A Resource for Healthcare Providers

Clinical Pathways for Colorectal Surgery

Enhanced Recovery Canada:

A Collaborative to Improve Surgical Care

Enhanced RECOVERY Canada

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Table of Contents

Preamble

1 **About ERC pathways**
- Scope and Purpose
- Target Population
- Target Audience
- Stakeholder Involvement
- Development and Revision History
- Editorial Independence

2 **Key Messages**
- Patient Engagement
- Analgesia
- Surgical Best Practices
- Fluid Management
- Nutrition
- Mobility and Physical Activity

5 **Overarching Recommendations**

ERC Colorectal Surgery Pathway

Patient Education
7 Analgesia
8 Surgical Best Practices
9 Fluid Management
10 Nutrition
11 Mobility and Physical Activity

Patient Optimization
12 Analgesia
13 Surgical Best Practices
14 Nutrition

Preoperative
16 Analgesia
19 Surgical Best Practices
21 Fluid Management

Intraoperative
24 Analgesia
26 Surgical Best Practices
28 Fluid Management

Postoperative
31 Analgesia
33 Surgical Best Practices
34 Fluid Management
37 Nutrition
38 Mobility and Physical Activity

Discharge
40 Analgesia
41 Nutrition
42 Mobility and Physical Activity

Table of Contents

Resources

44 **Glossary**

48 **References***

- 48 A Analgesia
- 51 S Surgical Best Practices
- 54 F Fluid Management
- 56 N Nutrition
- 58 M Mobility and Physical Activity

59 **Appendix A. Abbreviations**

60 **Appendix B. Analgesia Algorithm**

61 **Appendix C. Data Collection and Measurement**

66 **Appendix D. Process and Outcome Variables**

94 **Appendix E. Template for Physician Order Sets**

Note*
References are organized in sections according to their topics.
You can find specific references using the section letter.

A S F N M

This material also available online through the Canadian Patient Safety Institute website:
www.patientsafetyinstitute.ca/en/toolsResources/Enhanced-Recovery-after-Surgery/

About ERC 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 clinical pathway is based on six core principles applicable to all surgeries. The core principles include patient engagement, nutrition, mobility, fluid management, pain management, and surgical best practices. The clinical pathway is organized in a step-wise approach according to patients' continuum of care. Patient education and patient optimization are presented outside of the traditional pre-, intra-, post-surgical timeline to emphasize the importance of adequately preparing patients for surgery. The pathway includes variables for clinical audit and quality improvement purposes.

Target Population

Adult patients undergoing routine elective colorectal surgery.

Target Audience

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

Stakeholder Involvement

The clinical pathway was developed by a diverse group of experts from various healthcare fields from across the country. A patient and family engagement working group reviewed all pathways to ensure the patient perspective was integrated and prioritized.

Development

A knowledge management specialist completed a systematic search of the literature for all clinical practice guidelines and consensus statement about enhanced recovery after colorectal surgery. These guidelines and consensus statements were reviewed by the experts for quality, currency, content and applicability within the Canadian context.

Editorial Independence

All working group members signed a member agreement form indicating that they had no conflicts of interest in relation to the project.

Key Messages

Patient Engagement

Patient engagement inclusion means patient engagement teams comprised of patients, families, caregivers and advocates are identified early, are involved with collaborative decision making, receive optimum communication and information before, during and after surgery.

Analgesia

- Patients and healthcare providers should be educated about the process of achieving optimal analgesia.
- Use a risk-based strategy for postoperative nausea and vomiting prophylaxis and adopt a multimodal approach for all patients with ≥2 risk factors.
- Drugs and doses used by patients should be documented before surgery to help identify opioid-tolerant patients and manage appropriately.
- Before surgery, and at checklist time in the operating room, work with the surgical and anesthesia team to develop a multimodal pain management plan with active strategies to minimize the use of opioids, which covers all phases of perioperative care.
- Multimodal analgesics prescriptions can be suggested to the surgical team when the patient is ready to be discharged. Non-opioid therapies should be encouraged as primary treatment.

Surgical Best Practices

- Use an evidence-based approach to preoperative assessment to optimize and treat relevant comorbidities.
- Consider mechanical bowel preparation with oral antibiotics for all patients.
- Use minimally invasive surgery whenever the expertise is available and clinically appropriate.
- Prevent surgical site infections by routinely implementing infection prevention strategies.
- Avoid the routine use of intra-abdominal drains and nasogastric tubes.

Key Messages

Fluid Management

- ☐ The importance of staying hydrated before and after surgery should be emphasized to patients.
- ☐ Most patients can have unrestricted access to solids for up to 8 hrs before anesthesia and clear fluids for oral intake up to 2 hrs before the induction of anesthesia is encouraged.
- ☐ With some exceptions, maltodextrin is encouraged for carbohydrate loading before surgery to reduce insulin resistance.
- ☐ IV fluid maintenance with balanced crystalloid solution should be used 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/hr).
- ☐ Goal-directed volume therapy should be used to replace intravascular losses; in high risk patients and/or high-risk surgery advanced hemodynamic monitoring is suggested.
- ☐ Fluid balance measures should routinely be reported and reviewed.
- ☐ Postoperative weight gain indicative of fluid retention is more important than the amount of fluid administered.

Nutrition

- ☐ Patients should be educated about the role of nutrition in recovery before surgery, in hospital, and once they are discharged home.
- ☐ Screen patients for nutritional risk at the initial surgical consult or at the pre-admission clinic.
- ☐ Patients at risk for malnutrition should be assessed by a dietitian, and receive appropriate therapy if needed, before being admitted to the hospital.
- ☐ Offer patients food and fluid as soon as possible after surgery, including high-protein oral nutritional supplements.
- ☐ Patient food intake should be monitored. Patient's consistently eating ≤50% of their food for 72 hrs, or as soon as clinically indicated, should receive a comprehensive nutrition assessment.

Key Messages

Mobility and Physical Activity

- ☐ Before surgery, educate patients about the negative impact of prolonged bed rest and the importance of early postoperative mobilization.
- ☐ Patients should be up and moving as soon as possible after surgery.
- ☐ Assess your patient's capacity for mobility to guide decisions about mobilization, exercise and, if needed, interventions to aid in the transition back to activities of daily living.
- ☐ Encourage patients to return to their normal activities of daily living once they leave the hospital.

Overarching Recommendations

1

Pre-set orders should be used as part of enhanced recovery pathways.

2

Implementation of Enhanced Recovery requires assessment of adherence to Enhanced Recovery processes, which may be assessed by compliance and ongoing process measurement. This may require utilizing a database, and risk adjustment for various procedures and patient populations.

3

A pre-admission discussion of milestones, discharge criteria and the patient's role in the recovery process should take place with the patient and/or family prior to surgery.

4

Patient and family education should be presented using a variety of formats and delivery styles, including:

- Printed material (booklets, pictograms)
- Individual and group counselling
- Webinars
- Videos

5

All healthcare professionals involved in the care of elective colorectal surgery patients should be familiar with the ERC pathways for colorectal surgery.

Phase 1. Patient Education

Phase 2. Patient Optimization

Phase 3. Preoperative

Phase 4. Intraoperative

Phase 5. Postoperative

Phase 6. Discharge

1 Patient Education

Analgesia

Recommendations

- Patients should receive preoperative counseling about pain management expectations, modalities of pain control, and the risks of opioid medications.
- Education is necessary for pre-admission clinic staff to understand the process of achieving optimal analgesia.
- Particular attention should be taken to educate both patients and staff about transitioning patients from TEA (or other analgesia techniques) to oral analgesics.
- Careful consideration should be given to educating opioid-dependent patients about the potential for increased postoperative pain and effective pain management strategies.

Tools and Equipment

- Link to Patient Optimization Guide
- Link to Precare Colorectal Surgery Video Guide

Additional Information

Patient and staff education about the process to achieve optimal analgesia for functional recovery needs to continue into the PACU and postoperative ward.

Data Collection

Patient preadmission counseling

1 Patient Education

Surgical Best Practice[S1-3]

Recommendations

- Preadmission education should include education about the surgery, its rationale and recovery, along with ostomy education and marking if necessary.
- Patients should be advised to shower or bath with chlorhexidine soap or regular soap the night before and the morning of surgery.

Tools and Equipment

- Link to Patient Optimization Guide
- Link to Precare Colorectal Surgery Video Guide

Additional Information

While uncommon for colon cancer, 60% of patients with rectal cancer will have a stoma of some variety.

Data Collection

Patient preadmission counseling

1 Patient Education

Fluid Management[F1-4]

Recommendations

The importance of staying hydrated should be emphasized during the preadmission discussion. Specific guidance on fasting and hydration recommendations should be provided, including the potential harm from prolonged preoperative fasting (e.g. NPO after midnight).

Tools and Equipment

- Link to Patient Optimization Guide
- Link to Precare Colorectal Surgery Video Guide

Additional Information

- Counseling on dehydration avoidance should be provided if the likelihood of ileostomy is high.
- Discuss and explain the role of preoperative carbohydrate drinks.
- Normal daily water requirement is 25-30 ml/kg (on average 2 L of water/day).

Data Collection

Patient preadmission counseling

1 Patient Education

Nutrition[N1, N2]

Recommendations

- Prior to hospitalization all patients should receive information describing expectations around nutrition and surgery.
- Patients 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 Patient Optimization Guide
- Link to Precare Colorectal Surgery Video Guide

Data Collection

Patient preadmission counseling

1 Patient Education

Mobility and Physical Activity[M1]

Prelude: Evidence for early mobility and physical activity following colorectal surgery is limited to guide safe patient handling and practice. Thus, expert consensus was obtained using a Delphi study to provide a set of guidelines to assist healthcare providers with strategies for early mobilization.

Recommendations

Patients should receive education about the negative impact of prolonged bed rest and the importance of early and progressive mobilization after surgery.

Implementation Approaches

- Education about early mobilization should be delivered in an education session with a nurse, physiotherapist or kinesiologist.
- Family members should be educated about how they can facilitate and encourage early mobilization.
- Education about early mobilization should be reinforced throughout the hospital stay.

Tools and Equipment

- Link to Patient Optimization Guide
- Link to Precare Colorectal Surgery Video Guide

Data Collection

Patient preadmission counseling

2 Patient Optimization

Analgesia

Identify Opioid Tolerance[A1-3]

Recommendations

- Opioid-tolerant patients may require closer follow-up and referral to Acute Pain Services after surgery.
- Drugs and doses used by patients should be documented to help identify opioid-tolerant patients and to modify the pain management plan accordingly.

Additional Information

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

Anxiety Screening[A4-9]

Recommendations

Ideally, patients should be screened for anxiety. A short-acting anxiolytic might be proposed if a high level of anxiety is identified.

Tools and Equipment

Use a validated self-assessment screening tool like GAD-7 or the HADS.

Additional Information

Prevalence of anxiety is likely moderate to high among colorectal surgery patients. Melatonin might be considered to reduce anxiety.

2 Patient Optimization

Surgery

Risk Assessment[S4-12]

Recommendations

- Patients should undergo a thorough, evidence informed preoperative assessment prior to colorectal surgery. This may include, but is not limited to: cardiorespiratory status, frailty, risk of thrombosis and bleeding, and diabetes.
- Anemia is common in patients presenting for colorectal surgery and increases all cause morbidity. Attempts to correct anemia should be made prior to surgery. Blood transfusion has long-term effects and should be avoided if possible.

Smoking and Alcohol Use[S13-17]

Recommendations

- Identify smokers and high-risk drinkers by self-reporting.
- ≥4 weeks of abstinence from smoking and alcohol prior to surgery is recommended.

Tools and Equipment

If available, offer all smokers and high-risk drinkers access to an intervention program.

Additional Information

- Smoker includes daily smokers and occasional smokers.
- High-risk drinking is defined as consumption of ≥3 drinks/day.

2 Patient Optimization

Nutrition

Nutrition Screening[N3-10]

Recommendations

- Patients should be screened as early as possible for nutritional risk at the the pre-admission clinic.
- 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 clinical concern for chronic nutrition risk, refer to a dietitian for optimization.

Tools and Equipment

Use a screening tool like the CNST. The CNST tool asks two questions:

1. Have you lost weight in the past 6 months without trying to lose this weight?
2. Have you been eating less than usual for more than a week?

Additional Information

Prevalence of nutrition risk prior to abdominal surgery is reported to be 12%-47%.

Data Collection

Malnutrition screening

Nutrition Assessment[N4, N11]

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 assessment tool like the SGA or a comprehensive nutrition assessment completed by a dietitian as soon as possible to facilitate nutrition optimization prior to surgery.

2 Patient Optimization

Nutrition Therapy[N4-6]

Recommendations

- Patients assessed as malnourished (SGA B or C) should receive an individualized treatment plan that may include therapeutic diets (e.g. high energy, high protein diet), ONS, EN and PN based on a comprehensive nutritional assessment by a dietitian.
- The decision to delay surgery to optimize nutritional status should be undertaken by the patient, dietitian and surgeon.

Additional Information

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

3 Preoperative

Analgesia

Multidisciplinary Team Meeting[A6]

Recommendations

Before surgery begins or at checklist time, the multidisciplinary team should discuss the type of surgery (open vs. laparoscopic), the risk of opening (if laparoscopic), the location and length of incisions and other potential complications.

Additional Information

The degree of pain after surgery will vary based on the surgical approach and planned analgesia will need to take this into account.

Preanesthetic Medication[A10-13]

Recommendations

- Patients should not routinely receive long- or short-acting sedative medication from midnight prior to surgery and immediately before surgery.
- If a patient has significant anxiety a short-acting anxiolytic administered at the time of epidural placement is acceptable.
- Midazolam should be avoided except at epidural placement or if high levels of anxiety exist prior to surgery.
- Continuation of preoperative opioid regimens (same doses) should occur on the day of surgery and in the postoperative period in opioid-dependent patients.

Additional Information

- Sedative premedication delays immediate postoperative recovery by impairing mobility and oral intake.
- In opioid-dependent patients an adequate opioid dose needs to be maintained to prevent opioid withdrawal.

3 Preoperative

Antiemetic Prophylaxis[A8, A11, A13-17]

Recommendations

- A risk-based strategy of prophylaxis should be used.
- A multimodal approach to prophylaxis should be adopted in all patients with ≥2 risk factors.
- Patients with 1-2 risk factors should receive two drugs in combination using first-line antiemetics such as dopamine antagonists, serotonin antagonists and corticosteroids. Discuss with the surgeon preoperatively or at checklist time.

Tools and Equipment

Use a validated score like the Apfel to identify patients who would benefit from prophylactic antiemetics.

Additional Information

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

Data Collection

Use of antiemetic prophylaxis

3 Preoperative

Multimodal Opioid-Sparing Pain Management[A10, A13-15, A18-20]

Recommendations

- A multimodal pain management plan with active strategies to minimize the use of opioids should be developed before surgery, which covers all phases of perioperative care.
- The following preoperative interventions are acceptable in a pain management plan (see algorithm for guidance):
  - IV/oral analgesia
    - NSAIDs/COX2
    - Acetaminophen
    - Gabapentinoids (opioid-tolerant patients only)
  - Neural blockades
    - TEA - recommended for planned open surgeries, surgeries where there is a high risk of conversion from laparoscopic to open, and for patients at high risk of pulmonary complication.
    - Regional analgesia techniques - recommended for laparoscopic surgery and administered as either:
      - Single shot: TAP, RS, 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 (0.25 to 0.5 mg/kg then 0.25 mg/kg/hr)
    - +/- IV magnesium sulfate
    - +/- IV clonidine or dexmedetomidine
- Optimal 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/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.
- Risk of leakage may preclude the use of NSAIDs – ask the surgeon about the quality of 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.

3 Preoperative

Surgery

Mechanical Bowel Preparation (MBP)[S1, S18-25]

Recommendations

- MBP using a combined iso-osmotic mechanical preparation and oral antibiotics 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[S17]

Recommendations

IV antibiotics should be administered within 60 mins before incision.

Tools and Equipment

Refer to your local institutional antimicrobial stewardship guidelines.

3 Preoperative

Preventing Hypothermia[S26, S27]

Recommendations

Patients should be prewarmed for 20-30 minutes before induction of anesthesia.

Venous Thromboembolism (VTE) Prophylaxis[S17, S26, S27]

Recommendations

Patients should receive intermittent pneumatic compression and pharmacological thromboprophylaxis with LMWH.

Tools and Equipment

- Intermittent pneumatic compression device
- Caprini score

Additional Information

Risk factors for VTE are numerous. Most patients will have ≥1 risk factor, and as many as 40% will have ≥3 risk factors.

Data Collection

Preoperative VTE chemoprophylaxis

3 Preoperative

Fluid

- Fasting[F1, F5]

Recommendations

- Prolonged preoperative fasting (e.g. NPO after midnight) should be abandoned.
- Unrestricted access to solids for up to 8 hrs before anesthesia and clear fluids for oral intake up to 2 hrs before the induction of anesthesia is encouraged.
- Patients with an increased risk of aspiration and with fluid restriction should be considered on a case by case basis, and preoperative diet restrictions may need to be extended.

Additional Information

- Clear fluid is a liquid that you can see through. Examples include: water, electrolyte-containing sports drinks, non-pulp fruit juices and tea/coffee without milk/cream.
- The day before surgery patients receiving mechanical bowel preparation should only receive clear fluids.
- Risk factors for aspiration include:
  - Documented gastroparesis
  - Metoclopramide and/or domperidone use to treat gastroparesis
  - Documented gastric outlet or bowel obstruction
  - Achalasia
  - Dysphagia
- Examples of patients with fluid restrictions include dialysis and CHF.

Data Collection

Allow clear liquids up to 2 hrs before induction.

3 Preoperative

Complex Carbohydrate Loading[F6-11]

Recommendations

- Maltodextrin may be used for carbohydrate loading to reduce insulin resistance.
- If maltodextrin is included, 50 g PO consumed over a max of 5 mins ≥2 hrs before surgery is recommended. Simple sugar (e.g. fructose) may be used instead of maltodextrin. However, it will not exert 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 2 hrs before induction.

Weight Monitoring[F12]

Recommendations

Measure preoperative weight the morning of surgery.

Tools and Equipment

Calibrated scales

Additional Information

- Despite limitations in interpreting weight changes after surgery (e.g. metabolic response to surgery), and challenges in obtaining accurate weight measurements (e.g. 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 Preoperative

• Effects of Bowel Preparation[F6]

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 2 hrs before induction of anesthesia.

4 Intraoperative

Analgesia

Multimodal Opioid-Sparing Pain Management[A6, A13, A21-27]

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 Q1hr or infusion 0.25 mg/kg/hr).
  - Dexamethasone (IV 4 mg).
  - Other adjuncts can be considered even if based on limited evidence to manage pain (e.g. 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 CWI can be performed +/- postoperative continuous infusion at the end of the surgery prior to patient's emergence from anesthesia.
  - In addition, adjuvant analgesics mentioned above must be added.
- Intraoperative considerations for IV opioids:
  - Doses should be titrated to minimize the risk of unwanted effects.

Tools and Equipment

Nociception monitors can be used to compute real-time NOL and ANI indices (available in Canada) and to guide dose titration of opioids.

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

(Please see next page for a complete list)

4 Intraoperative

Multimodal Opioid-Sparing Pain Management[A6, A13, A21-27]

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

4 Intraoperative

Surgery

Antimicrobial Prophylaxis[S28, S29]

Recommendations

- Antibiotics with short half-lives (e.g. <2 hrs) should be re-dosed every 3-4 hrs during surgery if the operation is prolonged or bloody.
- Postoperative doses of antibiotics covering aerobic and anaerobic bacteria given in the preoperative phase are not needed.

Tools and Equipment

Refer to your local institutional antimicrobial stewardship guidelines.

Surgical Approach[S1, S17, S24, S30]

Recommendations

A minimally invasive surgical approach 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, locally invasive cancers.

Normothermia[S17, S28, S30, S31]

Recommendations

Intraoperative maintenance of normothermia with appropriate interventions should be used routinely to keep central core temperature ≥36°C.

Tools and Equipment

- Heated IV fluids and upper body forced air heating covers may help to maintain normothermia.
- CAS Guidelines to the Practice of Anesthesia - Perioperative Temperature Management.

Additional Information

(Please see next page for a complete list)

4 Intraoperative

Normothermia[S17, S28, S30, S31]

Additional Information

Up to 90% of patients undergoing surgery develop hypothermia.

Data Collection

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

Surgical Site Infection (SSI) Prevention[S1, S25]

Recommendations

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

Tools and Equipment

- CDC Prevention Guideline for the Prevention of SSI
- AHRQ Safety Program for Surgery - Building Your SSI Prevention Bundle
- CPSI Prevent SSIs: Getting Started Kit

Drains and tubes[S1, S17, S24]

Recommendations

The routine use of intra-abdominal drains and NGTs should be avoided.

4 Intraoperative

Fluid

• Fluid Management[F13-17]

Recommendations

- IV fluid maintenance with balanced crystalloid solution 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/hr).
- Goal-directed volume therapy to replace intravascular loss
  - Replace fluid loss with balanced crystalloid solution 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 and/or for major surgeries associated with large amounts of blood loss or fluid shifts.
  - Replace urine output and GI loss (if measurable) with balanced crystalloid solution.
- When patients leave the operating room or the PACU, intravascular volume status should be estimated based on physiologic parameters (e.g. blood pressure, heart rate) and quantitative measures (e.g. blood loss, urine output). 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

- In light of recent findings from the RELIEF trial, a maintenance infusion rate ≤ 5 ml/kg/hr increases the risk of AKI.
- 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

(Please see next page for a complete list)

4 Intraoperative

Fluid Management[F13-17]

Data Collection

- Volume of IV fluid administration
- Optional:
  - Balanced crystalloid solution
  - Duration of surgery
  - Fluid balance with the following measures: EBL, total amount of IV fluids, UO, other losses = fluid balance
  - Advanced hemodynamic monitoring
  - Use of volumetric pumps

4 Intraoperative

Management of Hemodynamic Instability[F5, F18]

Recommendations

- Establish causation: rather than treat every instance of clinical anomaly (e.g. hypotension, tachycardia, oliguria) with a bolus of 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.

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% 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 CVC placement.

5 Postoperative

Analgesia

Multimodal Opioid-Sparing Pain Management[A6, A11, A28-31]

Recommendations

- A multimodal pain management plan with active strategies to minimize the use of opioids should be used.
- Postoperative considerations for IV/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.
    - Transition from IV to PO as soon as possible.
- Postoperative considerations for TEA:
  - Patient age and cognitive function should guide the use of PCEA or epidural continuous infusion managed by a nurse.
    - Low-dose bupivacaine (0.05%) 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 (e.g. 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) and acetaminophen (4 g/day) 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 (e.g. 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 (PCA for laparoscopic surgery) should be discontinued and replaced by oral opioids as soon as possible.
- Continuous infusion lidocaine can be used in early and intermediate postoperative hours if an epidural was not placed, but at late time points (for up to 48 hrs postoperatively) should be considered for patients with high pain scores in PACU only (if not, discontinue infusion at the end of PACU).

Tools and Equipment

Use epidural stop test at 48 hrs.

5 Postoperative

Multimodal Opioid-Sparing Pain Management[A6, A11, A28-31]

Additional Information

- Risk of leakage may preclude the use of NSAIDs.
- Evidence of effect for IV lidocaine on reduction of postoperative pain at early (1-4 hrs) and intermediate (24 hrs) time points, but not at late time points (48 hrs).
- Non-anesthesia providers should be educated about the possible hazards of lidocaine use (LAST).
- Tramadol should be used cautiously in patients >75 yrs, ASA 3 or 4, and with impaired mobility or frailty.
- IV ketamine might be continued for 48 hrs 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 analgesia
  - Use of PCA opioid

Pain Assessment[A19]

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.

Breakthrough Pain Management[A19]

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 opioids (e.g. hydrocodone, oxycodone, morphine, hydromorphone). Carefully titrate for the lowest effective opioid dosage.

5 Postoperative

Surgery

- ## Glycemic control[S17]

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 Catheters[S1, S25, S28]

Recommendations

- Urinary catheters should be removed within 24 hrs of elective colonic or upper rectal resection, irrespective of TEA use.
- Urinary catheters should be removed within 48 hrs of mid/lower rectal resections.
- For patients who fail trial of void, clean intermittent catheterization for 24 hrs should be considered after elective colorectal surgery.

Data Collection

Urinary catheter removal

- ## Venous Thromboembolism (VTE)[S4]

Recommendations

Consideration should be given to extended-duration pharmacological thromboprophylaxis (4 wks) in patients undergoing colorectal cancer resection.

5 Postoperative

Fluid

Fluid Maintenance[F1, F4, F11, F12, F15, F19, F20]

Recommendations

- At the end of surgery, or at least by 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/day of water. Potassium, sodium and chloride should be monitored to ensure patients meet daily electrolyte needs (1 mmol/kg each). Electrolyte deficiencies can be replaced using an enteral or IV route.
- In patients not tolerating oral fluid intake (e.g. postoperative ileus), a maintenance infusion of 1.5 ml/kg/hr of IV fluids should be started.

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

5 Postoperative

Management of Hemodynamic Instability[F21-23]

Recommendations

- In patients in whom volume expansion is indicated to correct a clinical anomaly (e.g. hypotension, tachycardia, oliguria) the likelihood of fluid responsiveness should be estimated before giving a bolus of IV fluids.
  - In the HDU and ICU, advanced hemodynamic monitoring should be used to determine fluid responsiveness, either after a fluid challenge or a PLR maneuver.
  - If advanced hemodynamic monitoring is unavailable (e.g. surgical wards and PACU), a rapid (15-30 mins) 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's repeated. If there is no beneficial response, further fluid boluses are unlikely to be effective and may cause harm; seek expert advice.
- Vasopressors should be considered for managing vasodilatory states such as epidural-induced hypotension provided the patient is normovolemic.
- Anuria warrants immediate attention.

Tools and Equipment

- Volumetric pump for maintenance infusion and fluids boluses (except in critical situations e.g. 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 PP response following a PLR maneuver to determine whether stroke volume will increase with volume expansion. An increase in PP of >10% 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.

5 Postoperative

- Ileus[F6, F24]

Recommendations

Rational fluid replacement to maintain euvolemia and electrolyte repletion is recommended for the treatment of postoperative gastrointestinal dysfunction.

Additional Information

The addition of gum as a form of sham feeding has not been shown to improve time to bowel recovery.

5 Postoperative

Nutrition

Nutrition Therapy[N4-6, N12-16]

Recommendations

- Patients should be offered food and fluid as early as day of surgery and definitely 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% of their food. Patient’s consistently eating ≤50% of their food for 72 hrs 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 (e.g. SGA B and SGA C) before surgery should receive a high protein, high energy diet post-operatively and be followed by a dietitian. If they are not anticipated to meet nutritional goals within 72 hrs through oral intake, they should receive supplemental PPN, PN, or EN. Nutrition support should be discontinued when the patient is able to take in ≥60% 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

To encourage adequate intake in hospital offer:

- Small servings for the first meals (POD0 and POD1).
- High-protein ONS targeting 250-500 kcal/day. Med Pass program can be used to deliver 60 ml up to four times per day.
- 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 (e.g. signs noting that the fridge in the hallway is stocked with ONS).
- Encouragement to family and friends to bring in favourite foods from home to stimulate appetite; education on optimal choices.

Data Collection

Date tolerating diet

5 Postoperative

Mobility

Patient Assessment Prior to Early Mobilization[M2]

Recommendations

- Nurses should be responsible for the initial assessment prior to first mobilization attempt.
- If mobility issues are identified (e.g. preoperative conditions or surgical complications that result in difficulty mobilizing after surgery) patients should be further assessed by a physiotherapist who should assist/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 and/or disoriented.
  - Patient reports severe pain.
  - Severe nausea/vomiting present.
  - Severe tachycardia, low blood pressure or abnormal electrocardiography present.
  - Severe tachypnea and/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, 6-Minute Walk and Timed Up and Go.

5 Postoperative

In-Hospital Mobilization[M3]

Recommendations

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

Implementation Approaches

- On POD 0 patients should be encouraged to mobilize out of bed (e.g. 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.
- Ideally, from POD 1 until hospital discharge, patients should be encouraged to be up in a chair and walk at least 3 times a day.
- 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

6 Discharge

Analgesia

- Discharge[A32]

Recommendations

- Multimodal analgesics prescriptions can be suggested to the surgical team. Non-opioid therapies should be encouraged as primary treatment (e.g. acetaminophen, NSAIDs if approved by surgical team).
- Titrate discharge medication based on what patients are taking in the hospital.
- Non-pharmacologic therapies should be encouraged (e.g. ice, elevation, physical therapy).
- Do not prescribe opioids with other sedative medications (e.g. benzodiazepines).
- Short-acting opioids should not be prescribed for more than 3-5 day courses (e.g. morphine, hydromorphone, oxycodone).
- Educate patient on tapering of opioids as surgical pain resolves.
- Fentanyl or long-acting opioids (e.g. methadone, OxyContin) should not be prescribed to opioid naïve patients.
- Educate patient about safe use of opioids, potential side effects, overdose risks, and developing dependence or addiction.
- Refer and provide resources for patients who have or are suspected to have a substance use disorder after surgery.

6 Discharge

Nutrition

Nutrition Care[N4]

Recommendations

- 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 (e.g. SGA B or SGA C) who do not fully recover 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 (e.g. meal programs, grocery shopping services).
- Ileostomy patients should receive specific guidelines from a dietitian to reduce the risk of dehydration.
- Primary caregivers and other practitioners involved in post-discharge care should be provided with details about the patient's nutritional status (e.g. 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.

6 Discharge

Mobility

• 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

- Education about post-discharge physical activity should be delivered prior to discharge in an education session with a nurse, physiotherapist or kinesiologists.
- Education should be delivered by physiotherapists if physical activity restrictions are expected after discharge.
- Family members should be educated about how they can facilitate and encourage post-discharge physical activity.

• Patient Assessment Prior to Initiation of Post-Discharge Physical Activity[M2]

Recommendations

- Patient assessment prior to discharge should be conducted by members of the multi-disciplinary team.
- If mobility issues are identified, patients should be further assessed by a rehabilitation/exercise professional (physiotherapist, occupational therapist, kinesiologists, as appropriate), who should prescribe and/or supervise physical activities according to an individually prescribed exercise plan.

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.

6 Discharge

Post-Discharge Physical Activity[M4, M5]

Recommendations

- Patients should be encouraged not to stay in bed and resume activities of daily living (such as 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, e.g. crunches, sit-ups) and lift weights only according to previous consensus-based recommendations (avoid lifting >5 kg (11 lbs) for 1-2 wks and >15 kg (33 lbs) for 3-4 wks).
- 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 by the WHO as soon as it is safely possible (e.g. at least 150 mins of moderate-intensity physical activity throughout the work week; muscle-strengthening activities of major muscle groups for 2 or more days a week).
- Ideally, patients should be encouraged to walk (at least 3 times per day) and climb stairs if available (daily or every 2 days).
- Ideally, patients should receive a self-managed home exercise program with set progression goals. Coaching may be provided e.g. over the phone with a rehabilitation/ exercise professional.
- A “Step Count” system may be used to set activity goals and facilitate progression.

Data Collection

- Outcome Measures:
  - Acute length of stay
  - Complication rate
  - Visits to emergency department within 30 days after discharge
  - Readmission within 30 days after discharge

Multimodal Opioid Sparing Analgesia Pathway

Epidural stop test	A process that generally occurs on postoperative day 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 (optimal analgesia achieved) at noon the catheter is removed from the epidural space and oral analgesia is continue.
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.[A8]
Opioid induced hypergalgesia	Increased sensitivity to noxious stimuli.

Fluid Management Pathway

Passive leg raise	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.[F23]
Pulse pressure	The difference between systolic and diastolic pressure.

Nutrition Management Pathway

Diet therapy	A broad term for the practical application of nutrition as a preventative or corrective treatment of disease.
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.[N20]
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.[N17]
High protein oral nutritional supplements (ONS)	A ready-made liquid, powder, or pudding with macronutrients and micronutrients, containing >20% of energy provided from protein.
Malnutrition	For the purposes of this document, malnutrition is defined as the deficiency (or imbalance) of energy, protein and other nutrients.[N18]
Nutrition assessment	An in-depth, specific and detailed evaluation of nutritional status.[N19]
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.[N16]
Patient journey	Begins at time of diagnosis and continues through treatment and recovery.
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.
Parenteral nutrition (PN)	Intravenous 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.[N21]
Subjective global assessment (SGA)	A nutrition assessment tool that is a gold standard for diagnosing malnutrition.

Mobility and Physical Activity Pathway

Delphi Method	A method of systematically surveying a group of experts to reach consensus opinion on a specific topic.
Early mobilization	Mobilization out of bed starting on the day of surgery (POD 0) or within 12 hrs after arrival on the ward.
Exercise	Physical activity that is planned, structured, repetitive and intended to maintain or improve physical fitness.[M6]
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.
Mobility	The ability to move freely and easily.[M7]
Mobilization	The commencement of upright activities after a period of reduced mobility to resume activities of daily living
Physical activity	Any bodily movement produced by skeletal muscles that requires energy expenditure.[M8]
Therapeutic exercise	Bodily movement that is prescribed to correct an impairment/injury, improve physical function or maintain a state of well-being.[M9]

Multimodal Opioid Sparing Analgesia Pathway

A

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Multimodal Opioid Sparing Analgesia Pathway

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Multimodal Opioid Sparing Analgesia Pathway

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Surgical Best Practices Pathway

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Nutrition Management Pathway

N

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Abbreviations

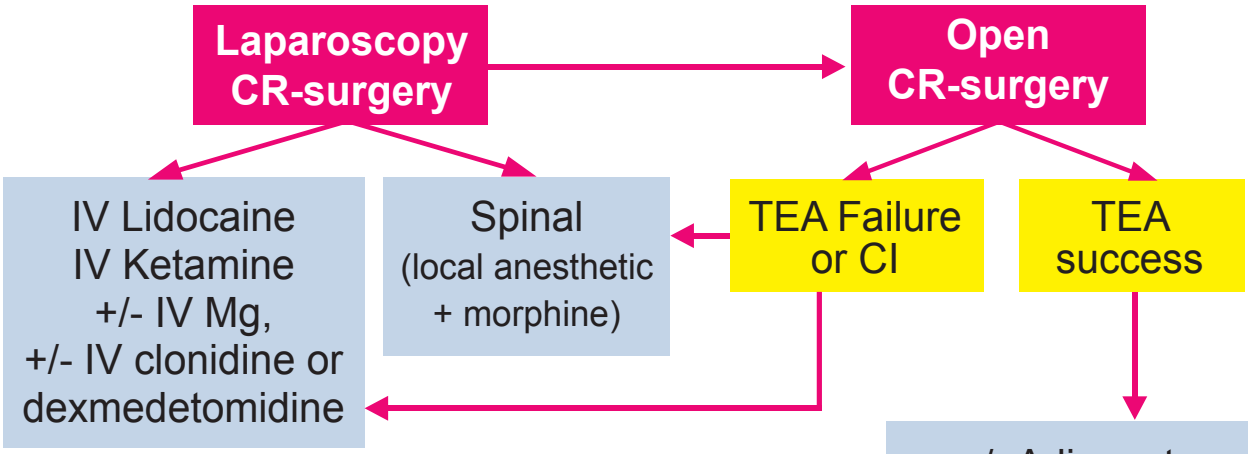
ACS, American College of Surgeons
ADL, activities of daily living
AHRQ, Agency for Healthcare Research and Quality
AKI, acute kidney injury
ANI, analgesia nociception index
ASA, American Society of Anesthesiologists
CAS, Canadian Anesthesiologists' Society
CDC, Centres for Disease Control and Prevention
CEA, continuous epidural anesthesia
CHF, congestive heart failure
CI, continuous infusion
CNST, Canadian Nutrition Screening Tool
CO, cardiac output
COX2, cyclo-oxygenase-2
CPSI, Canadian Patient Safety Institute
CR, colorectal
CVC, central venous catheter
CWI, continuous wound infusion
EBL, estimated blood loss
EN, enteral nutrition
ETCO2, end-tidal carbon dioxide
GAD, Generalized Anxiety Disorder
IBD, inflammatory bowel disease
HDU, high dependency unit
ICU, intensive care unit
IV, intravenous
LA, local anesthetic
LAST, local anesthetic systemic toxicity
LMWH, low-molecular-weight heparin
LOS, length of stay
MBP, mechanical bowel preparation
NGT, nasogastric tube
NOL, nociception level index
NPO, nothing by mouth
NSAIDs, non-steroidal anti-inflammatory agents
ONS, oral nutritional supplements
PACU, Post Anesthesia Care Unit
PCEA, patient-controlled epidural analgesia
PLR, passive leg raise
PN, parenteral nutrition
PO, by mouth
POD, postoperative day
PONV, postoperative nausea and vomiting
PP, pulse pressure
PPN, peripheral parenteral nutrition
RS, rectus sheath
SAB, subarachnoid block
SGA, subjective global assessment
SV, stroke volume
TAP, transversus abdominis plane
TEA, thoracic epidural analgesia
UO, urine output
VTE, venous thromboembolism
VTI, velocity time integral
WHO, World Health Organization

Analgesia Algorithm

Preop

- Evaluate the history and medication.
- Educate – Set expectations with the patient.
- Discuss the use of NSAIDs based on surgical and patient's issues.
- Start preoperative multimodal analgesia: PO Tylenol +/- NSAIDs.
- At the checklist: Discuss the type of surgery (laparotomy vs laparoscopic) and risk of conversion.

Intraoperative



+/- use of intraoperative nociception monitors to guide opioid administration

At the end of surgery:

a) Single shot or Continuous infusion Abdominal trunk blocks (e.g. TAP, RS) or

b) Continuous Wound infusion (CWI) of LA

Postop

Multimodal analgesia including opioids for breakthrough pain with +/- :

a) Abdominal trunk blocks with continuous infusion (e.g. TAP block), or

b) CWI

CEA/PCEA
(local anesthetic + opioid)
for 48-72 hrs
STOP-test at 48 hrs

Data Collection and Measurement

Summary

This resource will guide participants in the *Enhanced Recovery Canada (ERC)* Patient Safety Improvement Project through the data collection and measurement process. It includes information regarding 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 necessary for each *ERC* Project Team 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 World Health Organization created an international coding system of medical classifications; the International Statistical Classification of Diseases and Related Health Problems (ICD), version 10. Within *ERC*, we will use this coding system to describe the colorectal surgeries which should be included in your patient population. By providing your Health Care Information Management and Technology Department with this following list of ICD-10 codes they should be able to provide data on the number of colorectal surgeries performed monthly and details regarding the acute care stay of the patients who endured these procedures.

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[1] is provided below. 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% of population required
20 - 100	20
>100	15 - 20% of population size

Baseline Data Collection should occur over a 3-month period to ensure an accurate reflection of the surgical care provided. During the implementation phase of the *ERC* Project, monthly data collection and reporting is recommended to reflect the process changes and improvements in postoperative patient outcomes.

**It is recognized that there is often a delay in coding patient charts post-discharge. Liaise with the Health Care Information Management and Technology Department to see if a process to expedite review of colorectal surgery charts is feasible to provide more current patient outcome data to the ERC Team.*

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 must be obtained before any changes are made, then at scheduled time periods throughout the implementation to reflect the progress of the project.

First, baseline data should be obtained to give your team and organization an overview of the care currently provided by all healthcare providers along the patient continuum. Baseline data can be collected through retrospective chart review. If collecting data retrospectively is not feasible, it is possible to collect in real-time at the beginning of the Safety Improvement Project, prior to any implementation changes. It is recommended to review patient charts for a three-month time period.

Data Collection and Measurement

To determine success of the *ERC* Project, it is recommended to collect both outcome and process variables. An outcome variable determines if a specific intervention is having the desired effect on a clinical measure, such as reducing postoperative infection rates. 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 infection, it may measure the *process* of removing urinary catheters.

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. It is anticipated that these process variables will be found via manual chart review, whether your organization documents on paper or electronically. Higher compliance to ERAS® recommendations (process variables) results in better postoperative patient outcomes after colorectal cancer surgery, including reduced postoperative complications, reduced occurrence of symptoms delaying discharge, and reduced readmission to hospital.[2] The process variables to be collected are listed below, with full description found in *Appendix D.* Compliance to these measures are to be collected on a monthly basis and reported to your *ERC* Teams.

Data Collection and Measurement

Surgical Phase	Process Variables
Preoperative	Pre-admission Counselling Malnutrition Screening Use of Anti-emetic Prophylaxis** Preoperative Mechanical Bowel Preparation Preoperative Oral Antibiotics Preoperative VTE Chemoprophylaxis Allow Clear Liquids up to 2 hrs Before Induction Allow Maltodextrin up to 2 hrs 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 Multi-modal Pain Management Urinary Catheter Removal IV Fluid Discontinuation Date Tolerating Diet Daily Weights 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 Multi-Modal 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.*

***Please note that use of anti-emetic prophylaxis in the intraoperative phase would also be compliant with evidence-based Enhanced Recovery recommendations.*

Many institutions with established Enhanced Recovery pathways across Canada also subscribe to a database to measure their surgical health care 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, the *ERC* project has adopted 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.

Data Collection and Measurement

**It is acknowledged that gaps in documentation may inaccurately reflect surgical care provided. It is recommended to provide education to the multidisciplinary team involved with colorectal surgery patients regarding the process variables to be collected. This education should include the individual process variables and importance of documentation to accurately reflect the compliance to evidence-based practices recommended by the ERC Project.*

Outcome Variables

Literature reveals that implementation of Enhanced Recovery pathways improves postoperative patient outcomes.[2] As per the *ERC* Project, the outcome variables to be collected on the colorectal surgery population are below, with full description to be found in *Appendix D.*

- Acute length of stay
- Complication rate
- Visits to Emergency Department 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 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

Preoperative Phase

• Pre-Admission Counselling

Intent of Variable	To capture **whether or not the patient received counseling before admission** describing expectations and detailing the postoperative care plan.
Definition	Pre-admission counseling refers to the provision of written information prior to admission which details expectations specific to diet and bathing preoperatively and breathing/coughing exercises, mobility, and diet advancement postoperatively.
Criteria	Describe if patient was provided with specific written instructions detailing expectations and responsibilities before surgery such as: fasting times, oral carbohydrate, showering and after surgery (pain control, deep breathing and coughing exercises, mobility expectations, goals for nutritional intake, discharge criteria, and expected hospital stay). • **Yes:** Patient provided with specific written instruction. • **No:** Patient not provided with specific written instructions.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	Hospitals can meet these criteria by providing ERC Patient Optimization Guide or using their own instructions their own instructions which address all of these elements: ○ Preoperative Information ○ Fasting times ○ Oral carbohydrate ○ Showering

Process and Outcome Variables

Notes (continued)	• Postoperative Information
	  ○ Pain control
	  ○ Deep breathing and coughing exercises, mobility expectations
	  ○ Goals for nutritional intake
	  ○ Discharge criteria
	  ○ Expected hospital stay

Process and Outcome Variables

Preoperative Phase

• Malnutrition Screening

Intent of Variable	To capture **whether or not 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 CNST as early as possible for nutrition risk, either at the initial surgical consult or at the preadmission clinic.
Criteria	Describe if a screening tool was used prior to surgical intervention: • **Yes:** Malnutrition screening tool was used. • **No:** Malnutrition screening tool was not used.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	The CNST tool asks two questions: • 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 Anti-emetic Prophylaxis

Intent of Variable	To capture patients whether **anti-emetic prophylaxis was used.**
Definition	Examples include: • Antiemetics (cholinergic, dopaminergic (D2), serotonergic (5 - HT3), or histaminergic); OR • Dexamathasone; OR • Omission of nitrous oxide; OR • Total intravenous anesthesia with Propofol and Remifentanil
Criteria	Indicate whether pre OR intraoperative anti-emetic interventions were used: • **Yes:** If the patient has documented preoperative anti-emetic interventions within 2 hrs before surgery; OR if intraoperative anti-emetic interventions were used. • **No:** Pre or Intraoperative anti-emetic intervention was not used.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	

Process and Outcome Variables

Preoperative Phase

• 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 (e.g. polyethylene glycol with or without electrolytes) to clear fecal material from the bowel lumen.
Criteria	• **Yes:** Patient underwent and completed a mechanical bowel preparation prior to surgery. • **No:** Patient did not undergo a mechanical bowel preparation prior to surgery.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• 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.
Notes	• If there is no consistent documentation of this information at your site, we recommend following up with nursing/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 which attempted but could not tolerate or complete the process.

Process and Outcome Variables

Preoperative Phase

• 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.
Criteria	• **Yes:** Patient received preoperative oral antibiotics within 24 hrs prior to surgery. • **No:** Patient did not receive preoperative oral antibiotics.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• Assign "No" if prophylactic antibiotics were only administered intravenously at the time of surgery and no oral antibiotics were received within 24 hrs 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	• If there is no consistent documentation of this information at your site, we recommend following up with nursing/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 which attempted but could not tolerate or complete the process. • If patient is taking other antibiotics for other medical conditions and not specifically for surgery, do not assign this variable.

Process and Outcome Variables

Preoperative Phase

• Preoperative Venous Thromboembolism (VTE) Chemoprophylaxis

Intent of Variable	To capture whether patient **received preoperative VTE Chemoprophylaxis.**
Definition	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: • Active GI bleeding, cerebral hemorrhage, or retroperitoneal bleeding • Documented bleeding risk • Thrombocytopenia
Criteria	• **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).
Options	• Yes • No • No, high bleeding risk
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• Assign “no” if the first dose of VTE chemoprophylaxis is administered postoperatively.
Notes	

Process and Outcome Variables

Preoperative Phase

• Allow Clear Liquids Up to 2 Hours Before Induction

Intent of Variable	To capture whether **patients take clear liquids up to 2 hrs before surgery start time,** rather than traditional fasting after midnight.
Definition	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. Alternative fasting guidelines should be administered to those who are considered high risk for aspiration. High risk patients include: • Delayed gastric emptying • Gastroparesis • Gastrointestinal obstruction • Upper gastrointestinal malignancy Alternative fasting guidelines should be administered to those who have fluid restrictions. Fluid restriction patients include: • Dialysis • Congestive heart failure
Criteria	Indicate whether the patient actually consumed clear liquids between midnight and 2 hrs prior to surgery, rather than traditional fasting after midnight: • **Yes:** Consumption of clear liquids any time between midnight and 2 hrs before surgery. • **No:** No consumption of clear liquids between midnight and 2 hrs before surgery; consumption of liquids not documented. • **No, high risk or fluid restriction patient:** Patient has one of the conditions listed above.
Options	• Yes • No • No, high risk or fluid restriction patient

Process and Outcome Variables

Scenarios to Clarify (Assign Variable)	• Assign “Yes” if there is documentation that patient consumed clear liquids up to 2 hrs prior to surgery.
Scenarios to Clarify (Do NOT Assign Variable)	• Assign “No” if clear fluids have been exclusively used to take PO medications.
Notes	

Process and Outcome Variables

Preoperative Phase

• Allow Maltodextrin 2 Hours Before Induction

Intent of Variable	To capture whether patient **consumed Maltodextrin 2 hrs before surgery start time.**
Definition	50g of Maltodextrin was administered and consumed over a maximum of 5 minutes ≥2 hrs before surgery start time. Exclusion Criteria: • 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).
Criteria	• **Yes:** Patient received Maltodextrin ≥2 hrs before surgery start time. • **No:** Patient did not receive Maltodextrin ≥2 hrs before surgery start time. • **No, exclusion criteria:** Patient did not receive Maltodextrin 2 hrs before surgery start time due to documented contraindication to consuming Maltodextrin.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• Assign “yes” if patient received Maltodextrin 2 hrs before surgery start time and it was consumed within a maximum of 5 mins.
Scenarios to Clarify (Do NOT Assign Variable)	• Assign “no” if Maltodextrin was consumed over a time period >5 mins. • Assign “no” if Maltodextrin was consumed >2 hrs before surgery start time.
Notes	

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	Regional anesthesia includes epidural analgesia with anesthetics or opioids, intrathecal (spinal) opioid administration, and transversus abdominis plane (TAP) blocks. • A thoracic epidural is placed in the T1 - T12 levels and is used for infusion of anesthetics or opioids (e.g. 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 (e.g. morphine, fentanyl and/or lidocaine, procaine, ropivacaine) administered once prior to surgery. • TAP blocks are performed under ultrasound guidance, where local anesthetic (e.g. ropivacaine, bupivicaine) 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.
Criteria	Indicate whether a form of regional anesthesia was employed: • **Yes**: A thoracic epidural, spinal anesthesia OR TAP block were administered. • **No:** None of the above regional anesthesia methods were employed.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• Subcutaneous local wound injection of bupivacaine liposome injectable suspension/bupivacaine/lidocaine or disposable continuous local anesthetic infusion pump would not be included as a type of regional anesthesia.
Notes	• See examples per Analgesia Algorithm.

Process and Outcome Variables

Intraoperative Phase

• Patient Temperature at the End of Surgery or on Arrival to PACU

Intent of Variable	To capture **whether or not 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.
Criteria	• **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.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	

Process and Outcome Variables

Intraoperative Phase

• Volume of IV Fluid Administration

Intent of Variable	To capture the **volume of intravenous fluid administered** intraoperatively.
Definition	IV fluid includes crystalloid and colloid solutions.
Criteria	• Numeric value representing total volume of IV crystalloid and colloid fluid administered.
Options	• Any numeric value ≥0 ml
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• Do not include volumes of blood products.
Notes	

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 hrs of surgery finish time.
Definition	Multi-modal pain management refers to use of non-opioid analgesics to reduce opioid-related side effects. Strategies or medications that would qualify include two or more of the following: • Non-steroidal anti-inflammatory drugs (NSAIDs) (including ibuprofen, ketorolac, cyclooxygenase-2 inhibitors) • Acetaminophen • Gabapentinoids (gabapentin or pregabalin) • Ketamine • Intravenous lidocaine (infusion) • Regional anesthesia (refer to "Use of Regional Anesthesia" variable)
Criteria	Indicate whether a multi-modal approach to pain management was used in the postoperative period. • **Yes:** Two more of the above analgesics were administered (simultaneously) in the postoperative period within 48 hrs of surgery finish time. • **No:** Two or more of the above analgesics were not administered simultaneously in the postoperative period within 48 hrs of surgery finish time.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• PRN orders for pain medication alone would not qualify.
Notes	• 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	A urinary catheter is typically placed at the time of surgery and removed within the first 48 hrs after surgery.
Criteria	Indicate the documented date of urinary catheter removal, or indicate if the patient did not have a urinary catheter placed for the procedure. • **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.
Options	• POD 0 • POD 1 • POD 2 • ≥ POD 3 • N/A
Scenarios to Clarify (Assign Variable)	• Enter date of urinary catheter removal, even if urinary retention occurs and the patient requires intermittent catheterization or catheter reinsertion. • If urinary catheter is removed at the end of the case in the operating room, enter removal on POD 0. • If patient is discharged from the hospital with a urinary catheter in place, enter ≥ POD 3.
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	

Process and Outcome Variables

Postoperative Phase

• IV Fluid Discontinuation

Intent of Variable	To capture the date of **maintenance intravenous fluid discontinuation following surgery.**
Definition	Maintenance intravenous fluids are run at a continuous, steady rate (usually 50 – 150 ml/hr).
Criteria	Indicate the date of maintenance intravenous fluids discontinuation. • **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**
Options	• POD 0 • POD 1 • POD 2 • ≥ POD 3 • No postoperative IV fluids administered
Scenarios to Clarify (Assign Variable)	• Enter date if maintenance rate intravenous fluids are stopped, even if the patient subsequently receives a bolus of a set volume of fluid (e.g. 500 ml or 1,000 ml). • Enter date if the maintenance rate intravenous fluids are stopped, even if fluids are subsequently resumed for a change in the patient's clinical status.
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	

Process and Outcome Variables

Postoperative Phase

• 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 ml - 1,000 ml) without need for intravenous fluids.
Criteria	Indicate the first date on which the patient tolerated a diet. • **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.
Options	• POD 0 • POD 1 • POD 2 • ≥ POD 3
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• N/A
Notes	• While vomiting may be a sign that a patient did not tolerate their diet, vomiting can be due to multiple factors and we do not have a specific threshold defined for when vomiting indicates lack of tolerating diet. Documentation of emesis/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 (e.g. regular diet, low residue diet, cardiac/diabetic diet).

Process and Outcome Variables

Postoperative Phase

• Daily Weights

Intent of Variable	To capture **whether a patient was weighed daily** postoperatively for the first 48 hrs after surgery (postoperative day one and two) as surrogate measure of fluid overload.
Definition	The patient was weighed daily as an additional vital sign to avoid fluid overload.
Criteria	Indicate whether the patient was weighed daily: • **Yes**: The patient was weighed on postoperative day one and two. • **No**: The patient was not weighed on postoperative day one and two.
Options	• Yes • No
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• If a patient was not weighed preoperatively then do not assign this variable. • If a patient was not weighed on both postoperative days one and two, do not assign this variable.
Notes	• 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

Postoperative Phase

• 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: • Ambulation a distance of 10 feet or more. • Ambulation for a duration of 2 minutes or more.
Criteria	Specify the first documented date of patient ambulation following surgery. • **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 patient mobilization after 00:00 on POD 3.
Options	• POD 0 • POD 1 • POD 2 • ≥ POD 3
Scenarios to Clarify (Assign Variable)	• N/A
Scenarios to Clarify (Do NOT Assign Variable)	• Standing at bedside • Up to chair
Notes	

Process and Outcome Variables

• Optional Process Variables

Optional Fluid Management Variables		
Variable Name		
Balanced Chloride-Restricted Solution	**Intent of Variable**	To capture whether the intravenous solutions administered as maintenance infusion are isotonic and chloride-restricted.
	Definition	Any IV solution administered with very similar physiologic plasma osmolarity and solute concentrations. • Examples of balanced chloride-restricted solutions include: Lactated Ringer's and Plasma-lytes. • Example of unbalanced solutions: 0.9% Na^+Cl^- solution (normal saline).
	Criteria	Indicate whether the IV solutions administered as maintenance infusion were isotonic and chloride-restricted. • **Yes**: If the patient received IV solutions that were isotonic AND chloride-restricted. • **No**: If the patient received IV solutions that were not isotonic AND chloride-restricted.
	Options	• Yes • No
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

Optional Fluid Management Variables (Continued)		
Variable Name		
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 (e.g. gastrointestinal loss).
	Criteria	Fluid balance calculated by subtracting the total output from the total input.
	Options	Fluid balance (negative or positive) expressed in ml or L.
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 (e.g. pulse pressure variation, stroke volume variation). Heart rate and blood pressure monitoring (invasive or noninvasive) are not considered advanced monitoring.
	Criteria	Indicate whether an advanced hemodynamic monitor was used during the procedure: • **Yes**: An advanced hemodynamic monitor was used during the procedure. • **No**: An advanced hemodynamic monitor was not used during the procedure.
	Options	• Yes • No

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.
	Criteria	Indicate whether a volumetric pump was used during the procedure: • **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.
	Options	• Yes • No

Process and Outcome Variables

Optional Multi-Modal Pain Management Variables		
Variable Name		
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.
	Criteria	Specify whether a patient underwent an open or laparoscopic procedure. • **Open**: The patient underwent an open surgical procedure. • **Laparoscopic**: The patient underwent a laparoscopic surgical procedure +/- Pfannenstiel incision.
	Options	• Yes • No
Epidural Anesthesia	**Intent of Variable**	To capture whether epidural anesthesia was used.
	Definition	A thoracic epidural is placed between the T9 - T12 levels and is used for infusion of anesthetics or opioids (e.g. 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, and for patients at high risk of pulmonary complication.
	Criteria	Specify whether patient received epidural anesthesia: • **Yes**: The patient received epidural anesthesia. • **No**: The patient did not receive epidural anesthesia.
	Options	• Yes • No

Process and Outcome Variables

Optional Multi-Modal Pain Management Variables (Continued)		
Variable Name		
Intraoperative Nerve Trunk Blocks	**Intent of Variable**	To capture whether the patient received intraoperative nerve trunk blocks.
	Definition	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: • Single shot: TAP, RS, SAB +/- opioid, wound infiltration. • Continuous block: TAP/RS catheter, pre-peritoneal wound catheter infiltration.
	Criteria	Specify whether patient received intraoperative trunk blocks: • **Yes**: The patient received either single shot: TAP, RS, SAB, wound infiltration OR continuous block: TAP/RS catheter, peritoneal wound catheter infiltration. • **No**: The patient did not receive either single shot: TAP, RS, SAB, wound infiltration OR continuous block: TAP/RS catheter, peritoneal wound catheter infiltration.
	Options	• Yes • No

Process and Outcome Variables

Optional Multi-Modal Pain Management Variables (Continued)		
Variable Name		
Intraoperative Multimodal Analgesia and Adjuvants	**Intent of Variable**	To capture whether patient received intraoperative multimodal analgesia and adjuvants.
	Definition	Minimizing opioid analgesia reduces the adverse effects of opioid use during and after surgery. Examples of adjuvants include intravenous infusions of lidocaine, ketamine, +/- magnesium sulfate, +/- clonidine or dexmedetomidine.
	Criteria	Indicate whether intraoperative multimodal analgesia and adjuvants were used: • **Yes**: The patient received either intravenous lidocaine, ketamine, magnesium sulfate, clonidine OR dexmedetomidine intraoperatively. • **No**: The patient did not receive either intravenous lidocaine, ketamine, magnesium sulfate, clonidine OR dexmedetomidine intraoperatively.
	Options	• Yes • No
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 the surgical noxious stimuli.
	Criteria	Indicate whether a nociception monitor was used: • **Yes**: A nociception monitor was used. • **No**: A nociception monitor was not used.
	Options	• Yes • No

Process and Outcome Variables

Optional Multi-Modal Pain Management Variables (Continued)		
Variable Name		
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%) and low dose opioids (e.g. 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 at POD 2.
	Criteria	Indicate whether postoperative epidural analgesia was used. • **Yes**: Postoperative epidural analgesia was used. • **No**: Postoperative epidural analgesia was not used.
	Options	• Yes • No
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.
	Criteria	Indicate whether postoperative PCA opioid was used: • **Yes**: Postoperative PCA opioid was used. • **No**: Postoperative PCA opioid was not used.
	Options	• Yes • No

Process and Outcome Variables

Outcome variables

**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/services provided in that care setting.
Complication Rate	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/effect relationship is documented, regardless of timeline. *Noted 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. Complication rate is calculated by: $\frac{\text{Number of patients who experienced a complication}}{\text{Total number of patients who underwent surgery}}$
Visits to Emergency Department within 30 Days after Discharge	Patients who were discharged from an acute care institution after surgery but returned to hospital Emergency Department within 30 days after discharge. *Noted that there may be limitations to accessing information of patients who visit Emergency Departments outside the Regional Health Authority.
Readmission within 30 Days after Discharge	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. *Noted that there may be limitations to accessing information of patients who are readmitted outside the Regional Health Authority.

Data Collection and Measurement

1. Canadian Patient Safety Institute (CPSI). Prevent surgical site infections; Getting started kit. https://www.patientsafetyinstitute.ca/en/toolsResources/Documents/Interventions/Surgical%20Site%20Infection/SSI%20Getting%20Started%20Kit.pdf. Accessed February 25, 2019.

2. Gustaffson UO, Hausel J, Thorell A, Ljungqvist O, Soop M, Nygren J. Adherence to the enhanced recovery after surgery protocol and outcomes after colorectal cancer surgery. Arch Surg. 2011;146(5):571-7.

Template for Physician Order Set

Enhanced Recovery After Colorectal Surgery Preoperative Medication Orders

Patient Name	
Health Care Number	
Date of Birth	

Allergies

Preoperative Clinic

- ☐ Prescription to be provided for Mechanical Bowel Preparation of sodium picosulfate or polyethylene glycol-based electrolyte solution + oral antibiotics.

Day of Surgery

- ☐ 50g Maltodextrin consumed over 5 minutes, 2 hrs prior to surgery (excluding specific patient populations - refer to Fluid Management Clinical Pathway).
- ☐ IV antibiotics administered within 60 mins before incision.
- ☐ Pharmacological thromboprophylaxis with Low Molecular Weight Heparin.
- ☐ 1 x STAT dose of Acetaminophen.

If opioid-tolerant:

- ☐ Regular dosing of opioids
- ☐ Gabapentanoids

Template for Physician Order Set

Enhanced Recovery After Surgery Preoperative Medical Orders

Patient Name	
Health Care 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 (e.g. CNST).
  - ☐ If patient at risk for malnutrition, send consult for assessment by dietitian.
  - ☐ If dietitian identifies patient as malnourished, individualized treatment plan commenced.
- ☐ Identify smokers and high-risk drinkers via self-reporting.
  - ☐ Educate regarding 4-week abstinence from smoking and alcohol.
  - ☐ If available, offer access to intervention program.
- ☐ If necessary, attempt to correct anemia.

Preoperative Clinic

- ☐ Thorough, evidence-informed preoperative assessment, including cardiorespiratory status, frailty, risk of thrombosis and bleeding, diabetes, etc.
- ☐ Screening for anxiety (e.g. GAD-7, HADS).
- ☐ Screening for opioid tolerance using medications and doses.
- ☐ Screening for risk factors of postoperative nausea and vomiting (Apfel Scoring System).

Instructions regarding preoperative fasting:

- ☐ Unrestricted access to solids for up to 8 hrs before anesthesia (if no mechanical bowel preparation) and clear fluids for oral intake up to 2 hrs before the induction of anesthesia is encouraged.
- ☐ If increased risk of aspiration identified, diet restrictions extended.

Template for Physician Order Set

- ☐ 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.
☐ Instructions regarding bathing with chlorhexidine soap or regular soap the night before and the morning of surgery.
☐ 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

☐ Unrestricted access to solids for up to 8 hrs before anesthesia (if no mechanical bowel preparation) and clear fluids for oral intake up to 2 hrs 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 Set

Enhanced Recovery After Colorectal Surgery Intraoperative Recommendations

Patient Name	
Health Care 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 2 hrs 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/hr).
- ☐ 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 and/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 does anxiolytic to be administered prior to epidural placement.

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

- ☐ TEA

WITH

- ☐ Analgesic adjuvants, started early in anesthesia:
    - IV Ketamine (0.25 to 0.5 mg/kg then 0.25 mg/kg/hr)
    - IV Dexamethasone (4 mg)
    - +/- IV magnesium sulfate
    - +/- IV clonidine or dexmedetomidine

Template for Physician Order Set

For laparoscopic surgery, or when epidural is not used for above listed scenarios:

- ☐ 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 mg/kg Q1h or infusion 0.25 mg/kg/hr)
- IV Dexamethasone (4 mg)
- +/- IV magnesium sulfate
- +/- IV clonidine or dexmedetomidine

☐ Regional analgesia techniques, administered at the end of surgery as either:

- Single shot: TAP, RS, SAB +/- wound infiltration with local anesthetics.
- Continuous block: TAP/RS catheter, preperitoneal wound catheter for local anesthetics continuous infusion.

Template for Physician Order Set

Enhanced Recovery After Colorectal Surgery Postoperative Medication Orders

Patient Name	
Health Care Number	
Date of Birth	

Allergies

VTE Prophylaxis

- ☐ Pharmalogical thromboprophylaxis with Low Molecular Weight Heparin, with consideration for extended-duration (4 weeks) in patients undergoing colorectal cancer resection.
- ☐ Intermittent pneumatic compression.

Nausea Management

Using Apfel Scoring System:

- ☐ Patients with 1 - 2 risk factors, use two drugs in combination using front-line antiemetics (e.g. dopamine antagonists, serotonin antagonists and corticosteroids).
- ☐ Patients with ≥2 risk factors, use multi-modal postoperative nausea and vomiting (PONV) prophylaxis.

Pain Management

- ☐ Acetaminophen 1000 mg PO every 6 hrs (maximum from all sources 4000mg in 24 hrs).
- ☐ NSAIDs x 72 hrs if quality of anastomosis is strong.
- ☐ 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 (e.g. for open surgery or high risk to open):

- ☐ Bupivacaine (0.05%) +/- low dose opioids (e.g. Fentanyl 2 mcg/ml or Morphine 5 - 10 mcg/ml) at 5 - 14 ml/hr.
- ☐ Stop test at 0600h POD 2.

If no epidural placed prior to OR (e.g. for laparoscopic surgery):

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

Patient's Reconciled Home Medications

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Template for Physician Order Set

Enhanced Recovery After Colorectal Surgery Postoperative Medical Orders

Patient Name	
Health Care 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 x 4/day with medications.
- ☐ If patient consuming less than 50% of meals x 72 hrs, 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 x 3/day.
- ☐ If mobility issues identified, send consult to physiotherapy.
- ☐ Other: _____

Vitals / 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: _____

Template for Physician Order Set

Urinary Catheterization

- ☐ Urinary catheter to straight drainage.
- ☐ Colon or upper rectal resection: Discontinue urinary catheter 24 hrs postoperatively.
- ☐ Mid / Lower rectal resection: Discontinue urinary catheter 48 hrs postoperatively.
- ☐ If trial of void failed, intermittent catheterizations x 24 hrs, 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 (e.g. 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 - 30 minutes.
- ☐ If patient not tolerating oral fluid intake, maintenance infusion of 1.5 ml/kg/hr of IV fluids should be started.
- ☐ Other: _____

Other Medical Orders

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____