

# Clinical Practice Guidelines for Enhanced Recovery After Colon and Rectal Surgery From the American Society of Colon and Rectal Surgeons and the Society of American Gastrointestinal and Endoscopic Surgeons

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The American Society of Colon and Rectal Surgeons (ASCRS) and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) are dedicated to ensuring high-quality innovative patient care for surgical patients by advancing the science, prevention, and management of disorders and diseases of the colon, rectum, and anus as well as advancing minimally invasive surgery. The ASCRS and SAGES society members involved in the creation of these guidelines were chosen because they have demonstrated expertise in the specialty of colon and rectal surgery and enhanced

recovery. This consensus document was created to lead international efforts in defining quality care for conditions related to the colon, rectum, and anus and develop clinical practice guidelines based on the best available evidence. Although not proscriptive, these guidelines provide information based on which decisions can be made and do not dictate a specific form of treatment. These guidelines are intended for use by all practitioners, health care workers, and patients who desire information on the management of the conditions addressed by the topics covered in these guidelines. These guidelines should not be deemed

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inclusive of all proper methods of care nor exclusive of methods of care reasonably directed toward obtaining the same results. The ultimate judgment regarding the propriety of any specific procedure must be made by the physician considering all the circumstances presented by the individual patient. This clinical practice guideline represents a collaborative effort between the ASCRS and the SAGES and was approved by both societies.

## STATEMENT OF THE PROBLEM

Colorectal surgery has historically been associated with long postoperative hospital stays, high costs, and surgical-site infection (SSI) rates approaching 20%.<sup>1,2</sup> In addition, the incidence rates of in-hospital perioperative nausea and vomiting (PONV) may be as high as 80%<sup>3</sup> and readmission rates as high as 35%.<sup>4</sup> Enhanced recovery protocols (ERPs) are a set of standardized perioperative processes, the content of which may vary significantly, that are applied to patients undergoing elective surgery. In general, these protocols are not intended for nonelective cases, but components of ERPs could certainly be applied to the emergent/urgent patient.<sup>5,6</sup> Also known as “fast track” or “enhanced recovery after surgery” (ERAS) protocols, ERPs are designed to improve patient outcomes.<sup>7</sup> Outcomes of interest include alleviating nausea and pain, achieving early return of bowel function, and decreasing rates of wound infection and length of hospital stay.<sup>8</sup> Although numerous perioperative protocols exist, this clinical practice guideline will evaluate the evidence in support of individual measures to improve patient outcomes after elective colon and rectal resections.

Implementation of ERPs in colorectal surgery has been shown to reduce morbidity rates and decrease length of stay (LOS) without increasing readmission rates.<sup>9–13</sup> A 2011 Cochrane review found that ERPs were associated with reduced overall complication rates and LOS compared to conventional perioperative patient management.<sup>14</sup> Subsequent studies have shown that ERPs are associated with reduced health care costs, improved patient satisfaction, lower rates of complications, and reduced mortality.<sup>2,10,15–20</sup> ERPs are also associated with improved outcomes regardless of whether patients undergo laparoscopic or open surgery.<sup>21</sup> In addition, multiple studies have shown that ERPs are safe and efficacious in elderly patient populations.<sup>22–30</sup> Studies also support that ERPs should not be implemented and maintained dogmatically but rather require ongoing compliance evaluation and continual quality improvement.<sup>31–34</sup> Greater adherence to ERPs is associated with decreased complications and shorter LOS.<sup>35–38</sup>

There are many different preoperative, intraoperative, and postoperative components of a typical ERP, and it is difficult to identify which are most beneficial within the “bundle” of simultaneously implemented measures. This

clinical practice guideline evaluates the evidence pertaining to different components of ERPs for colorectal surgery. Although ostomy surgery, deep vein thrombosis prevention, bowel preparation, and frailty are discussed in this clinical practice guideline, a detailed review of these topics is beyond the scope of this clinical practice guideline; these topics are addressed in depth in other ASCRS Clinical Practice Guidelines.<sup>39–42</sup>

## MATERIALS AND METHODS

The original clinical practice guidelines for enhanced recovery after colon and rectal surgery from the ASCRS and the SAGES was published in 2017.<sup>43</sup> The present guideline was constructed using the 2017 guidelines as a platform. Compared with 2017, this guideline has 3 new recommendations and 5 statements with updated levels of evidence. All other statements have been reviewed and updated with current evidence (Table 1). A systematic search was conducted under the guidance of a librarian. In brief, a systematic search was conducted from January 1, 2016, to May 1, 2022, using the Cochrane Library, Embase, and the MEDLINE databases using a variety of key word combinations. A supplemental search was conducted using related articles and bibliographies of previously identified articles. Directed searches of the embedded references from the primary articles were also performed in certain circumstances. Prospective, randomized controlled trials (RCTs) and meta-analyses were given preference. A total of 7712 abstracts were identified; 6962 articles were excluded, and a total of 750 full-text articles were evaluated. Of those, 547 were excluded, and along with 212 articles from the 2017 guidelines, a total of 415 articles were included in the final document (Fig. 1). The final grade of recommendation was performed using the Grading of Recommendation, Assessment, Development, and Evaluation system (Table 2).<sup>44</sup> When the agreement was incomplete regarding the evidence base or treatment guideline, consensus from the committee chair, vice chair, and 2 assigned reviewers determined the outcome. Members of the ASCRS Clinical Practice Guidelines Committee worked together with members of the SAGES Colorectal Committee from inception to publication. The entire Clinical Practice Guidelines Committee of ASCRS and the Colorectal Committee of SAGES reviewed recommendations formulated by the subcommittee. The submission was approved by both the ASCRS and SAGES executive councils and then peer-reviewed by the *Diseases of the Colon & Rectum* and *Surgical Endoscopy*. In general, each ASCRS Clinical Practice Guideline (including joint guidelines) is updated every 5 years. No funding was received for preparing this guideline, and the authors have declared no competing interests related to this material. This guideline conforms to the Appraisal of Guidelines for Research and Evaluation checklist.

**Table 1.** What is New in the 2022 ASCRS Enhanced Recovery After Colon and Rectal Surgery Clinical Practice Guidelines*New Recommendations***Preoperative Interventions***Preadmission Nutrition and Bowel Preparation*

5. Oral nutritional supplementation is recommended in malnourished patients prior to elective colorectal surgery. Grade of recommendation: weak recommendation based on moderate quality evidence, 2B.

**Perioperative Interventions***Intraoperative Fluid Management*

15. Hypotension should be avoided as even short durations of mechanical bowel preparation < 65 are associated with adverse outcomes, in particular myocardial injury, and acute kidney injury. Grade of recommendation: strong recommendation based on moderate quality evidence, 1B.

**Postoperative Interventions***Discharge Criteria*

26. Early discharge prior to return of bowel function may be feasible in low-risk patients undergoing minimally invasive colectomy when coupled with close outpatient communication and follow-up. Grade of recommendation: weak recommendation based on moderate quality evidence, 2B.

*Updated Recommendations***Preadmission**

6. Mechanical bowel preparation combined with preoperative oral antibiotics is typically recommended prior to elective colorectal resection. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.

**Pain Control**

11. Thoracic epidural analgesia, while not recommended for routine use in laparoscopic colorectal surgery, is an option for open colorectal surgery if a dedicated acute pain team is available for postoperative management. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.

**Fluid Management**

13. Fluid administration should be tailored to avoid excessive fluid administration and volume overload or undue fluid restriction and hypovolemia. Grade of recommendation: strong recommendation based on high-quality evidence, 1A.

**Fluid Management**

14. Balanced chloride-restricted crystalloid solutions should be used for maintenance infusions and fluid boluses in patients undergoing colorectal surgery. There is no benefit to the routine use of colloid solutions for fluid boluses. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.

**Fluid Management**

16. In high-risk patients and in patients undergoing colorectal surgery with significant intravascular losses, the use of goal-directed hemodynamic therapy may be considered. Grade of recommendation: weak recommendation, based on moderate-quality evidence, 2B

**Postoperative Management**

25. Urinary catheters should typically be removed within 24-48 hours after mid/lower rectal resection. Grade of recommendation: strong recommendation based on moderate quality evidence, 1B.

**PREOPERATIVE INTERVENTIONS****Preadmission Counseling**

**1. A preoperative discussion regarding clinical milestones and discharge criteria should typically be performed before surgery. Grade of recommendation: strong recommendation based on low-quality evidence, 1C.**

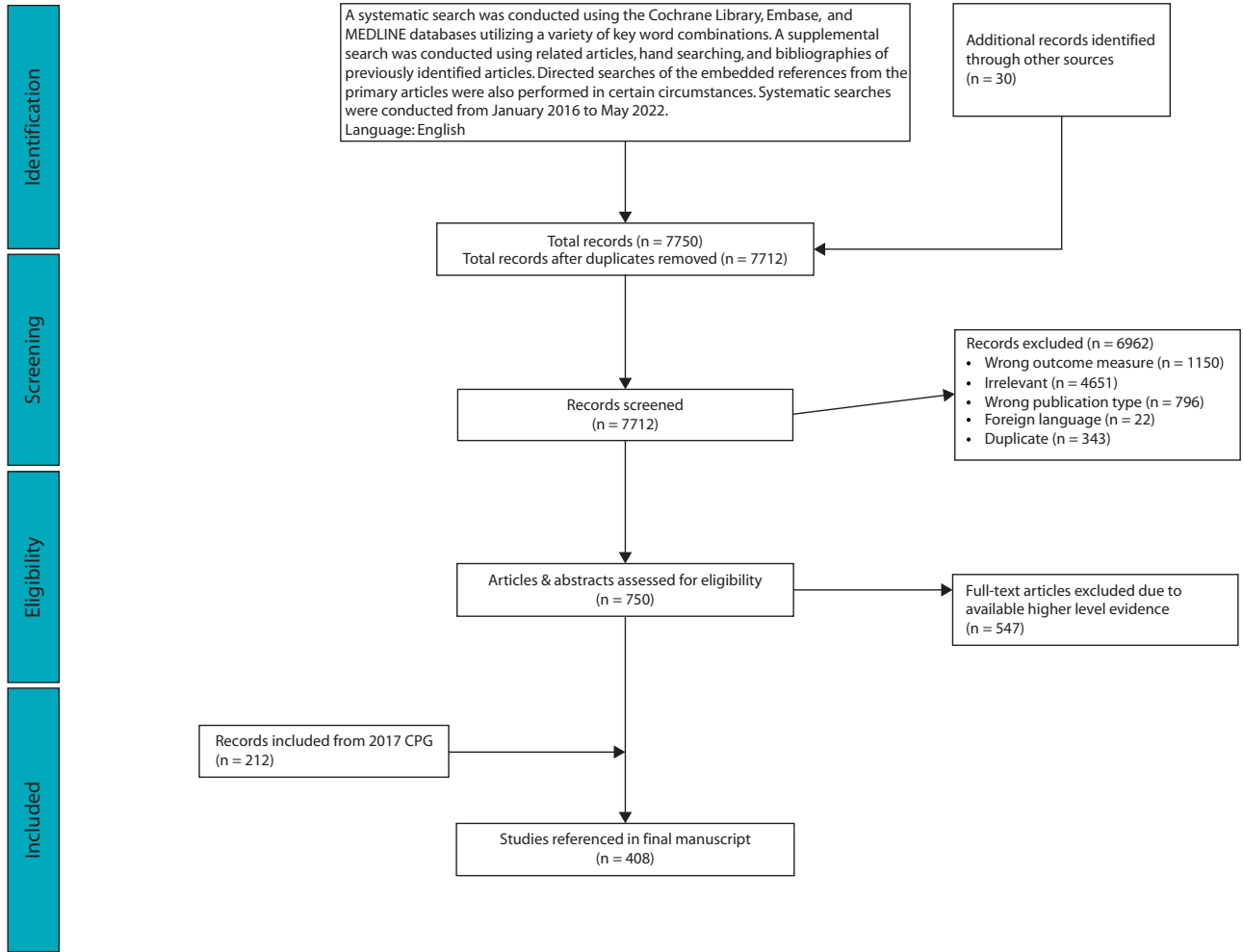
Preadmission counseling regarding milestones and discharge criteria are a well-established cornerstone of ERPs.<sup>7,45-50</sup> Single-center case series, prospective cohort studies, systematic reviews, and RCTs have reported the benefits of using an ERP that includes preoperative education describing milestones and discharge criteria.<sup>2,51-72</sup> Furthermore, compliance with an ERP that includes preoperative patient education is associated with decreased LOS and decreased complication rates.<sup>31,73-79</sup> Despite the benefit, in-person preoperative counseling can be resource intensive, which may limit its widespread use; prescribed phone calls may provide sufficient counseling while saving resources.<sup>78,79</sup>

**2. Patients undergoing ileostomy creation should receive stoma teaching and counseling regarding how**

**to avoid dehydration. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

The creation of an ostomy is an independent risk factor for prolonged LOS after colorectal surgery.<sup>50,80-83</sup> Several single-center and multicenter studies as well as a systematic review have shown that structured patient stoma education significantly improves quality of life, facilitates psychosocial adjustment, and reduces hospital LOS and hospital costs.<sup>84-94</sup>

Ostomy education can also impact readmission rates.<sup>80,95-97</sup> As dehydration is the most common cause of readmission after ileostomy creation,<sup>98,99</sup> counseling patients regarding dehydration avoidance is an important element of ERP.<sup>98,99</sup> In a prospective study of 42 patients versus 168 historical controls, implementation of an ileostomy pathway in which patients were directly engaged in ostomy management, discharged with supplies for measuring input/output, and set up with visiting nurse services reduced the readmission rate for dehydration from 15.5% to 0% ( $p = 0.02$ ).<sup>4</sup> Others have reported similar reductions in readmission rates for dehydration when using an ERP focused on ostomy education.<sup>100-102</sup>



**FIGURE 1.** PRISMA literature search flow sheet. CPG = clinical practice guideline; PRISMA = preferred reporting items for systematic reviews and meta-analysis.

Gonella et al, in a retrospective study of 296 patients, showed that the hospital readmission rate within 30 days postdischarge for dehydration dropped from 9% to 3.9% after protocol application.<sup>101</sup>

**Preadmission Nutrition and Bowel Preparation**

**3. Clear liquids may be continued up to 2 hours before general anesthesia. Grade of recommendation: strong recommendation based on high-quality evidence, 1A.**

Drinking clear fluids up to 2 hours before induction of anesthesia, according to data from multiple RCTs, is safe and improves patients’ sense of well-being.<sup>103–111</sup> The same RCTs have also reported that ingesting clear liquids within 2 to 4 hours of surgery versus >4 hours is associated with smaller gastric volumes and higher gastric pH at the time of surgery. The current practice guidelines of both the ASA and the European Society of Anesthesiology support this recommendation.<sup>111–113</sup>

**4. Carbohydrate loading should be encouraged before surgery in patients without diabetes. Grade of recommendation: weak recommendation based on moderate-quality evidence, 2B.**

The use of carbohydrate-rich beverages should be encouraged to attenuate insulin resistance induced by surgery and starvation.<sup>114–116</sup> The focus is not on avoiding glycogen depletion but rather on converting the patient from a fasting state to a fed state to impact insulin resistance. A 2014 Cochrane review of 27 international trials, including 1976 patients undergoing elective operations, concluded that carbohydrate loading was associated with a 0.3-day reduction in length of hospital stay compared with placebo or fasting (95% CI, 0.56–0.0) but no difference was found in overall perioperative complications.<sup>114</sup> Of note, most beverages consumed in these studies contained complex carbohydrates (eg, maltodextrin) as opposed to the monosaccharides (eg, fructose) or disaccharides (eg, sucrose) found in fruit juice or sports drinks. Another

**TABLE 2.** The GRADE System: Grading Recommendations

Grade	Description	Benefit versus risk and burdens	Methodologic quality of supporting evidence	Implications
1A	Strong recommendation, High quality evidence	Benefits clearly outweigh risk and burdens or vice versa	RCTs without important limitations or overwhelming evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1B	Strong recommendation, Moderate quality evidence	Benefits clearly outweigh risk and burdens or vice versa	RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise) or exceptionally strong evidence from observational studies	Strong recommendation, can apply to most patients in most circumstances without reservation
1C	Strong recommendation, Low or very low quality evidence	Benefits clearly outweigh risk and burdens or vice versa	Observational studies or case series	Strong recommendation but may change when higher quality evidence becomes available
2A	Weak recommendation, High quality evidence	Benefits closely balanced with risks and burdens	RCTs without important limitations or overwhelming evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2B	Weak recommendations, Moderate quality evidence	Benefits closely balanced with risks and burdens	RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise) or exceptionally strong evidence from observational studies	Weak recommendation, best action may differ depending on circumstances or patients' or societal values
2C	Weak recommendation, Low or very low quality evidence	Uncertainty in the estimates of benefits, risks and burden; benefits, risk and burden may be closely balanced	Observational studies or case series	Very weak recommendations; other alternatives may be equally reasonable

GRADE = Grades of recommendation, assessment, development, and evaluation; RCT = randomized controlled trial. Adapted from Guyatt et al.<sup>44</sup> Used with permission.

meta-analysis of 21 randomized studies including 1685 patients showed no overall difference in LOS; however, the subgroup of patients undergoing major abdominal surgery had a shorter LOS associated with carbohydrate loading (mean difference  $-1.08$  d; 95% CI,  $-1.87$  to  $-0.29$ ;  $p = 0.007$ ).<sup>117</sup> Another meta-analysis including 43 RCTs with 3110 elective surgery patients found that high-dose carbohydrate loading ( $\geq 45$  g) was associated with a reduced length of hospital stay compared to fasting ( $-1.7$  d; 95% CI,  $-3.2$  to  $-0.1$ ) or placebo/water ( $-1.4$  d; 95% CI,  $-2.7$  to  $-0.1$ ;  $p < 0.05$ ), but there were no differences in complication rates or other secondary end points.<sup>118</sup> This recommendation applies to patients without diabetes because patients with diabetes were not included in the trials.

**5. Oral nutritional supplementation is recommended in malnourished patients before elective colorectal surgery. Grade of recommendation: weak recommendation based on moderate-quality evidence, 2B.**

In malnourished patients planning elective GI surgery, oral nutritional supplementation targeting a protein intake of 1.2 to 1.5 g/kg/d for a period of 1 to 2 weeks has been associated with reduced postoperative complications and is endorsed by several national and international guidelines.<sup>119-122</sup> Meanwhile, the efficacy of immunonutrition, supplementation containing immune-modulating nutrients such as arginine, fish oil ( $\omega$ -3 fatty acids), nucleotides, and glutamine, over standard high protein oral nutritional supplements remains controversial. Meta-analyses have demonstrated reduced complications and infectious

complications and shortened LOS associated with preoperative immunonutrition.<sup>123,124</sup> However, other studies have reported conflicting results depending on whether patients were malnourished, the degree of industry support (more positive results reported in industry-sponsored trials), and the type of control used for comparison (standard isonitrogenous, isocaloric nonenhancing nutritional supplement versus normal diet without any supplementation).<sup>123-126</sup>

**6. Mechanical bowel preparation combined with preoperative oral antibiotics is typically recommended before elective colorectal resection. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

A 2011 Cochrane review of RCTs showed no benefit to mechanical bowel preparation (MBP) alone in colorectal surgery in reducing anastomotic leak or complications.<sup>127</sup> Meanwhile, a meta-analysis of 7 RCTs, including 1769 patients comparing MBP with oral antibiotics to MBP alone, showed a reduction in total SSI (7.2% versus 16.0%;  $p < 0.001$ ) and incisional site infection (4.6% versus 12.1%;  $p < 0.001$ ), with no difference in the rate of organ/space infection after elective colorectal surgery.<sup>128</sup> These trial findings are consistent with population-level data. In a retrospective analysis of a nationwide database from the United States, MBP plus oral antibiotic preparation in left colon resection was associated with decreased overall morbidity, superficial SSI, anastomotic leakage, and intra-abdominal infections.<sup>129</sup> Similar retrospective studies

in different populations (Veterans Administration database<sup>130</sup> and a Polish hospital database<sup>131</sup>) have also shown a reduction in SSI with the addition of oral bowel preparation to MBP. The Michigan Surgical Quality Collaborative database showed reductions in SSI and in postoperative *Clostridium difficile* colitis in patients who received MBP and oral bowel preparation versus patients who received no bowel preparation.<sup>132</sup> These kinds of data supported the *ASCRS 2019 Clinical Practice Guideline on Bowel Preparation*, recommending the use of a MBP combined with preoperative oral antibiotics in elective colorectal surgery.<sup>40</sup>

### Preadmission Optimization

**7. Multimodal prehabilitation before elective colorectal surgery may be considered for patients with multiple comorbidities or significant deconditioning. Grade of recommendation: weak recommendation based on moderate-quality evidence, 2B.**

Prehabilitation, defined as enhancement of the patient's preoperative condition, has been proposed as a possible strategy for improving postoperative outcomes.<sup>133–135</sup> Several recent RCTs<sup>136–143</sup> and systematic reviews have demonstrated that prehabilitation improves physical function before colorectal or major abdominal surgery.<sup>135,144–148</sup> However, whether better physical function translates into improved postoperative outcomes remains debatable.<sup>135–139,147,149</sup> A meta-analysis of 35 studies evaluating 3402 patients undergoing major abdominal surgery found that patients who received prehabilitation experienced significantly lower rates of overall complications ( $p = 0.005$ ), pulmonary complications ( $p < 0.001$ ), and cardiac complications ( $p = 0.044$ ).<sup>150</sup> Another meta-analysis of 8 trials with 442 patients undergoing major liver, colorectal, gastroesophageal, and general abdominal surgery demonstrated significant reductions in postoperative pulmonary complications and overall postoperative morbidity in the prehabilitation group versus the control group and no differences in LOS.<sup>151</sup> Although the available data remain limited because of many underpowered studies, patients with lower baseline functional capacity undergoing open surgery may achieve the greatest benefit from prehabilitation.<sup>137–139,141,142,152</sup>

### Preadmission Orders

**8. Standardized order sets should be used in enhanced recovery pathways. Grade of recommendation: weak recommendation based on low-quality evidence, 2C.**

Comprehensive, multifaceted ERPs are complex and require multidisciplinary collaboration between stakeholders, including nursing teams, anesthesiologists, social workers, and surgeons. Increased compliance with ERP components

has repeatedly been associated with improved perioperative outcomes.<sup>153–156</sup> Dedicated order sets standardize care and are considered essential for improving compliance with ERP elements.<sup>2,13,157,158</sup> The use of order sets has proven to be effective in reducing the risk of SSI.<sup>157,159,160</sup>

## PERIOPERATIVE INTERVENTIONS

### Surgical-Site Infection

**9. A bundle of measures should be in place to reduce SSI. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Various SSI prevention bundles have been described to decrease SSIs in colorectal surgery. Although there are many commonalities between SSI bundles, there is no universal standardization of elements and it is rare for the impact of any 1 component to be specifically evaluated.<sup>161–167</sup> Preoperative measures incorporated into bundles include a chlorhexidine shower, MBP with oral antibiotics, intravenous antibiotics within 1 hour of incision, and standardization of the surgical field preparation with chlorhexidine/alcohol.<sup>168</sup> Operative measures typically found in SSI prevention bundles include the use of a wound protector, gown and glove changes before fascial closure, using a dedicated wound closure tray, antimicrobial sutures, limiting operating room traffic, and maintaining euglycemia and normothermia.<sup>169–171</sup>

A meta-analysis evaluating SSI prevention bundles including 17,557 patients reported risk reductions of 40% in the overall SSI rate, 44% in the superficial infection rate, and 34% in the deep/organ space infection rate. This analysis also reported that utilization of sterile wound closure trays, MBP with oral antibiotics, and glove changes before fascial closure were considered the most important to implement.<sup>170</sup> Another meta-analysis of 20,701 patients found that although there was significant heterogeneity in SSI reduction bundle component elements and compliance rates (ranging from 19% to 90% in the included studies), the OR of SSI was 0.56 with a bundle compared to without it.<sup>171</sup> Higher rates of compliance with specific bundle elements within SSI prevention bundles have repeatedly been associated with significantly lower SSI rates.<sup>159,160</sup>

### Pain Control

**10. A multimodal, opioid-sparing, pain management plan should be implemented before the induction of anesthesia. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Multiple studies have demonstrated that minimizing opioids after colorectal surgery is associated with earlier return of bowel function and shorter LOS.<sup>2,31,172</sup> One of the simplest techniques to limit opioid use is to schedule

nonnarcotic alternatives, such as acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs), rather than administering them on an as-needed basis.<sup>173–178</sup> There have been ongoing concerns about the postoperative safety profile of NSAIDs in this setting. However, a 2007 Cochrane review concluded that NSAIDs can cause a clinically unimportant transient reduction in renal function in the early postoperative period and, therefore, should not be withheld from adults with normal preoperative renal function.<sup>179</sup> In addition, experimental and observational clinical studies have shown that NSAIDs may increase the risk of anastomotic leak,<sup>180–183</sup> and subsequent research has demonstrated that this potential effect on anastomotic leak seems to be molecule and class specific<sup>184</sup>; diclofenac has been associated with the highest risk of leak in this setting. In a retrospective cohort study of 856 patients undergoing elective colorectal surgery, the risk of anastomotic leak rate was 11.8% versus 6.0% ( $p = 0.01$ ) in patients receiving diclofenac, but there was no differences in leak rates related to other nonsteroidals.<sup>185</sup> Additionally, 2 meta-analyses have demonstrated an overall increased risk of anastomotic leak with NSAIDs but no increase in the risk of anastomotic leak with the use of selective NSAIDs (such as cyclooxygenase 2 inhibitors).<sup>180,181</sup> In these studies, nonselective NSAID diclofenac use was associated with an increased leak rate (OR 2.79; 95% CI, 1.96–3.96;  $p < 0.001$  and pooled OR = 2.02; 95% CI, 1.62–2.50;  $p < 0.001$ ), whereas ketorolac and selective NSAIDs were not associated with anastomotic leak. In addition, a large multicenter cohort study in Europe showed no differences in anastomotic leak rate with nonselective NSAIDs.<sup>174</sup>

Perioperative gabapentinoids, ketamine, lidocaine, magnesium, and  $\alpha$ -2-agonists also have been administered to improve analgesia and reduce opioid consumption and postoperative hyperalgesia. The role of gabapentinoids is controversial because 2 large database studies reported that gabapentinoid use after colorectal or orthopedic surgery was associated with increased postoperative pulmonary complications and no reduction in postoperative opioid consumption.<sup>186,187</sup> A meta-analysis evaluating the perioperative use of gabapentinoids also reported no clinically significant analgesic effect from gabapentinoid use and stated that the routine use of these medications could not be recommended.<sup>188</sup> Meanwhile, a perioperative low-dose ketamine infusion can be especially useful in patients with chronic pain.<sup>189,190</sup> However, psychotropic adverse effects, dizziness, and sedation may impair immediate recovery, particularly in elderly patients.<sup>191</sup> Magnesium, either as a bolus or infusion, is also associated with a decrease in postoperative opioid consumption and can be a useful adjunct.<sup>192</sup>

Analgesic blocks and wound infiltration have shown benefit in opioid reduction among patients undergoing open and laparoscopic colorectal surgery.<sup>190,193</sup> There are an increasing number of block options, including but not limited to transversus abdominis plane (TAP), quadratus

lumborum, erector spinae, and rectus sheath blocks. Two meta-analyses of TAP blocks demonstrated decreased LOS compared with systemic opioid use in laparoscopic colorectal surgery.<sup>193,194</sup> A recent systematic review and meta-analysis demonstrated that laparoscopic-guided TAP block is safe and effective for pain management in minimally invasive surgery and seems to be as effective as ultrasound-guided TAP blocks with respect to early pain control and reducing postoperative opioid use.<sup>195</sup> Data remain controversial regarding the purported extended duration of benefit with long-acting local anesthetics such as liposomal bupivacaine in reducing postoperative opioid consumption.<sup>196–199</sup>

Another option, spinal analgesia with intrathecal morphine administration, can be used in the perioperative setting. Studies and meta-analyses have shown that intrathecal morphine is more effective than intravenous opioids in laparoscopic surgery and is associated with lower pain scores.<sup>2,200–202</sup> The concern about delayed respiratory depression related to this analgesia has not been substantiated and guidelines for postoperative monitoring have been published.<sup>203</sup>

**11. Thoracic epidural analgesia, while not recommended for routine use in laparoscopic colorectal surgery, is an option for open colorectal surgery if a dedicated acute pain team is available for postoperative management. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Thoracic epidural analgesia (TEA; T6–T12) has shown efficacy (versus patient-controlled analgesia or simple parenteral opioids) in controlling pain and limiting opioids in patients undergoing open colorectal surgery.<sup>204,205</sup> However, epidurals have no analgesic benefit over multimodal analgesia and abdominal wall blocks in laparoscopic surgery. In addition, evidence shows that the analgesic benefits provided by TEA do not translate into faster recovery in either laparoscopic or open colorectal surgery.<sup>206,207</sup> In fact, TEA may actually delay hospital discharge after laparoscopic surgery<sup>208</sup> because of the higher incidence rate of hypotension and urinary tract infections (UTIs) that necessitate additional postoperative care.<sup>207–210</sup>

### **Perioperative Nausea and Vomiting**

**12. Preemptive, multimodal antiemetic prophylaxis reduces perioperative nausea and vomiting. Grade of recommendation: strong recommendation based on high-quality evidence, 1A.**

Several validated scoring systems have been developed to identify patients at higher risk for PONV.<sup>211–216</sup> Risk factors for developing PONV include female sex, history of PONV and/or motion sickness, nonsmoking status, young age, laparoscopic surgery, use of volatile anesthesia, prolonged operative time, and opioid analgesia. Strategies to reduce the risk of PONV include using regional anesthesia

or propofol-based total intravenous anesthesia, avoiding volatile anesthetics, and minimizing perioperative opioids by using multimodal analgesia.<sup>207,217–220</sup> Although total intravenous anesthesia has been associated with reduced PONV and significantly better patient satisfaction compared to volatile anesthetics, its high cost has precluded widespread adoption.<sup>221,222</sup>

One guideline updated in 2020 supports preoperative risk assessment in all patients undergoing anesthesia and recommends subsequent tailored multimodal therapy to prevent and treat PONV.<sup>220</sup> Combining risk assessment with a specific recommendation for antiemetic intervention has been associated with a significant reduction in PONV in randomized and nonrandomized trials.<sup>223–226</sup> Given the low cost and minimal risk associated with antiemetics, the liberal use of a multimodal antiemetic protocol for all patients (regardless of risk) has been advocated.<sup>227,228</sup>

ERPs, which include multimodal PONV prophylaxis, are associated with reduced rates of PONV and readmission in colorectal surgery.<sup>229–231</sup> Multiple prospective and observational studies demonstrate that combination therapy using 2 or more antiemetics for preventing PONV is superior over a single agent.<sup>232–269</sup> A description of all the available prophylactic agents is beyond the scope of this clinical practice guideline. However, a common intervention for patients determined to be at high risk for PONV that has been studied in a randomized controlled manner is the administration of dexamethasone and ondansetron (or other 5-hydroxytryptamine 3 antagonist).<sup>225–270</sup> A meta-analysis of 9 RCTs, including 1089 patients, demonstrated that dexamethasone combined with other antiemetics provided significantly better PONV prophylaxis than single antiemetics and decreased the need for rescue therapy.<sup>271</sup> In addition, several meta-analyses found that dexamethasone did not increase postoperative infections or significantly impact glycemic control.<sup>272,273</sup>

### Fluid Management

**13. Fluid administration should be tailored to avoid excessive fluid administration and volume overload or undue fluid restriction and hypovolemia. Grade of recommendation: strong recommendation based on high-quality evidence, 1A.**

Both intravenous fluid overload and hypovolemia can significantly impair organ function, increase postoperative morbidity, and prolong hospital stay.<sup>274,275</sup> Intraoperative infusion regimens based on definitions such as liberal, restrictive, or supplemental should typically be avoided because of the variability in the volumes of fluid infused among different studies using these qualifiers.<sup>276</sup> However, more recently, within the ERP literature, the term “restrictive fluid management” has gained popularity and the amount of fluid recommended with restrictive fluid management has gradually decreased. The term “zero-balance” fluid management was

introduced to describe a restrictive fluid regimen aiming to avoid postoperative fluid retention (as indicated by weight gain).<sup>277</sup> However, although a zero-balance approach might improve postoperative GI function, it is associated with a slightly increased risk of acute kidney injury (AKI) (8.6% versus 5.0% in an RCT of 3000 patients undergoing major abdominal surgery).<sup>278</sup>

Based on these considerations, the overall goal of fluid management should typically be a positive fluid balance at the end of surgery of ~1 L. This should be sufficient to avoid hypovolemia and AKI while limiting substantial postoperative weight gain (>2.5 kg/d), which is associated with increased morbidity and prolonged hospital stay.<sup>279</sup>

**14. Balanced chloride-restricted crystalloid solutions should be used for maintenance infusions and fluid boluses in patients undergoing colorectal surgery. There is no benefit to the routine use of colloid solutions for fluid boluses. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Results from studies conducted in healthy volunteers and from meta-analyses of small RCTs indicate that balanced chloride-restricted crystalloid solutions should be preferred to normal saline to decrease the risk of hyperchloremic metabolic acidosis.<sup>280,281</sup> Large propensity-matched observational studies have reported an association between the use of normal saline and an increased incidence rate of renal dysfunction, postoperative morbidity, and mortality in surgical patients.<sup>282,283</sup> A large cluster randomized trial of 15,000 critically ill adults showed similar results, with lower rates of death and renal dysfunction attributed to the use of balanced crystalloids.<sup>284</sup> Based on the evidence from this trial, the current recommendation was upgraded from a 1C in 2017 to a 1B.

There is little evidence that colloids offer any benefit over crystalloids for fluid boluses, either during abdominal surgery or postoperatively in intensive care.<sup>285–289</sup> Meanwhile, there may be some benefit in individual cases, particularly in the setting of blood loss or when rapid resuscitation is needed.<sup>290,291</sup> Colloids restore circulating volume faster than crystalloids and with a lower fluid volume (although this difference is less than traditionally taught with a ratio of around 1:1.5).<sup>292</sup> Given that the evidence does not show an outcome benefit with colloids and that colloids are significantly more expensive, their routine use should be discouraged.

**15. Intraoperative hypotension should be avoided as even short durations of mean arterial pressure <65 mmHg are associated with adverse outcomes, in particular myocardial injury and acute kidney injury. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

In a recent retrospective analysis of 4282 patients undergoing noncardiac surgery, intraoperative hypotension defined as mean arterial pressure <65 mmHg occurred in



71% of patients.<sup>293</sup> Approximately one-third of these hypotensive events occurred before the surgical incision. There is increasing evidence from large retrospective database reviews showing that even a short duration of hypotension is associated with myocardial injury and AKI<sup>293–295</sup> and that the severity of injury is associated with both the duration and degree of hypotension.<sup>294,296</sup> One major prospective interventional trial showed a significant reduction in complications (38% versus 51%;  $p = 0.02$ ) with individualized blood pressure management ( $n = 147$ ) compared with standard pressure management ( $n = 245$ ).<sup>297</sup> In this study, patients in the intervention group had their fluid status optimized and then had a vasopressor infused to maintain their systolic blood pressure within 10% of their resting blood pressure. In patients with an epidural block, crystalloid or colloid preloading does not typically prevent hypotension induced by the neuraxial blockade because total blood volume is unchanged after neuraxial blockade<sup>298</sup>; in these circumstances, low-dose vasopressors, not intravenous fluids, restore colonic perfusion in patients with normovolemic hypotension.<sup>299</sup>

**16. In high-risk patients and in patients undergoing colorectal surgery with anticipated significant intravascular losses, the use of goal-directed hemodynamic therapy is recommended. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Objective measures of hypovolemia such as cardiac output, stroke volume, oxygen delivery, oxygen extraction, and mixed venous oxygen saturation and dynamic indices of fluid responsiveness (eg, pulse pressure variation or stroke volume variation) can help physicians decide whether to administer intravenous fluids for purposes of resuscitation. Several meta-analyses of RCTs have shown that goal-directed fluid therapy (GDFT) reduces postoperative morbidity and length of hospital stay, especially in high-risk patients undergoing major surgery.<sup>300–302</sup> High-risk patients have been variably defined as patients with a history of severe cardiorespiratory illness (eg, acute myocardial infarction, chronic obstructive pulmonary disease, stroke), a prolonged planned surgery (>8 h), age >70 years with limited physiological reserve, respiratory failure, and aortic vascular disease. However, it must be acknowledged that advancements in perioperative and surgical care seem to have offset the previously demonstrated benefits of GDFT, especially in low-moderate risk patients.<sup>303</sup> The largest multicenter RCT studying these issues included 734 high-risk patients undergoing major abdominal surgery (45% colorectal surgery and the majority in the context of an ERP) and showed a decrease in complications and mortality in patients treated with GDFT, although this difference did not meet statistical significance (relative risk [RR] = 0.84; 95% CI, 0.71–1.01;  $p = 0.07$ ).<sup>304</sup>

Recent studies have focused on goal-directed hemodynamic therapy, rather than GDFT, and showed an improvement in outcomes even in low-moderate risk patients.<sup>305</sup> These treatment algorithms first optimize stroke volume with fluid boluses and then, if hypotension persists, add a vasopressor to maintain mean arterial pressure of >65 mmHg. This management reflects the increasing evidence that perioperative hypotension is associated with harm and should be avoided.<sup>294,296,297</sup>

**17. In the absence of surgical complications or hemodynamic instability, intravenous fluids should be routinely discontinued in the early postoperative period. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

A few small, heterogeneous RCTs support discontinuation of intravenous fluids in the early postoperative period.<sup>279,306,307</sup> Traditional surgical practice recommends maintaining a minimal urine output target of 0.5 mL/kg/h in the postoperative period. However, a small prospective study of 40 low-risk patients undergoing a variety of elective colorectal resections randomly assigned subjects to a minimum urine output target of 0.2 or 0.5 mL/kg/h in the perioperative period, using intravenous fluid administration to achieve targets.<sup>308</sup> In this study, there were no differences in postoperative serum creatinine or other markers of acute renal tubular damage. Another RCT of patients undergoing elective colorectal surgery with an ERP evaluated the use of diuretics to achieve a euvolemic state in diuretically naive patients and found no difference in postoperative LOS or complications.<sup>309</sup>

### **Surgical Approach**

**18. A minimally invasive surgical approach should be used when the expertise is available and when appropriate. Grade of recommendation: strong recommendation based on high-quality evidence, 1A.**

High-quality evidence from RCTs and large database studies supports the use of laparoscopy in colorectal surgery. Two separate multicenter RCTs of patients with colon cancer—the ALCCaS trial from Australia and the COLOR trial from the Netherlands—showed laparoscopy to be superior to open resection regarding short-term outcomes (eg, return of bowel function, blood loss, postoperative pain, and hospital LOS).<sup>310,311</sup> Several other RCTs have reported improved perioperative morbidity, including total morbidity, wound morbidity, and nonsurgical morbidity, after laparoscopic compared to open colonic resection.<sup>312–315</sup> Other RCTs showed that patients undergoing laparoscopy experienced decreased time to pulmonary recovery, reduced use of narcotics, and improved short-term quality of life.<sup>316–318</sup> These results are consistent with large database studies that relied on data from the National Surgical Quality Improvement Program and the

National Inpatient Sample, which support the use of laparoscopy.<sup>319–322</sup> High-quality Cochrane reviews have evaluated short- and long-term outcomes as well and support the laparoscopic approach in colorectal surgery.<sup>323–325</sup>

The use of robotics in colorectal surgery has increased exponentially during the past decade,<sup>326</sup> and multiple studies have demonstrated the feasibility and safety of robotic colorectal surgery.<sup>326–330</sup> However, the benefits of the robotic approach over standard laparoscopy with regard to short- and long-term surgical outcomes have yet to be fully elucidated. Meta-analyses of RCTs suggest lower conversion rates with a robotic approach<sup>326,328–330</sup>; however, operative times and costs are consistently higher with robotic surgery compared to laparoscopy, whereas complication rates are similar between the 2 approaches.<sup>327,329</sup> Notably, many of the included studies in these meta-analyses and systematic reviews were of moderate to poor methodological quality.

Combining minimally invasive surgery with an ERP is associated with optimal outcomes, as demonstrated in the 4-arm LAFA trial, which randomly assigned 427 patients to open versus laparoscopic surgery with an ERP versus a traditional care pathway. In this study, patients undergoing laparoscopic surgery within an ERP had the shortest LOS and morbidity compared to either laparoscopy within a traditional care pathway or open surgery.<sup>331</sup> As such, a minimally invasive approach is recommended when appropriate to optimize postoperative recovery within an ERP.

**19. The routine use of nasogastric tubes and intra-abdominal drains for colorectal surgery should be avoided. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Small RCTs evaluating elective colorectal surgery have failed to demonstrate an impact from the routine use of nasogastric tube decompression on nausea, vomiting, time to return of bowel function, or LOS.<sup>332–334</sup> Alternatively, the routine use of nasogastric tube decompression delays the tolerance of oral intake by an average of 2 days and has been associated with a significantly higher risk of associated complications, notably pharyngolaryngitis.<sup>332,335,336</sup>

Similarly, there is no benefit to the routine use of intra-abdominal drains in colorectal surgery. RCTs show no significant differences in mortality, leak, or a composite of postoperative complications in patients who had drains placed.<sup>51,337–339</sup> The lack of benefit from operative drains has been demonstrated across a variety of colorectal anastomoses as well as low pelvic anastomoses specifically.<sup>337,338,340–345</sup> Meanwhile, a review of the US Rectal Cancer Consortium data found a nonstatistically significant association between drains and higher leak rates, but there was no difference in the rate of intervention for leak between patients with and without drains.<sup>346</sup> Notably,

this was a retrospective review and drain placement was left to the discretion of the operating surgeons; drain use was likely a surrogate for patients with a higher risk for leak caused by other factors. Contrary to these studies, a retrospective analysis of the Dutch TME data suggested that intra-abdominal drains in the presence of a diverting stoma may be associated with lower rates of surgical intervention in patients with anastomotic failure.<sup>347</sup>

## POSTOPERATIVE INTERVENTIONS

### Patient Mobilization

**20. Early and progressive patient mobilization is associated with shorter LOS. Grade of recommendation: strong recommendation based on low-quality evidence, 1C.**

Complications of prolonged immobility include skeletal muscle loss and weakness, atelectasis, insulin resistance, thromboembolic disease, and decreased exercise capacity.<sup>348,349</sup> It is estimated that muscle mass decreases by 1.5% to 2% for every day of bedrest.<sup>350</sup> However, the deconditioning associated with bedrest can be minimized or avoided by engaging in physical activity. Definitions of early mobilization within a colorectal ERP vary significantly, from any mobilization at all within 24 hours of operation to 8 hours of activity per day by the second postoperative day (POD).<sup>31,351</sup> Compliance with mobilization targets within ERPs varies significantly between centers, but early ambulation has been associated with faster recovery and fewer complications after colorectal surgery.<sup>35,352–354</sup> In a prospective cohort study of 100 patients, individuals who had a higher step count on the first POD after major abdominal or thoracic surgery were more likely to have a shorter LOS.<sup>355</sup>

There are limited data about interventions that specifically increase mobilization with regard to their effects on postoperative outcomes. A randomized trial compared facilitated supervised mobilization (n = 49) on POD0 to POD3 versus conventional care (n = 50) after colorectal surgery within the construct of an ERP.<sup>356</sup> In this study, step counts were higher in the intervention group, but there were no differences between the 2 groups in functional recovery, LOS, complications, or return of GI function. A subgroup analysis of this trial also did not find any differences in pulmonary function or postoperative pulmonary complications between the 2 arms.<sup>357</sup> These data suggest that additional resources to increase mobilization are not associated with improved outcomes within an established colorectal ERP. However, importantly, no studies have reported harm associated with early mobilization, even after perineal reconstruction after abdominoperineal resection.<sup>358</sup>

## Ileus Prevention

### 21. Patients should be offered a regular diet within 24 hours after elective colorectal surgery. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.

A 2019 Cochrane systematic review and meta-analysis evaluated 17 RCTs that compared early feeding (ie, within 24 hours of surgery) versus “later commencement” after lower GI surgery.<sup>359</sup> In this review, early feeding was associated with a 2-day decrease in length of hospital stay (weighted mean difference [WMD] 1.95; 95% CI, 0.91–2.99). However, perioperative management strategies varied significantly within the included trials and the mean LOS in the control group ranged from 6 to 24 days. Furthermore, the risk of complications such as anastomotic leak, wound infection, pneumonia, and mortality were not affected by early feeding. Even symptoms of nausea and vomiting were not significantly higher in the early feeding group in this review. Early enteral feeding is associated with faster return of GI function and with shorter time to flatus and first bowel movement.<sup>360</sup> Although there is heterogeneity between trials, the overall body of evidence supports the benefits of early feeding.

### 22. Sham feeding (ie, chewing gum for ≥10 min 3–4× daily) after colorectal surgery is safe, results in small improvements in GI recovery, and may be associated with a reduction in length of hospital stay. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.

Sham feeding such as gum chewing has been hypothesized to hasten recovery of GI function through increased saliva production and vagal cholinergic stimulation that increases bowel peristalsis.<sup>361</sup> Eighteen RCTs have evaluated chewing gum after colorectal surgery.<sup>362</sup> The majority of these trials used sugar-free gum chewed for at least 5 to 10 minutes 3× daily. However, the majority of these trials that were not performed in the context of an ERP were of low quality and had a high risk of bias. A meta-analysis of all 18 randomized trials reported that chewing gum was associated with shorter time to first flatus (WMD –8.81 h; 95% CI, –13.45 to –4.17), shorter time to first bowel movement (WMD –16.43 h; 95% CI, –22.68 to –10.19), and a reduction in LOS (WMD –0.89 d; 95% CI, –1.72 to –0.07).<sup>362</sup> The pooled outcome of “postoperative ileus” was also lower in the chewing gum arm (RR 0.41; 95% CI, 0.23–0.73). Other outcomes, including complications, readmission, and reoperations, were not significantly different between the 2 groups. Subgroup analysis of laparoscopic and open approaches maintained these significant associations. However, subgroup analysis of trials performed within the context of an ERP reported that chewing gum was no longer associated with significant decreases in the time to flatus and LOS.

In another systematic review and meta-analysis that only included 10 randomized trials that were deemed “high quality,”<sup>363</sup> the use of chewing gum was found to be associated with a lower incidence rate of postoperative ileus (RR 0.55; 95% CI, 0.39–0.79) and faster time to first flatus (WMD –0.31 d; 95% CI, –0.36 to –0.26) and bowel movement (WMD –0.47; 95% CI, –0.60 to –0.34) but no difference in LOS. However, the trials included in this meta-analysis had many of the same limitations pertaining to heterogeneity and variable perioperative management strategies that were present in the previous studies. Nonetheless, the overall body of literature suggests that chewing gum may only have a small effect on GI recovery without a clear effect on LOS but is safe and not costly.

There are even some data to support the use of coffee to facilitate GI recovery after colorectal surgery.<sup>364–366</sup> Caffeine and coffee may stimulate the lower GI tract and can potentially reduce postoperative ileus. A meta-analysis of 7 randomized trials including 606 patients reported that drinking coffee decreased the time to first bowel movement and toleration of oral intake but did not reduce time to flatus, overall complications, or LOS.<sup>367</sup>

### 23. Alvimopan is recommended to hasten recovery after open colorectal surgery. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.

Alvimopan, an oral peripheral-acting mu-opioid antagonist that minimizes the effect of opioids on postoperative GI function, was first approved by the US Food and Drug Administration in 2008. A systematic review of all relevant studies published up to May 2020 identified 31 studies that investigated the effect of alvimopan on GI function in colorectal surgery, of which 23 demonstrated a positive effect, and 8 reported no effect.<sup>368</sup> Of the 6 randomized trials, 4 were positive and 2 showed no effect related to the medication.

Most of the available data supporting alvimopan in the setting of colorectal surgery are limited to open surgery. Several RCTs and pooled post hoc analyses reported accelerated time to recovery of GI function with alvimopan 6- and 12-mg doses compared to placebo and a significantly shorter hospital LOS in the alvimopan 12-mg group compared with placebo for patients undergoing open surgery.<sup>369–378</sup> A Cochrane review of 9 studies affirmed that alvimopan was better than placebo in reversing opioid-induced increased GI transit time and constipation and that alvimopan was safe and efficacious in decreasing postoperative ileus, but the studies were limited to open surgery patients without an ERP in place.<sup>379</sup>

There have been no randomized trials evaluating alvimopan after laparoscopic surgery.<sup>380–382</sup> Most of the nonrandomized studies have shown modest benefits in favor of alvimopan for laparoscopic resection albeit within traditional care pathways.<sup>383–385</sup> Given the low quality of the available evidence, it

may be difficult to justify the use and cost of alvimopan in laparoscopic surgery in the setting of an ERP.

### Urinary Catheters

**24. Urinary catheters should typically be removed within 24 hours of elective colonic or upper rectal resection, irrespective of thoracic epidural analgesia use. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Urinary catheterization is routinely used in abdominal and pelvic colorectal surgery for intraoperative bladder decompression and monitoring urinary output. Assessing whether to remove catheters early should consider the risk of postoperative urinary retention requiring subsequent catheter reinsertion as well as the risk of UTI related to prolonged use of a catheter. Postoperative urinary retention is associated with decreased functional recovery (eg, less mobility, more postoperative pain) and longer LOS.<sup>386</sup> UTIs are also associated with increased morbidity, longer LOS, and mortality.<sup>387</sup> However, longer duration of catheter use is associated with higher rates of UTI, and in-and-out (ie, straight catheterization) catheterization in the setting of postoperative urinary retention is not associated with an increased risk of UTI.<sup>388,389</sup>

Overall, the evidence suggests that early urinary catheter removal within 24 hours of surgery is safe. In a large multicenter study of 2927 surgery patients (1897 colonic procedures), early catheter removal was associated with a higher incidence rate of catheter reinsertion compared to later removal (4.9% versus 1.9%;  $p < 0.001$ ) but a lower rate of UTIs (0.8% versus 4.1%;  $p = 0.003$ ).<sup>388</sup> LOS in this study was also shorter in the early catheter removal group by 1 day, and other studies have reported similar results.<sup>390,391</sup> There are increasing data suggesting that catheters can be removed even earlier (eg, within 6h after surgery) or avoided altogether.<sup>392–394</sup>

In the context of TEA, RCTs have investigated early urinary catheter removal compared with removal at the time of epidural discontinuation and found lower incidence rates of UTI after early catheter removal and no differences in recatheterization rates.<sup>395,396</sup> In an RCT of 215 patients undergoing abdominal or thoracic surgery with a thoracic epidural that randomly assigned patients to early catheter removal on POD1 or after epidural removal, the incidence rate of recatheterization was similar between groups, but the incidence rate of UTI was much lower in the early removal group (2% versus 24%;  $p = 0.004$ ).<sup>396</sup>

**25. Urinary catheters should typically be removed within 24 to 48 hours after mid/lower rectal resection. Grade of recommendation: strong recommendation based on moderate-quality evidence, 1B.**

Retracting the bladder and dissecting in close proximity to the lateral pelvic nerves during proctectomy may

increase the risk of postoperative urinary retention. There have been 4 RCTs comparing outcomes between early and late catheter removal specifically in the setting of proctectomy.<sup>397–400</sup> A meta-analysis of these 4 trials analyzed the noninferiority of early removal (before POD2) versus late (POD2 and after) catheter removal and concluded that the data were insufficient to conclude noninferiority of early catheter removal after proctectomy in terms of the development of postoperative urinary retention.<sup>401</sup> However, this meta-analysis showed that early catheter removal decreased the risk of UTI (9.7% versus 21.1%; absolute risk difference -11%; 95% CI, -17 to -4). Another systematic review and meta-analysis compared POD1 catheter removal versus POD3 or POD5 removal and found lower UTI rates in the earlier removal groups.<sup>402</sup> There may be some subgroups of patients who were not included in the clinical trials, such as patients who underwent pelvic exenteration, or patients who underwent difficult handsewn coloanal anastomosis, and management of these patients is up to the best clinical judgment of the surgeon balancing the risk of UTI versus urinary retention.

### Discharge Criteria

**26. Hospital discharge before return of bowel function may be offered for selected patients. Grade of recommendation: weak recommendation based on moderate-quality evidence, 2B.**

Traditional discharge criteria following colorectal surgery include demonstrating return of bowel function along with tolerance of oral intake, adequate pain control with oral analgesia, and the ability to mobilize in the absence of complications.<sup>403</sup> Many patients meet these criteria by POD1 or POD2.<sup>57,58,62</sup> However, there are increasing reports of same-day discharge, which hinges on the feasibility of discharging patients before return of bowel function.

The concept of the “ambulatory” or “outpatient” colectomy was first introduced more than a decade ago and was initially reported in small case series.<sup>62,404,405</sup> In these early reports, low-risk patients undergoing colorectal resection were successfully discharged home after an observation period of 24 hours without undue complications.<sup>57,62</sup> An RCT of patients undergoing minimally invasive colorectal resection for cancer randomly assigned 30 patients to discharge on POD1 regardless of bowel function with telemedicine follow-up on POD2 versus standard postoperative care with discharge after return of bowel function (RecoverMI trial).<sup>406</sup> In this study, the median LOS was 28.3 hours in the study arm and 51.5 hours in the control arm ( $p = 0.041$ ), and there were no differences in adverse events or quality of life between the 2 groups. Exclusion criteria included patient-reported history of severe postoperative nausea/vomiting. Patients were excluded who had a serum creatinine level of  $>1.5$  ng/mL, measured

within 30 days of surgery, or a history of congestive heart failure, defined as ejection fraction of 40% or less, or of more than 40% with systemic signs of heart failure. Finally, patients requiring conversion to open surgery or in whom an ostomy was necessary at the completion of the study were removed from the study and not randomized.

Other retrospective cohort studies have reported that same-day discharge after colorectal surgery was associated with low rates of readmission.<sup>128,407</sup> The largest of these retrospective cohort studies included 157 consecutive patients undergoing laparoscopic right, transverse, total, or left colectomy (left colectomy accounted for the majority of cases).<sup>407</sup> In this study, same-day discharge was possible in 93% of patients with an associated readmission rate of 6%.<sup>408</sup> These studies demonstrate that same-day discharge is feasible within an ERP in selected patients with acceptable complication rates.<sup>408</sup> Success of these initiatives depends on patients having adequate support at home, close outpatient surveillance, and the ability to tolerate clear liquids in the postoperative recovery unit.<sup>128</sup> This is an area with limited but evolving evidence. Recommendations could change as more evidence becomes available.

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