

## NUTRITION

# Nutritional Management of Lipogranulomatous Lymphangitis and Short Bowel Syndrome

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## CASE PRESENTATION

The patient was a 4-year-old neutered male English bulldog with a history of chronic intermittent vomiting and diarrhea. Results of the following initial diagnostics were mostly unremarkable: abdominal radiography, biochemistry panel, trypsin-like immunoreactivity, pancreatic lipase immunoreactivity, cobalamin, folate, and fecal flotation. *Giardia* enzyme-linked immunosorbent assay revealed low/normal cobalamin (385 ng/L; reference range, 251 to 908 ng/L) and albumin and cholesterol levels were low. Treatments included metronidazole, ranitidine, maropitant, deworming, and various diet trials (i.e., prescription hydrolyzed diets, veterinary therapeutic highly digestible diets, diets formulated for growth, and cooked chicken), but the patient failed to improve.

The patient was referred to a specialty hospital for additional diagnostics. Abdominal ultrasonography revealed concentric ileal thickening, which was determined to be a mass involving the caudal third of the jejunum, ileum, and proximal colon. A laparotomy was performed and the mass along with the distal third of the jejunum, including the ileum, were removed by performing a side-to-end anastomosis between the jejunum and the colon. Histopathology of the mass revealed chronic transmural lipogranulomatous and necrotizing lipogranulomatous lymphangitis.

After surgery, the patient continued to lose weight and had chronic mixed-bowel diarrhea and defecated frequently (6 to 8 times per day). His gastrointestinal signs were attributed to a combination of short bowel

## Abstract

A 4-year-old neutered male English bulldog was referred to the veterinary teaching hospital for presumed short bowel syndrome following an ileocecal resection to remove a tumor involving the caudal third of the jejunum, ileum, and proximal colon. Histopathology of the tumor revealed chronic transmural lipogranulomatous and necrotizing lymphangitis. After surgery, mixed-bowel diarrhea developed and the patient lost weight. When the diarrhea and weight loss did not respond to medical management, the patient was referred to the university nutrition service for nutritional management of presumed short bowel syndrome and lymphangitis. Diet modification in conjunction with medical management led to improved body weight and fecal consistency.



## Take-Home Points

- Lipogranulomatous lymphangitis is associated with inflammatory bowel disease and may result in an obstructive focal lesion near the ileocolic junction, requiring removal.
- Short bowel syndrome can affect patients after extensive bowel resection and often requires lifelong dietary management.
- Nutritional management for lipogranulomatous lymphangitis is similar to that for inflammatory bowel syndrome (i.e., highly digestible, low fat, novel or hydrolyzed protein, and novel carbohydrate).
- Finding a single diet that addresses multiple conditions can be challenging; however, new options for managing complex cases result from recent developments in commercial diets that are low in fat and contain hydrolyzed protein or are amino acid based.

syndrome (SBS) and lipogranulomatous lymphangitis (LGL), which was treated with prednisolone, cobalamin, cholestyramine, probiotics, psyllium, and metronidazole.

Two months after surgery, the patient continued to lose weight (20% weight loss and body condition score 3/9) and diarrhea did not improve. Laboratory tests revealed increased liver enzymes, hypocholesterolemia, decreased serum cobalamin, normal folate, an unremarkable complete blood count, and urine negative for protein. The patient was referred to the nutrition service for nutritional management of LGL and SBS.

## THE CONDITIONS

### Lipogranulomatous Lymphangitis

First reported in 1973, focal LGL is a rare form of inflammatory bowel disease (IBD).<sup>1,2</sup> It is believed to result from chronic leakage of chyle and ruptured lymphatic vessels, leading to a granulomatous reaction and nodule formation within the intestinal layers and mesenteric lymphatics.<sup>2,3</sup> Focal lymphangitis can result in formation of a localized mass that leads to intestinal obstruction. Surgical removal of the mass can alleviate signs related to the obstruction; however, after surgery additional medical and nutritional therapy for lymphangitis may be needed.<sup>1,2</sup>

Because LGL is related to IBD and lymphangiectasia, similar nutritional management principles can be applied. IBD is considered a multifactorial disease that is characterized by chronic gastrointestinal signs and increased numbers of cellular infiltrates within the lamina propria of the intestines.<sup>4</sup> Dietary management for patients with IBD involves feeding a diet that is

highly digestible and contains novel or hydrolyzed protein and novel carbohydrate.<sup>5</sup> Fat is often restricted because IBD can result in maldigestion of fatty acids, which can lead to osmotic or secretory diarrhea.<sup>6</sup> Lymphangiectasia is a condition in which the lymphatics within the intestinal villi become dilated and leak lymphocytes, lipids, and protein.<sup>7</sup> Nutritional management of lymphangiectasia involves feeding a diet that is highly digestible and low in fat (< 15% metabolizable energy [ME]).<sup>6</sup>

### Short Bowel Syndrome

SBS results from loss of normal physiologic intestinal function caused by removal of a portion of the intestines.<sup>8</sup> Although resection of 50% to 75% of the intestine has been reported to be associated with development of SBS, other reports indicate that the specific location of bowel removed may be more relevant than percentage of intestine removed.<sup>9,10</sup> Clinical signs (**TABLE 1**), outcome, and management vary according to the specific section of intestine that is removed.<sup>9</sup> Complications associated with SBS include alterations in gastrointestinal transit time, bacterial overgrowth, and bacterial translocation.<sup>11</sup>

**TABLE 1 Short Bowel Syndrome**

| CLINICAL SIGNS | LABORATORY ABNORMALITIES           |
|----------------|------------------------------------|
| Diarrhea       | Hypomagnesemia                     |
| Steatorrhea    | Hypoalbuminemia                    |
| Weight loss    | Hypocalcemia                       |
| Malnutrition   | Hypokalemia                        |
|                | Acid-base imbalance                |
|                | Vitamin B <sub>12</sub> deficiency |

SBS in humans has been studied extensively, and because it occurs less commonly in companion animals, management solutions for dogs with SBS are often derived from what is known about SBS in humans. After resection, the remaining intestines adapt by increasing the intestinal surface area to improve absorption of nutrients. That process can be enhanced with enteral nutrition, which provides nutrients to enterocytes and colonocytes within the remaining portion of the intestines and promotes hypertrophy, hyperplasia, and intestinal dilation.<sup>11</sup>

Removal of the ileum can lead to steatorrhea and impaired nutrient absorption because of its role in absorbing water, fatty acids, bile acids, fat-soluble vitamins, and vitamin B<sub>12</sub>. Because most cobalamin is absorbed in the ileum, parenteral supplementation with cobalamin is recommended. In patients without an ileum, impaired bile acid absorption can decrease taurine uptake because bile acids are conjugated with taurine. Although taurine is not an essential amino acid in dogs (they can synthesize it if dietary protein and sulfur-containing amino acids are adequate), taurine supplementation is recommended due to the potential for impaired bile acid reabsorption, leading to increased loss of taurine in dogs.

Dietary management after complete resection of the ileum requires feeding a low-fat (<20% fat ME), highly digestible diet that will provide nutrients while the intestines are undergoing adaptation.<sup>12</sup> Removal of the ileocecal valve has been associated with a poorer outcome and may contribute to increased intestinal motility as well as bacterial overgrowth due to the loss of the mechanism to prevent reflux of bacteria from the colon into the small intestine.<sup>8-10</sup> Adding insoluble fiber to the diet can help slow gastrointestinal transit time, allowing for improved water and sodium absorption.<sup>12</sup> Mixed fiber can bind bile acids, and fermentable fiber can be fermented into short-chain fatty acids in the colon. Short-chain fatty acids have trophic effects and provide energy for the colonocytes.<sup>11</sup> Care should be

**TABLE 2 Dietary Fat Levels**

| FAT LEVEL | FAT RANGE, % ME | GRAMS/1000 KCAL |
|-----------|-----------------|-----------------|
| Low       | < 25            | < 29            |
| Moderate  | 26–40           | 30–45           |
| High      | > 41            | > 46            |

ME = metabolizable energy

taken when considering the amount and type of dietary fiber because it can reduce the digestibility of the diet. Although fiber offers benefits, prioritizing the digestibility of the diet is recommended for patients with SBS.

## CASE ASSESSMENT AND PLAN

At the time of the nutrition consultation, the patient was reported to be lethargic, and despite consuming 2.4 times his resting energy requirement was still underweight (body condition score 3/9) and had generalized moderate muscle loss. The patient was being fed a veterinary therapeutic hydrolyzed diet (Purina Pro Plan Veterinary Diet HA Hydrolyzed Vegetarian Canine Formula [[proplanvetdirect.com](https://proplanvetdirect.com)], with a 311 kcal ME/cup caloric distribution of 20% protein, 24.1% fat, and 55.9% carbohydrate) divided into 5 meals throughout the day, which was not controlling his signs. The patient was receiving psyllium (1 to 3 teaspoons per day), but it was reported to cause increased flatulence, did not improve his clinical signs, and was thus discontinued.

A customized home-prepared diet was formulated by the nutrition service using computer software (BalanceIT, [balance.it](https://balance.it)) to meet the dietary needs for adult maintenance. In the formulated diet, calories remained the same, dietary fat was decreased from 24% fat ME to 15% fat ME, the protein source was whitefish, and the carbohydrate source was sweet potato (the protein and carbohydrate sources were both believed to be novel). With regard to the meaning of

**TABLE 3 Comparison of Diets Fed to the Patient\***

| CALORIC DISTRIBUTION             | THERAPEUTIC VETERINARY HYDROLYZED DIET | HOME-PREPARED DIET |
|----------------------------------|----------------------------------------|--------------------|
| Protein, % ME                    | 20                                     | 41                 |
| Fat, % ME                        | 24                                     | 15                 |
| Carbohydrate, % ME               | 56                                     | 44                 |
| Total dietary fiber, g/1000 kcal | 12                                     | 18                 |

\*Caloric distribution on a metabolizable energy (ME) basis that the patient was being fed at the time of the referral compared with that of the formulated home-prepared diet.



low-fat diets, examining the percentage of ME or grams of nutrients per 1000 kcal can help identify diets as low, moderate, or high in fat. **TABLE 2** offers guidelines for categorizing fat content in the diet. To improve absorption, the food was offered in 5 to 6 smaller meals throughout the day.

Two weeks after his diet was transitioned to the home-prepared diet, the patient's weight had improved and frequency of defecation decreased from 5 times per day to 1 to 2 times per day; however, stool consistency remained poorly formed. The patient was evaluated by his local veterinarian on a regular basis until he reached an ideal weight.

Six months after initiation of feeding the home-prepared diet, the patient was returned for an evaluation by the nutrition service. He was being fed the home-prepared diet exclusively and was receiving metronidazole, taurine, budesonide, probiotics, and monthly parenteral cobalamin. A biochemistry panel revealed that all liver enzymes, except for alkaline phosphatase (attributed to budesonide), serum cobalamin, and folate were within the reference range. At the time of his final evaluation, the patient had reached his ideal weight and normal muscle mass, his stool was reported as soft but formed, and the frequency of defecation decreased to once a day. Note that in some dogs with SBS, fecal consistency will not return to normal. The improvement in this patient was attributed to a combination of diet modification (**TABLE 3**), medical management, and intestinal adaptation.

## SUMMARY

SBS and LGL in this patient required a combination of medical and nutritional management strategies. Commercial therapeutic diets are formulated to manage a wide range of conditions; however, for dogs with multiple conditions, it can be challenging to identify a diet that will address every condition. This case demonstrates how a home-prepared diet formulated by a veterinary nutritionist offered the flexibility needed to facilitate nutritional support for the patient, which led to an improved outcome. Since the time of this case, several new commercial diets have become available that are low in fat and have hydrolyzed protein or are amino acid based. Those diets offer new options for patients that require both a low-fat diet and a unique protein source. **TVP**

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Dr. Torres attended Colorado State University (CSU) for her undergraduate and veterinary education. After she earned her DVM degree in 2001, she went into small animal private practice in Albuquerque, New Mexico. She joined community practice at CSU's James L. Voss Veterinary Teaching Hospital in 2008, and earned her feline and canine DABVP certification in 2011. As a general practitioner, she has observed the power of preventive medicine. Seeing how preventing disease can be so much easier for a pet than treatment led her to explore the effects of obesity on companion animals and nutrition's role in obesity management. Her enthusiasm for nutrition in multiple areas inspired her to seek additional training in the field of nutrition at CSU, and she completed a residency in nutrition and became a diplomate of the American College of Veterinary Internal Medicine (Nutrition) in 2021. She enjoys spending time with her husband and 2 sons, 2 cats, a yorkiepool, and a French bulldog.