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PERIOPERATIVE NUTRITIONAL CONSIDERATIONS IN PATIENTS WITH INFLAMMATORY BOWEL DISEASE

Introduction

Despite significant advances in medical therapy for inflammatory bowel disease (IBD) in recent decades, surgical management remains common in the setting of both Crohn's disease (CD) and ulcerative colitis (UC). While the risk of colectomy for UC has declined in the biologic era, most patients with CD will undergo at least one intestinal resection in their lifetime.[1]

Preoperative nutritional status is a well-established determinant of surgical morbidity.[2,3] Surgery elicits a metabolic stress response that is proportional to the extent of surgical injury. Adequate lean body and micronutrient stores are needed for healing of surgical incisions, and the individual must be metabolically capable of anabolism for tissue repair.[2] Deficits at any point in this process may lead to complications including anastomotic failure, surgical site infections, delayed return of gastrointestinal (GI) function, and postoperative physical disability with prolonged length of hospital stay.[3]

Patients with IBD are well known to have a high prevalence of nutritional disorders including protein calorie malnutrition, sarcopenia, obesity, and micronutrient deficiencies.[4-7] Patients with severe active disease unresponsive to medications and those undergoing surgery have the highest malnutrition rates of up to 85%.[6,8,9] Malnutrition in IBD results chiefly from a combination of poor dietary intake and chronic inflammation.[6] Inflammatory cytokines enact systemic metabolic changes, whereby peripheral tissue stores are mobilized to support production of acute phase reactants, and a state of insulin resistance diverts nutrients from non-essential targets including muscle.[2] This produces a catabolic state in which muscle protein degradation exceeds synthesis, leading to net muscle loss roughly proportional to the severity and duration of inflammatory stress.[2] Corticosteroid use and reduced physical activity can further lead to negative changes in body composition.[6]

Nutritionally speaking, the majority of IBD surgeries are indicated at the worst possible time. Patients undergoing colectomy for acute severe UC (ASUC) have severe systemic inflammation and are profoundly catabolic, whereas those who require intestinal resection for CD may have variable inflammatory activity but frequently have had a long period of disease and reduced intake due to strictures and anorexia. Given the combination of reduced nutritional reserves and a chronic inflammatory state that promotes tissue breakdown rather than healing, it is not surprising that malnutrition in IBD is a powerful risk factor for non-elective surgery as well as increased postoperative morbidity and mortality.[6,8] Low body mass index (BMI) at time of surgery is associated with increased risk of anastomotic failure, postoperative infections, need for re-operation, longer hospital length of stay (LOS), and death.[7] Weight loss in excess of 10% in the six months before IBD surgery, which is present in up to 54% of cases,[7] is also a significant negative predictor, particularly in resections for CD. Although malnutrition is overall more prevalent in CD than UC,[6] ASUC is associated with significant catabolism, and sarcopenia is present in up to one third of UC patients with high disease activity.[5] Sarcopenia, the condition of reduced muscle mass and strength, is also present in one quarter of patients with CD at time of surgery and importantly, is independent of BMI, occurring commonly

Malnutrition Universal Screening Tool (MUST)	
	Points
BMI kg/m^2	>20 = 0 18.5-20 = 1 <18.5 = 2
Unplanned weight loss in past 3-6 months (%)	< 5 = 0 5-10 = 1 > 10 =2
Patient is acutely ill and there has been or is likely to be no nutritional intake for >5 days	2
Total score	0 = low risk 1 = medium risk 2+ = high risk

Saskatchewan IBD Nutrition Risk Tool (SaskIBD-NR)	
	Points
Have you experienced nausea, vomiting, diarrhea or poor appetite for greater than two weeks?	No = 0 1-2 symptoms = 1 >3 symptoms = 2
Have you lost weight in the last month without trying?	No = 0 Unsure = 1 Yes = <5lbs = 0 5-10lbs = 1 10-15lbs = 2 >15lbs = 3
Have you been eating poorly because of a decreased appetite?	No = 0 Yes = 2
Have you been restricting any foods or food groups?	No = 0 Yes = 2
Total score	0-2 = low risk 3-4 = medium risk >5 = high risk

Table 1. The Malnutrition Universal Screening Tool (MUST) and the Saskatchewan IBD Nutrition Risk Tool (SaskIBD-NR)(1) are malnutrition screening tools that have been validated in the setting of IBD; adapted from Haskey N, Pena-Sanchez JN, Jones JL, Fowler SA. Development of a screening tool to detect nutrition risk in patients with inflammatory bowel disease. Asia Pac J Clin Nutr. 2018;27(4):756-62

in patients with normal weight and overweight.[7] IBD patients with sarcopenia have an increased risk of needing surgery including higher rates of colectomy in UC.[5] Sarcopenia is also independently associated with an increased risk of major postoperative complications, including infection, critical care unit admission, increased LOS, and venous thromboembolism.[5]

While low BMI is associated with increased risk of many postoperative complications, the evidence for increased risk with obesity is inconclusive with some studies suggesting increased risk and some showing no difference.[7]

With a growing armamentarium of biologic drugs that can instill hesitancy to declare failure of medical

therapy, IBD patients can have long periods of poor nutrition and uncontrolled inflammation preceding an eventual surgical intervention. Healthcare system limitations with reduced availability of surgical resources, exacerbated by the COVID-19 pandemic, have introduced further surgical delays during which nutritional status continues to decline. Given the high prevalence and strong impact of malnutrition on surgical outcomes in IBD, there is a need for a proactive and aggressive nutritional approach in this population.

Preoperative Considerations

Screening and Assessment

All patients with IBD should undergo nutritional evaluation prior to surgery, at minimum with a nutritional screening tool (e.g., MUST, SaskIBD-NR; **Table 1**), followed by formal nutritional assessment by a registered dietitian for those who screen medium to high risk for malnutrition.[6,10] Assessment of weight or BMI alone is insufficient, as there can be profound changes in body composition and hidden sarcopenia in obesity.[6] Albumin should not be used to evaluate nutritional status[7,11] as low albumin levels are caused by inflammation leading to third space redistribution and accelerated albumin breakdown despite normal or even increased albumin synthesis.[2] Albumin is a good indicator of inflammatory stress and has prognostic value for surgical complications, but a preserved albumin level is not uncommon in the presence of severe malnutrition especially when systemic inflammatory burden is low.[2]

Nutritional Intervention

Patients diagnosed with malnutrition or nutritional risk should receive a preoperative nutritional intervention.[6] If severe malnutrition is present and surgery is not emergently required, nutrition society guidelines recommend delaying surgery for 7-14 days during which time there should be aggressive nutritional optimization.[6] These recommendations are based mostly on data from major abdominal cancer surgery, where such optimization results in greatly reduced morbidity and mortality, including seven-fold odds reduction in infectious complications.[3] However, the duration of optimization in the setting of IBD may need to be significantly longer in some cases,[6] particularly in complicated CD with abdominal sepsis and/or strictures where there may be both profound undernutrition and high inflammatory burden.

Most of the evidence for preoperative nutritional intervention in IBD comes from CD literature, whereas there is limited evidence for use of preoperative enteral nutrition (EN) or parenteral nutrition (PN) in UC.[7] Physiologic reasoning supports the notion that the immense inflammatory burden of ASUC cannot be overcome by nutrient delivery and source control (i.e., colectomy is needed to reverse the catabolic state.[2]) Nutrition support modalities outlined below are thus mostly considered for the surgical CD patient, although they may also apply to some UC patients, for whom the nutritional approach should be individualized.[6] In general, the approach is always oral feeding in preference to tube feeding, and parenteral feeding only if the other two modalities fail. Immediately prior to surgery, prolonged fasting (i.e., fasting after midnight) should be avoided in line with Enhanced Recovery After Surgery (ERAS) principles, as this practice exacerbates insulin resistance and increases metabolic stress.

Oral and Enteral Feeding

The preferred method of nutritional intervention in patients who cannot achieve adequate intake with diet alone is the use of oral nutritional supplements (ONS), particularly as this can be done at home.[3,6] ONS can deliver substantial calories and protein, are well tolerated by patients, and when providing up to 600 kcal/d, they do not impair intake of regular food.[6] In some cases, ONS can be used as the exclusive means of nutritional intake, termed exclusive EN (EEN). EEN is an established therapy for treatment of CD in children where it has efficacy similar to corticosteroids, but data have also emerged supporting its use in adults.[12] In the presence of abscess when immune suppressants are contraindicated, EEN not only supports nutrition but can also exert anti-inflammatory effects.[8] If adequate intake cannot be achieved through diet and/or ONS, but there is no contraindication to use of the GI tract for nutrition, a feeding tube for delivery of EN is the next step.[8] Even in the setting of intestinal strictures and partial bowel obstruction where ONS are not tolerated, slow infusion of EN via tube can be successful.[8] Supplemental EN can be used for overnight tube feeding while patients are encouraged to eat during the day. There is no difference in efficacy between EN delivered by tube versus EN consumed orally.[6] Oral EN is feasible and well tolerated in the majority of patients with severe CD who have indications for preoperative EN.[13] Both partial EN and EEN have shown similar benefits.[13] There is insufficient evidence to promote the use of specific products, although typically a polymeric product is preferred.[8]

Retrospective cohorts of EEN before surgery in CD have demonstrated improvement in inflammatory markers and reduced postoperative infectious and anastomotic complications, with up to 25% of patients no longer requiring surgery.[7] Several small prospective trials seem to confirm these benefits.[7,14] Preoperative EN has also shown benefit for reduced major complications in the setting of sarcopenia.[5] Adequate duration of preoperative oral and enteral nutrition interventions has yet to be defined and varies by individuals and likely the type of surgery; however, objective reduction in inflammation has been proposed as a surrogate marker that optimization has been achieved.[15] The time to reach this endpoint appears to be between 2 and 5 weeks in most CD patients.[15] It has been suggested that preoperative EEN should last for no

less than 2 weeks, with preference for 4-6 weeks.[13] In patients with mild-to-moderate malnutrition in whom surgery will not occur for 3 months or more, personalized dietary counselling and the use of ONS have been associated with low risk of postoperative complications and some improvement in body composition before surgery.[14]

Parenteral Nutrition

When there is an indication for preoperative nutrition support but EN is contraindicated or not feasible, PN is required. Typically, this occurs in the setting of bowel obstruction, ileus or a high output fistula.[3] Although a low output distal small bowel or colocutaneous fistula does not require use of PN, a proximal or high output fistula necessitates restriction in oral intake and PN, although maintaining at least partial oral or EN intake is beneficial.[6] PN is also needed in cases of EN failure, which is more likely to occur in patients who require hospital admission preoperatively due to their illness, and those with higher nutritional risk.[13] PN should always be used in conjunction with an oral/EN diet unless those are absolutely contraindicated.[6]

In CD patients with malnutrition, preoperative PN reduces complications and is associated with an approximately 20 cm shorter length of intestinal resection,[7] but potentially at the cost of increased hospital LOS.[11] Benefits are seen with PN duration of at least 5 days and are greater if PN is also continued postoperatively.[7,11] Newer generation lipid emulsions containing fish oil and olive oil may have anti-inflammatory benefits in the setting of surgery that translate to reduced complications, although further study is needed.[11] A concern with the use of PN is often around risk of blood stream infection in the setting of central venous catheter (CVC) use. In cases where PN is needed for less than 10-14 days, the use of peripheral PN should be strongly considered as this therapy can deliver 100% of a patient's protein requirements without the need for a CVC.[8] Even if caloric needs are not met but protein intake can reach 1.5 g/kg/day, there is reduction in postoperative infections in CD.[9]

Postoperative Considerations

Early Postoperative Care

Early (within 24 hours) re-introduction of oral or enteral feeding after surgery for IBD is associated with improved outcomes,[1] including significant reduction in LOS. There is strong evidence that EN within 24 hours of surgery for CD reduces complications and accelerates anastomotic healing.[6] The use of ONS should also be encouraged at this stage if oral intake is inadequate. EN via feeding tube is indicated for patients who cannot initiate nutrition orally or if oral intake will be nil for 5 days or not exceed 50% of requirements for more than a week.[3,6] In patients who are malnourished at the time of surgery, such as when emergency surgery is needed, it is recommended to initiate EN or PN as soon as possible postoperatively.[8] In patients who were receiving PN preoperatively, PN should continue postoperatively until adequate (meeting at least 50-60% of caloric needs) oral or tube feeding is established.[3] Generally, perioperative care of IBD patients should follow ERAS principles including early feeding, early mobilization and maintenance of normoglycemia.[6]

High Output Ileostomy

CD is a strong independent risk factor for development of a high output ileostomy (HOS).[16] Management of HOS requires multiple components of care: expert dietetic advice regarding nutrition and hydration strategies; attention to salt and water repletion to maintain hydration and renal function; pharmacotherapy including anti-motility agents (e.g., loperamide, diphenoxylate-atropine, codeine), and anti-secretory agents (proton pump inhibitors).[17] Anti-motility agents can be used alone, or combined if stronger effect is needed. They should be dosed regularly (as opposed to as needed), and preferably timed 30 minutes before meals in order to counteract the pro-motility effect of eating. If patients cannot maintain urine output above 1.2 L per day, they should be considered for home IV fluids.[17] Provided there is not a concurrent pathology such as obstruction or active IBD, HOS tends to improve over time with bowel adaptation.

Diarrhea

The same medications as those used in HOS can be used to treat malabsorption-related diarrhea after IBD surgery. In the setting of ileal resection for CD, diarrhea may be partly due to bile acid malabsorption; however, bile acid binding medications such as cholestyramine should be used with caution and avoided in patients with extensive (>60-100 cm) ileal resection, as these patients are already bile acid deficient and these drugs will worsen fat malabsorption. Bile acid binders and fibre supplements are to be avoided when there is no colon in continuity (i.e., ileostomy) as they have no physiologic basis for use in this setting and exacerbate nutrient malabsorption.[18]

Short Bowel Syndrome

Patients with CD who undergo extensive or repeated small bowel resections are also at risk of developing short bowel syndrome (SBS), which can lead to intestinal insufficiency or intestinal failure. The risk of SBS should be considered prior to intestinal resection and can be predicted based on the location of intestinal resection and length of remaining small bowel. Jejunal resections are much better tolerated than ileal resections, and preservation of ileocecal valve and/or colon segment in continuity are of great benefit for maintaining intestinal autonomy.[19] Home PN may be required in cases of chronic intestinal failure from SBS.

These patients should be treated by an experienced intestinal failure program for intestinal rehabilitation, as weaning off PN can be accomplished in up to 50% of patients within two years and some patients may benefit from use of gastrointestinal growth factor therapy.[19]

Micronutrients

Because most vitamins and minerals are bound to plasma proteins that are affected by the acute phase response, micronutrient testing should occur following resolution of acute surgical stress when there is no further systemic inflammation related to active IBD.[7,20] Micronutrient deficiencies can be predicted by certain clinical situations. For instance, B12 deficiency can occur with as little as 20 cm resection of distal ileum,[2] while zinc is depleted in the setting of high output ostomy, significant diarrhea, and enterocutaneous fistula.[20] Micronutrient testing should be tailored to patient disease characteristics, anatomy, diet and signs of deficiency (ex. presence of anemia), but should include B12, vitamin D and iron studies as a minimum.[10] Generally, micronutrients should be checked annually when IBD is in remission but patients with a history of upper GI resection or multiple or extensive bowel resections, and those with SBS should receive extra attention to their micronutrient status.[6]

Long-term Outcomes

Patients with UC who undergo colectomy for medically refractory disease typically have good nutritional outcomes. With removal of the inflamed organ, nutritional status improves and sarcopenia will even reverse.[5] In patients with CD, surgery has also been shown to improve lean body mass, although those with sarcopenia are at greater risk of postoperative complications, which can lead to worsening nutritional status in some cases.[5] After IBD surgery, patients need a personalized approach according to their anatomy and disease, ideally including consultation with a skilled registered dietitian. Patients, especially those with sarcopenia, should be advised to do regular resistance exercises, and consume a minimum of 1 g/kg/day of protein in quiescent disease and 1.2-1.5 g/kg/day in active disease.[6] Patients with ileostomy should have regular monitoring of renal function and hydration status.

Conclusions

Surgery remains a mainstay in the treatment of complicated and refractory IBD. These patients have high rates of malnutrition and are at significant risk of surgical complications that directly result from an altered metabolism related to inflammation and malnutrition. Preoperative nutritional screening should be mandatory for all IBD patients who require surgery, and personalized optimization undertaken if malnutrition or high nutritional risk is detected. Nutrition care pre-operatively and post-operatively reduces risk of complications and significantly improves outcomes, and in the setting of refractory inflammation, surgery itself leads to improved nutritional status long term. There is emerging evidence in other fields supporting the use of multi-modal prehabilitation combining nutritional intervention with an exercise program and mental health support. Future studies should evaluate comprehensive prehabilitation in patients with IBD.

Key Takeaways:

1. Patients undergoing surgery for IBD have a high prevalence of malnutrition due to catabolic effects of chronic inflammation coupled with inadequate nutritional intake
2. Malnutrition, especially if there is weight loss exceeding 10% in the prior 6 months, is a strong predictor of adverse surgical outcomes in IBD including infections, anastomotic failure and increased length of stay
3. All patients undergoing surgery for IBD should have a nutritional evaluation prior to surgery using a nutritional risk screening tool followed by nutritional assessment and intervention for those who screen positive
4. If need for surgery is non-emergent and severe malnutrition is present, surgery should be delayed for at least 7-14 days to allow for aggressive nutritional optimization
5. In complicated CD, pre-operative enteral nutrition for at least 2 weeks but preferably 4-6 weeks is demonstrated to reduce post-operative infectious and wound healing complications
6. Successful surgery will improve the nutritional status of IBD patients, but monitoring is required for malabsorptive complications including micronutrient deficiencies, protein calorie malnutrition from SBS, and dehydration in those with an ostomy

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References:

1. Barnes EL, Lightner AL, Regueiro M. Perioperative and postoperative management of patients with Crohn's disease and ulcerative colitis. *Clin Gastroenterol Hepatol.* 2020;18(6):1356-66.
2. Sobotka L, Allison SP, European Society for Clinical N, Metabolism. Basics in clinical nutrition. Fifth edition. ed. Prague: Galén; 2019. XXXIV, 676 pages.
3. Weimann A, Braga M, Carli F, et al. ESPEN practical guideline: Clinical nutrition in surgery. *Clin Nutr.* 2021;40(7):4745-61.
4. Gold SL, Raman M. Malnutrition Assessment in patients with inflammatory bowel disease. *Canadian IBD Today.* 2023;1(1):35-42.
5. Ryan E, McNicholas D, Creavin B, et al. Sarcopenia and inflammatory bowel disease: a systematic review. *Inflamm Bowel Dis.* 2019;25(1):67-73.
6. Bischoff SC, Bager P, Escher J, et al. ESPEN guideline on Clinical Nutrition in inflammatory bowel disease. *Clin Nutr.* 2023;42(3):352-79.
7. Adamina M, Gerasimidis K, Sigall-Boneh R, et al. Perioperative dietary therapy in inflammatory bowel disease. *J Crohns Colitis.* 2020;14(4):431-44.
8. Chiu E, Oleynick C, Raman M, et al. Optimizing inpatient nutrition care of adult patients with inflammatory bowel disease in the 21st century. *Nutrients.* 2021;13(5):1581.
9. Yamamoto T, Lightner AL, Spinelli A, et al. Perioperative management of ileocecal Crohn's disease in the current era. *Expert Rev Gastroenterol Hepatol.* 2020;14(9):843-55.
10. Gold SL, Raman M. Editorial: a formula shake each day keeps the complications away - the tolerability and effect of orally-delivered enteral nutrition in improving post-operative outcomes in patients with Crohn's disease. *Aliment Pharmacol Ther.* 2022;56(4):739-40.
11. Schwartz E. Perioperative parenteral nutrition in adults with inflammatory bowel disease: a review of the literature. *Nutr Clin Pract.* 2016;31(2):159-70.
12. Day A, Wood J, Melton S, Bryant RV. Exclusive enteral nutrition: An optimal care pathway for use in adult patients with active Crohn's disease. JGH Open. 2020;4(2):260-6.
13. Meade S, Patel KV, Luber RP, et al. A retrospective cohort study: pre-operative oral enteral nutritional optimisation for Crohn's disease in a UK tertiary IBD centre. *Aliment Pharmacol Ther.* 2022;56(4):646-63.
14. Fiorindi C, Cuffaro F, Piemonte G, et al. Effect of long-lasting nutritional prehabilitation on postoperative outcome in elective surgery for IBD. *Clin Nutr.* 2021;40(3):928-35.
15. Zangenberg MS, Horesh N, Kopylov U, et al. Preoperative optimization of patients with inflammatory bowel disease undergoing gastrointestinal surgery: a systematic review. *Int J Colorectal Dis.* 2017;32(12):1663-76.
16. Seifarth C, Augustin LN, Lehmann KS, et al. Assessment of risk factors for the occurrence of a high-output ileostomy. *Front Surg.* 2021;8:642288.
17. Bridges M, Nasser R, Parrish C. High output ileostomies: the stakes are higher than the output. *Pract Gastroenterol.* 2019.
18. Bering J, DiBaise JK. Short bowel syndrome: Complications and management. *Nutr Clin Pract.* 2023;38 Suppl 1:S46-S58.
19. Bielawska B, Allard JP. Parenteral nutrition and intestinal failure. *Nutrients.* 2017;9(5):466.
20. Gold SL, Manning L, Kohler D, et al. Micronutrients and their role in inflammatory bowel disease: function, assessment, supplementation, and impact on clinical outcomes including muscle health. *Inflamm Bowel Dis.* 2023;29(3):487-501.