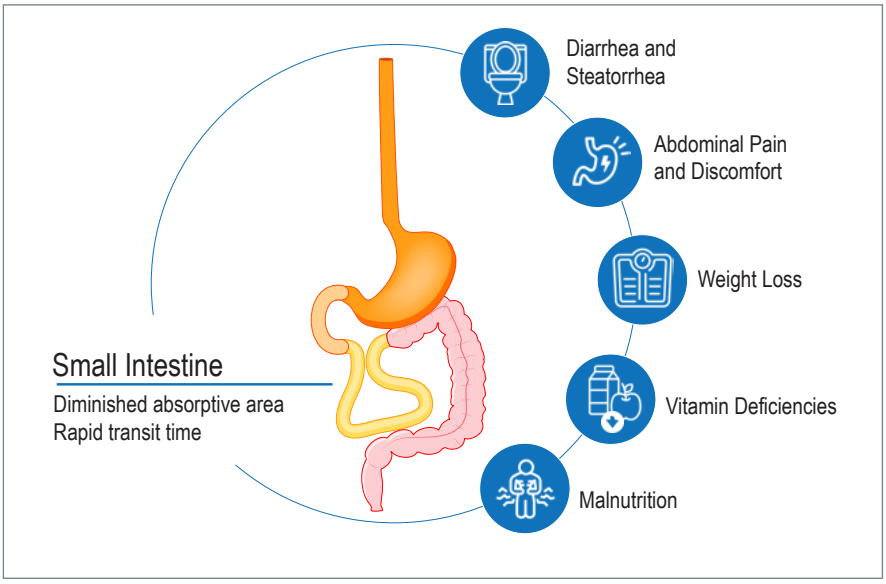
PRACTICE TOOL

Optimizing Enteral Nutrition in Patients with Fat Malabsorption due to Short Bowel Syndrome

Introduction

Patients with short bowel syndrome (SBS) are at a high risk for developing fat malabsorption and steatorrhea, which can significantly worsen when enteral nutrition (EN) is administered.[1] Fat malabsorption is a major complication of SBS because it critically contributes to nutritional deficiencies and clinical manifestations of SBS.

This practice tool reviews various therapeutic treatments for fat malabsorption and strategies to optimize EN in patients with SBS.



Fat Malabsorption in SBS

Patients with SBS develop fat malabsorption due to the effects of decreased intestinal surface area and accelerated transit time on optimal nutrient absorption. Fat malabsorption in SBS patients may lead to impaired growth and development in children, malnutrition, vitamin deficiency, and chronic infection, which in turn leads to an increased risk of morbidity and mortality.[2] Targeting fat malabsorption in patients with SBS can decrease symptom burden and prevent malnutrition.

Nutritional Considerations and Enteral Autonomy in SBS

Patients with SBS often require more than 1.5 times their goal caloric intake.[3] Therefore, EN is often used in combination with parenteral nutrition (PN) to support normal growth and development. Providing EN has the following benefits:[4]

- Enhance intestinal adaptation
- Preserve hepatic immune function
- Improve gut barrier function

Due to complications associated with the use of PN, the goal is to transition from PN to EN, with the ultimate goal of achieving enteral autonomy.

Enteral autonomy allows patients to meet their nutritional and fluid needs without any PN support. The biggest limitation to achieving the benefits of enteral autonomy is the presence of fat malabsorption.[1] EN may worsen fat malabsorption if not monitored or provided properly.[1] The achievement of enteral autonomy is associated with early intervention in the setting of an intestinal rehabilitation center, remnant intestine length > 40 cm, and a preserved ileocecal valve.[5]

Therapeutic Treatment

Despite advances in the management of SBS, no single therapeutic approach targeting fat malabsorption has reliably demonstrated improved PN weaning and decreased mortality.[1] The following medical and nutritional therapies have been used in SBS:

- Antimotility
- Antisecretory agents: proton pump inhibitors, H2 blockers
- Antidiarrheals: loperamide, tincture of opium, clonidine
- Octreotide
- Bile acid replacement therapy
- Antibiotics (ciprofloxacin, metronidazole)
- Probiotics
- Glucagon-like peptide-2
- Enteral nutrition
- Pancreatic enzyme replacement
- Immobilized lipase cartridge

Pancreatic Enzyme Replacement

Several recent studies have focused on the use of pancreatic enzymes to improve fat absorption. The benefit of oral pancreatic enzyme replacement in patients with Cystic Fibrosis (CF) is well established in those with acquired pancreatic insufficiency.[6] However, they are not indicated for use with enteral tube feeds and have been associated with clogging risk.[7] Furthermore, they have not been shown to be effective in SBS and are not recommended.[8] Although both CF and SBS involve fat malabsorption, the mechanisms differ and thus may require different treatment approaches.

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Use of Inline Immobilized Lipase Cartridge

An alternative strategy for improving fat absorption in SBS is with the use of an immobilized lipase cartridge (ILC) (RELiZORB, Alcresta Therapeutics, Inc.). An inline digestive lipase cartridge was introduced in 2015 and is cleared for use in infant and pediatric patients (ages 0 years and above) and in adult patients to hydrolyze fats in EN formula (Figure 1).

When EN formula flows through the cartridge, the triglycerides in the formula are hydrolyzed to free fatty acids and monoglycerides by the immobilized lipase in the cartridge.[9,10] The hydrolyzed fats then flow into the intestinal tract through the patient's enteral feeding tube.

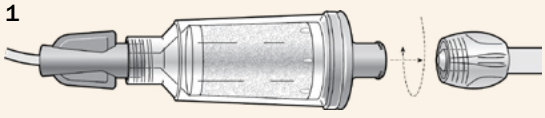
This ILC has been shown to break down fats in EN formulas, including the conversion of triglycerides into long-chain polyunsaturated fatty acids (LCPUFAs) such as docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA), and arachidonic acid (AA), which are critical for growth and development.[7] For example, these LCPUFAs may play a critical role in promoting post-resection intestinal adaptation.[11]

By hydrolyzing fats in EN formulas prior to gastrointestinal delivery, the use of an ILC greatly reduces reliance on native pancreatic lipase to digest fats after entry into the small intestine. This therapeutic approach could bypass key barriers to fat absorption in SBS—namely, rapid intestinal transit and reduced mucosal surface area.[1]

Two preclinical studies in a porcine model of SBS have demonstrated that the ILC:[12,13]

- Improved the absorption of fat and fat-soluble vitamins
- Increased plasma levels of the omega-3 fatty acid DHA and omega-6 fatty acid EPA
- Reduced PN dependence
- Increased advancement of EN
- Increased intestinal length

Figure 1



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A single-center, retrospective study of 13 pediatric patients with SBS demonstrated that use of the ILC was associated with improved EN tolerance and clinical outcomes.[14]

These patients used an average of 3.4 cartridges a day using both bolus and continuous feedings. Two of the 13 patients experienced worsening symptoms after two weeks and discontinued the ILC.

Among the remaining 11 patients, mean weight increased significantly by 2.8 kg ($p<0.001$), stool frequency declined ($p=0.041$), 73% demonstrated increased EN caloric intake, and 50% reduced parental support (PS) volume and calories.

These findings suggest an ILC may enhance fat absorption and improve nutritional outcomes in pediatric SBS. Other clinical trials using an ILE in SBS are ongoing and outcomes data are being collected in a direct-to-patient SBS registry.[15]

Summary

Fat malabsorption is a critical cause of morbidity in SBS. Therapeutic strategies to address fat malabsorption need to be tailored to the individual SBS patient. Pre-hydrolysis of fats using an ILC may enhance the absorption of fats and fat-soluble nutrients. This approach shows promise in mitigating the signs, symptoms, and clinical consequences of fat malabsorption in patients with SBS.

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