This is considered an interruption in care. To clarify, postoperative complications occurring after discharge are not recorded.</p> <ul style="list-style-type: none"> • Complication rate is calculated by number of patients who experienced a complication • total number of patients who underwent surgery
Visits to the emergency department within 30 days after discharge	<p>Patients who were discharged from an acute care institution after surgery but returned to hospital emergency department within 30 days after discharge.</p> <p>*Note that there may be limitations to accessing information of patients who visit emergency departments outside the Regional Health Authority.</p>
Readmission within 30 days after discharge	<p>Patients who were discharged from an acute care institution after surgery but were readmitted to an acute care institution within 30 days after the discharge.</p> <p>*Note that there may be limitations to accessing information of patients who are readmitted outside the Regional Health Authority.</p>

Template for Physician Order Sets

Enhanced recovery after colorectal surgery preoperative medication orders

Patient name	
Healthcare number	
Date of birth	

Allergies

PREOPERATIVE CLINIC

- If bowel being prepped, prescription provided to patient for sodium picosulfate or polyethylene glycol-based electrolyte solution plus oral antibiotics
- Routine carbohydrate loading in the immediate preoperative period is recommended, though there is no consensus regarding the optimal regimen and formulation

DAY OF SURGERY

- 50 g maltodextrin consumed over five minutes two hours prior to surgery (excluding specific patient populations - refer to Fluid Management Clinical Pathway)
- IV antibiotics administered within 60 minutes before incision
- Pharmacological thromboprophylaxis with LMWH
- 1 x preoperative dose of acetaminophen, NSAID such as celecoxib (unless contraindicated), and tramadol

If opioid-tolerant:

- Regular dosing of opioids
- Gabapentanoids (major surgery only)

Template for Physician Order Sets

Enhanced recovery after surgery preoperative medical orders

Patient name	
Healthcare number	
Date of birth	

Allergies

SURGICAL CLINIC OR SURGEON'S OFFICE

- Thorough, evidence-informed preoperative assessment, including cardiorespiratory status, frailty, risk of thrombosis and bleeding, diabetes, etc.

Patient and family education regarding:

- Achieving milestones and the patient's role in the recovery process
- Discharge criteria
- Nutrition and surgery milestones – adequate food intake, optimization of nutrition status, hydration
- Early and progressive mobilization after surgery and negative impacts of immobility
- Opioid sparing analgesia - pain management expectations, modalities of pain control, risks of opioid medications, optimal analgesia for functional recovery, transition to oral analgesics
- If necessary, ostomy education including dehydration avoidance and marking.
- Screening for nutritional risk (for example CNST)
 - If patient at risk for malnutrition, send consult for assessment by dietitian
 - If dietitian identifies patient as malnourished, individualized treatment plan commenced a minimum of seven days before surgery
- Identify smokers and high-risk drinkers via self-reporting
 - Provide education regarding four week abstinence from smoking and alcohol
 - Offer nicotine replacement therapy
 - If available, offer access to brief intervention for high-risk drinking
- If necessary, attempt to correct anemia using IV iron

Template for Physician Order Sets

Enhanced recovery after surgery preoperative medical orders (cont'd)

Patient name	
Healthcare number	
Date of birth	

PREOPERATIVE CLINIC

- If not conducted previously, a thorough, evidence-informed preoperative assessment, including cardiorespiratory status, frailty, risk of thrombosis and bleeding, diabetes, etc.
- Screening for anxiety (for example GAD-7, HADS)
- Screening for opioid tolerance; take detailed history of medications and doses
- Screening for risk factors of postoperative nausea and vomiting (Apfel scoring system)
- Instructions regarding preoperative fasting:
 - Patients should be encouraged to eat a normal meal the night before and a light snack up until six hours before anesthesia (if no mechanical bowel preparation) and drink clear fluids for up to two hours before the induction of anesthesia. A light snack is a non-fatty meal such as dry toast
 - If increased risk of aspiration identified, diet restrictions extended
 - Role of preoperative carbohydrate drinks
 - Potential harm from prolonged preoperative fasting
- Review of patient and family education, as per information delivered in surgeon's clinic or office
- Instructions regarding mechanical bowel preparation and oral antibiotics
- A multimodal pain management plan with active strategies to minimize the use of opioids should be developed, covering all phases of perioperative care

DAY OF SURGERY

- Patients should be encouraged to eat a normal meal the night before surgery and have a light snack up until six hours before anesthesia (if no mechanical bowel preparation); and drink clear fluids for up to two hours before the induction of anesthesia is encouraged
- Intermittent pneumatic compression device applied
- Measure patient weight with the patient wearing surgical gown

Template for Physician Order Sets

Enhanced recovery after colorectal surgery intraoperative recommendations

Patient name	
Healthcare number	
Date of birth	

Allergies

IN OPERATING SUITE

- During safe surgery checklist, the multidisciplinary team should discuss the type of surgery, risk of opening (if applicable), location and length of incisions, potential complications

Fluid management

- Avoid administration of IV fluids to replace preoperative fluid losses in patients who received iso-osmotic bowel preparation provided there was unrestricted intake of clear fluids for up to two hours before induction of anesthesia
- IV fluid maintenance with balanced crystalloid solution, via volumetric pump, to ensure water and electrolyte homeostasis with the goal of achieving 1.5 to 2.0 L positive fluid balance at the end of surgery (6-8 ml/kg/h)
- Goal-directed volume therapy to replace intravascular loss
 - Replace fluid loss with crystalloids or colloids and determine the absolute amount based on hemodynamic response
 - Advanced hemodynamic monitoring (SVV, PPV, SV, CO, VTI and ETCO) should be used for high-risk patients or for major surgeries associated with large amounts of blood loss or fluid shifts
 - Replace urine output and GI loss (if measurable) with balanced crystalloids

Pain management

- If anxiety identified, order single dose short-acting anxiolytic to be administered prior to epidural placement
- Consideration for total intravenous anesthesia using propofol with depth of anesthesia monitor

For planned open surgeries, surgeries where there is a high-risk of conversion from laparoscopic to open, and for patients with previous pulmonary disease or at high risk of pulmonary complication:

- TEA

WITH

- Analgesic adjuvants, started early in anesthesia:
 - IV ketamine (bolus 0.25 mg/kg to 0.5 mg/kg then 0.25 mg/kg/hr. during surgery)
 - IV dexamethasone (4 mg)
 - +/- IV magnesium sulfate
 - +/- IV clonidine or dexmedetomidine

Template for Physician Order Sets

Enhanced recovery after colorectal surgery intraoperative recommendations (cont'd)

Patient name	
Healthcare number	
Date of birth	

For laparoscopic surgery, TEA failure or if contraindicated:

- Intrathecal morphine (single shot)

OR

- lidocaine (1-1.5 mg/kg at induction of anesthesia and 1-1.5 mg/kg/hr. for maintenance during surgery)
- ketamine (bolus 0.25-0.5 mg/kg then 0.25 mg/kg/hr.)
- +/- IV magnesium sulfate
- +/- IV clonidine or dexmedetomidine
- Regional analgesia techniques, administered at the end of surgery as either:
 - Single shot: TAP, RS, SAB +/- opioid, wound infiltration
 - Continuous block: TAP/RS catheter, preperitoneal wound catheter infiltration

Template for Physician Order Sets

Enhanced recovery after colorectal surgery postoperative medication

Patient name	
Healthcare number	
Date of birth	

Allergies

VTE PROPHYLAXIS

- Pharmacological thromboprophylaxis with low molecular weight heparin, with consideration for extended duration (28 days) in all patients
- Intermittent pneumatic compression

NAUSEA MANAGEMENT

Using Apfel scoring system:

- Patients with 1-2 risk factors, use two drugs in combination using front-line antiemetics (for example dopamine antagonists, serotonin antagonists and corticosteroids)
- Patients with ≥ 2 risk factors, use two to three antiemetics

PAIN MANAGEMENT

- Acetaminophen 1000 mg PO every six hours (maximum from all sources 4000 mg in 24 hours)
- NSAIDs x 72 hours (based on discussion with the surgical team)
- Tramadol 50 mg QID
- If non-opioid medications insufficient, administer oral opioids for breakthrough pain relief
- If IV or subcutaneous opioids necessary, carefully titrate for lowest effective opioid dosage

If patient opioid-tolerant:

- Continue preoperative opioid regime
- Refer to acute pain management services

If epidural placed prior to OR (for example for open surgery or high-risk to open):

- Bupivacaine (0.05 percent) +/- low dose opioids (for example fentanyl 2 mcg/ml or morphine 5-10 mcg/ml) at 5-14 ml/hr. Adjust rate to optimize analgesia and minimize motor blockade.
- Stop test at 0600h POD 2

If no epidural placed prior to OR (for example for laparoscopic surgery):

- Continuous infusion abdominal trunk blocks
- Continuous IV ketamine or lidocaine for 24-48 hours postoperatively
- Continuous wound infiltration (if lidocaine not used)

Template for Physician Order Sets

Enhanced recovery after colorectal surgery postoperative medication (cont'd)

Patient name	
Healthcare number	
Date of birth	

PATIENT'S RECONCILED HOME MEDICATIONS

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

ADMISSION INFORMATION

- Unit of admission: _____ Physician: _____
- Diagnosis: _____
- Expected length of stay: _____

CONSULTS

- Various physician specialties, as clinically appropriate
- Various allied health disciplines, as clinically appropriate
- Other

Template for Physician Order Sets

Enhanced recovery after colorectal surgery postoperative medical orders

Patient name	
Healthcare number	
Date of birth	

Allergies

ADMISSION INFORMATION

- Unit of admission: _____ Physician: _____
- Diagnosis: _____
- Expected length of stay: _____

CONSULTS

- Various physician specialties, as clinically appropriate
- Various allied health disciplines, as clinically appropriate
- Other _____

DIET AND NUTRITION

- Encourage oral fluids on admission to surgical unit (minimum 25-30 ml/kg/day)
- Advance diet as tolerated, offer solid food at least by POD 1
- Food intake self-monitoring by patient
- High protein oral nutrition supplement (60 ml) administered up to QID with medications
- If patient consuming <50 percent of meals x 72 hours, send consult to dietitian

If patient identified as malnourished prior to admission:

- High protein, high energy diet
- Consult to dietitian
- Other: _____

ACTIVITY

- Encourage early mobilization throughout inpatient stay
- Deep breathing and coughing exercises
- Foot and ankle pumping and quadriceps exercises every hour while awake
- POD 0, mobilize to chair or walk short distance with assistance from ward staff
- Starting POD 1, out of bed as much as tolerated and ambulate at least TID
- If mobility issues identified, send consult to physiotherapy
- Other: _____

Template for Physician Order Sets

Enhanced recovery after colorectal surgery postoperative medical orders (cont'd)

Patient name	
Healthcare number	
Date of birth	

VITALS AND MONITORING

- Temperature, heart rate, respiratory rate, blood pressure, oxygen saturation monitoring as per institutional policies
- Fluid balance, including oral fluid intake, as per institutional policies
- Blood glucose maintained between 6 - 10 mmol/L
- Daily weight measurements on POD 1 and 2
- Other: _____

URINARY CATHETERIZATION

- Urinary catheter to straight drainage
- Colon or upper rectal resection: Discontinue urinary catheter 24 hours postoperatively
- Mid or lower rectal resection: Discontinue urinary catheter 48 hours postoperatively
- If trial of void failed, intermittent catheterizations x 24 hours, then reinsert if necessary
- Other: _____

LABORATORY INVESTIGATIONS

- As per individual patient requirements based on history and clinical presentation

WOUND CARE

- Postoperative dressing monitoring and changes as per institutional policies
- Other: _____

IV THERAPY

- Discontinue IV fluids at the end of surgery, or at least by POD 1, when patient tolerating oral fluids and in absence of physical signs of dehydration or hypovolemia
- Prior to administration of IV fluid bolus, give consideration to all possible causations of clinical anomalies (for example hypotension, tachycardia, oliguria)
- If increase in stroke volume needed and patient anticipated to be fluid responsive, IV fluid bolus administered at 3 ml/kg of balanced salt solution over 15 to 30 minutes
- If patient not tolerating oral fluid intake, maintenance infusion of 1.5 ml/kg/h of IV fluids should be started
- Other: _____

OTHER MEDICAL ORDERS

- _____
- _____
- _____
- _____
- _____



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