CASE BY CASE: NUTRITION

Case Presentation: Nutritional Management of Chylothorax

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Chylothorax is defined as the accumulation of modified lymphatic fluid (chyle) within the pleural cavity. Normal fat digestion and absorption from the gastrointestinal tract results in triglycerides from foods being packaged into chylomicrons within the jejunal mucosal cells, which then enter the lymphatic system. This fluid is referred to as chyle. Chyle from lumbar and mesenteric lymphatics flows to the cisterna chyli, then into the thoracic duct where it enters the venous circulation. When this path is disrupted or if pressure within the lymphatics is increased, chylothorax may result from leakage of chyle into the pleural space. Primary causes include thoracic duct compression, neoplasia, thymoma, fungal disease, or lung lobe torsion. Chylothorax may also be caused by increased systemic venous pressure resulting from right-sided heart failure, heartworm disease, pericardial effusion, cardiomyopathy, tricuspid dysplasia, or thromboembolic disorders.[1,2] Although uncommon, chylothorax may result from diaphragmatic hernia, thoracic surgery, trauma, or severe coughing or vomiting. In many cases, the exact underlying cause of chylothorax is not determined and is therefore termed idiopathic.[2] Clinical signs of chylothorax relate to pleural cavity disease and may be acute or chronic. Affected patients will have tachypnea or more subtle signs (e.g., lethargy, anorexia, coughing, exercise intolerance). Because chyle contains water, electrolytes, lipids, proteins, and fat-soluble vitamins, drainage and removal of chyle from the pleural space can result in

Abstract

Chylothorax is the accumulation of modified lymphatic fluid (chyle) within the pleural cavity. Primary causes include thoracic duct compression, neoplasia, thymoma, fungal disease, or lung lobe torsion; secondary causes include increased systemic venous pressure or trauma. Clinical signs include tachypnea, lethargy, anorexia, coughing, or exercise intolerance. Treatment options include nutritional management, medical management, and/or surgical intervention. This case report describes nutritional management that was used to stabilize a patient with chylothorax before surgical treatment and was then continued afterward due to a positive response and suspected comorbidities.

Take-Home Points

- Chylothorax is the accumulation of chylous fluid within the pleural cavity, resulting from disruption of normal lymphatic flow from the digestive tract to the venous circulation.
- Chylothorax is diagnosed by confirming the presence of a white, milky fluid within the pleural space that contains high levels of triglycerides compared with levels in serum.
- The most common form of chylothorax is idiopathic and is diagnosed by ruling out other potential causes.
- Management of chylothorax has included nutritional, medical, and surgical approaches.
- Nutritional management with low-fat diets alone is usually not successful, necessitating surgical interventions.
- Medical management with the supplement rutin or the medication octreotide has been suggested; however, studies demonstrating efficacy are lacking.
- Surgical treatment options for chylothorax include several potential approaches, and procedures are often combined to improve outcomes.

dehydration and electrolyte imbalances. Chronic and recurrent chylothorax can also result in constrictive pleuritis, which worsens the prognosis. Recommended treatment for chylothorax has included nutritional, medical, and/or surgical intervention.[1] This case presentation outlines a nutritional approach to management of chylothorax that was initiated to stabilize the patient for eventual surgical treatment.

HISTORY AND PRESENTATION

The patient was a 5-year-old, 31-kg, neutered male goldendoodle with a body condition score of 4/9 (Purina Body Condition System, bit.ly/3ZtGbmt) and a normal muscle condition score (**FIGURE 1**). He had a history of progressive hyporexia over 6 weeks with intermittent lethargy and bouts of vomiting along with soft stools (fecal score 4 to 5/9; Purina Fecal Scoring Chart, bit.ly/3KoWyeC). He also had a history of otitis externa, suspected atopy, and suspected chronic enteropathy, which was managed with a topical otic medication (steroid/antifungal/antibiotic), lokivetmab (Cytopoint; Zoetis, zoetisus.com) injections, and a hydrolyzed veterinary therapeutic diet (Hill's Prescription Diet z/d Dry Dog Food, hillsvet.com) given at 1.5 cups twice daily (1062 kcal/day). The patient was receiving heartworm and flea/tick preventives year round, and all vaccinations were up to date.

INITIAL ASSESSMENT

The primary care veterinarian reported that the patient's physical examination was normal: temperature was 38.2 °C (100.7 °F), heart rate measured 90 beats/min, and respiration rate measured 35 breaths/min with normal effort. Weight loss of 2 kg was noted; his previous weight at an annual examination 6 months earlier was 33 kg. Screening abdominal and thoracic radiography were performed, and fluid was identified within the pleural space (**FIGURE 2**). The patient was referred to a specialty/emergency care facility for additional diagnostics.

FIGURE 1. Photograph of chylothorax patient taken before presentation.

At the emergency facility, the patient was bright, alert, and responsive. A grade 2/6 systolic heart murmur was ausculted. Thoracic radiographs confirmed pleural effusion and showed mild atelectasis of caudal lung fields. A thoracocentesis removed ~3 mL of white, milky fluid from the left cranial thorax and ~20 mL from the right thorax. Differentials for accumulation of fluid within the pleural space included a transudate, modified transudate, exudate, or chylous effusion. Given the appearance of the fluid, chylous effusion was highly suspected. Definitive diagnosis of chylothorax is based on detection of a triglyceride level in fluid that is higher than that in serum. Fluid was submitted along with blood and urine for diagnostic testing.

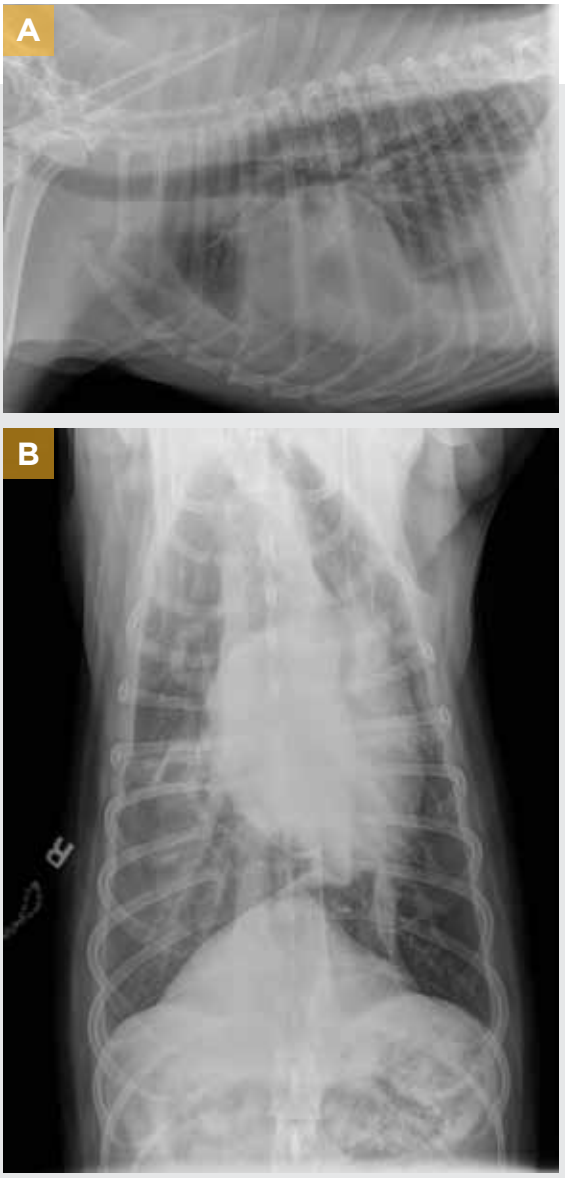

FIGURE 2. (A) Right lateral and **(B)** ventrodorsal chest radiographs of the chylothorax patient, showing fluid within the pleural space.

DIAGNOSTIC TESTS AND PERTINENT RESULTS

Laboratory findings for blood, urinalysis, and the pleural effusion (protein levels not reported) are shown in **TABLE 1**.

Direct smears of the pleural fluid contained low numbers of nucleated cells and erythrocytes in a pink background. Concentrated smears were highly cellular. The nucleated cells were primarily lymphocytes (60% to 65%; mostly small, a few medium and large) with a moderate number of macrophages (35% to 40%) and a small number of neutrophils and mesothelial cells (<5%). No atypical cells or etiologic agents were seen. The interpretation was lymphocytic effusion consistent with chylous effusion.

Additional diagnostics included an echocardiogram, which indicated mild mitral and tricuspid regurgitation but no chamber dilation, no changes in heart wall thickness, and normal contractility. Pleural effusion was noted. A full body computed tomography (CT) scan revealed no evidence of neoplasia or underlying cause for the chylous effusion. A CT lymphangiogram with injection of contrast revealed normal lymphatic circulation. Because a cause was not identified, the diagnosis was idiopathic chylous effusion.

TREATMENT OPTIONS

Medical Management

Medical management of chylothorax involves nutrition, thoracocentesis to remove fluid, and/or medications. Fluid removal will improve patient comfort and resolve clinical signs but is rarely curative, although there are a few reports of spontaneous resolution.[1,2] Medications to address chylothorax include the supplement rutin and/or the somatostatin analogue octreotide. Rutin is a nutraceutical that may purportedly increase lymphatic vessel uptake of edema fluid. Rutin has led to some improvement in cats with chylothorax, but it has not been evaluated in dogs.[3,4] Octreotide, a somatostatin analogue that has been given parentally to dogs and cats with chylothorax, has been shown to have a low success rate, is costly, and is not widely used.[1,5,6] For the patient in this case report, rutin supplementation was initiated at a dose of 1500 mg PO q8h, in case a

TABLE 1 Laboratory Test Results

TEST (REFERENCE RANGE)	VALUE	NOTES
COMPLETE BLOOD COUNT		
Monocytes [(0.2–0.5) × 10^3/µL]	0.8 × 10^3/µL	High
Platelets [(180–366) × 10^3/µL]	179 × 10^3/µL	Low, clumping
SERUM BIOCHEMISTRY		
Urea nitrogen (12–27 mg/dL)	5 mg/dL	Low
Chloride (106–115 mmol/L)	117 mmol/L	High
Albumin (2.8–3.6 g/dL)	2.7 g/dL	Low
AST (16–41 U/L)	59 U/L	High
Creatine kinase (51–169 U/L)	175 U/L	High
Serum peripheral triglyceride (20–79 mg/dL)	127 mg/dL	High
Urinalysis	Yellow/clear, USG 1.02, pH 7.3, protein negative, all else negative/normal; sediment inactive	8 mL, collected by cystocentesis
PLEURAL FLUID		
Cholesterol:triglyceride ratio (<0.2 is consistent with chylous effusion)	0.08	
Triglyceride	2051 mg/dL	
Cholesterol	169 mg/dL	
SNAP 4Dx (IDEXX, idexx.com)	Negative for heartworm, *Ehrlichia* species, *Borrelia burgdorferi*, *Anaplasma* species	

AST = aspartate aminotransferase; USG = urine specific gravity

benefit could be appreciated. Due to signs of nausea and inappetence, an antacid was also prescribed to help support appetite (omeprazole 40 mg q12h for 7 days).

Surgical Options

Surgical treatment can include thoracic duct ligation, cisterna chyli ablation, and/or pericardiectomy; varying success rates are reported for each. Often the procedures are combined to increase success rates.[1] Another option is placement of a port to facilitate drainage of chyle into the peritoneal space for resorption or into the subcutaneous space for removal. The prognosis after surgical treatment ranges from good to excellent, but the optimal surgical procedure to treat canine chylothorax is unknown due to low case numbers and the variety of interventions reported.

Nutritional Management

The clients in this case report elected surgical intervention; however, to help stabilize the patient before surgery and optimize the surgical outcome, initiation of nutritional management to address the hyporexia, vomiting, diarrhea, and weight loss was recommended. It was suspected that the vomiting and diarrhea may have been associated with chronic enteropathy as well as the chylothorax.

Typically, a low-fat diet is recommended to reduce dietary fatty acid production, absorption, and transport through the lymphatic system. In theory, a low-fat diet may reduce the chylous component of the effusion and facilitate resorption of fluid from within the pleural

Rutin is a nutraceutical that may purportedly increase lymphatic vessel uptake of edema fluid. Rutin has led to some improvement in cats with chylothorax, but it has not been evaluated in dogs.[3,4]

TABLE 2 Homemade Diet Prescribed

NUTRIENT	INGREDIENT	AMOUNT OF COOKED FOOD, GRAMS/DAY
Protein	Turkey: white meat (ground turkey, fat free [<1% fat], or turkey breast meat), cooked	239
Carbohydrate	White rice: long grain, cooked	283
Fiber	Sweet potato: cooked, boiled, flesh only/no peel	185
Fat	Oil, walnut	3.2 (or ⅔ tsp)
	Oil, salmon	3 (or ⅔ tsp)
	Oil, medium-chain triglyceride (MCT oil, liquid; NOW Foods, nowfoods.com)	17 (or 3 ⅔ tsp)
Nutritional supplements (added daily to food)	Chef's Canine Complete Vitamin/Mineral Supplement (My Pet Grocer, mypetgrocer.com)	9.8 (or 2 scoops)
Total		740

MCT = medium-chain triglyceride

space; however, the fluid volume produced may remain unchanged. Because the patient had a history of weight loss and hyporexia, he needed a palatable diet and close monitoring of body weight. As food-responsive chronic enteropathy was suspected, selecting a novel protein diet was prioritized. Historically, this dog was noted to be extremely picky and food aversions to various commercial diets had developed; thus, a homemade diet with higher palatability was also recommended.

A homemade diet using turkey as the protein source was formulated (**TABLE 2**), which was novel according to the patient's diet history (i.e., turkey had not been previously fed). The key nutrients of concern were:

- Total fat and fat type (long-chain versus medium-chain triglycerides)
- Calorie density
- Electrolytes (sodium, chloride, and potassium)
- Protein/essential amino acids

In theory, a low-fat diet may reduce the chylous component of the effusion and facilitate resorption of fluid from within the pleural space; however, the fluid volume produced may remain unchanged.

The diet provides 1.44 kcal/gram: 35% protein; 5.2% fat (1.29% linoleic acid); 2.5% fiber on a dry matter basis, which is equivalent to 7.8 g protein/100 kcal; as well as a total of 1.15 g fat/100 kcal and 31% protein, 10% fat, and 59% carbohydrate on metabolizable energy basis. The plan was to offer this diet in 3 meals per day. This diet was considered "ultra low fat" but meets the required minimum per Association of American Feed Control Officials recommendations (aafco.org) for the essential fatty acid linoleic.

OUTCOME

The patient consumed the prescribed homemade diet readily. He gained 1 kg (total body weight, 32 kg) at a 4-week recheck, his stool quality improved (fecal score 2 to 3/9), and vomiting resolved. His body condition score slightly improved to 4 to 5/9.

FOLLOW-UP

Although no clinical signs were appreciated, repeat radiographs confirmed reaccumulation of pleural fluid after 8 weeks and surgical intervention was planned. The patient underwent thoracic duct ligation, subtotal pericardiectomy (open), pleural port placement, paracostal celiotomy and mesenteric lymphangiography, and chest tube placement. His recovery was uneventful; at his recheck examination 1 month later, there was no evidence of any effusion. His body weight remained stable at 33 kg with a body condition score of 5/9. The clients elected to continue the homemade diet because the patient's appetite was robust, stool quality and consistency were excellent, and he seemed more stable than when fed the previous hydrolyzed diet.

SUMMARY

In the veterinary literature, evidence outlining successful treatment of idiopathic chylothorax in dogs and cats is limited; most commonly published are case reports or small case series.[2] Currently, surgical interventions are recommended over medication and nutritional management alone.[2] In 1 study of cats, nutritional and medical management was chosen instead of surgery, but mortality rates were high (>80%); further studies are needed to define the best treatment approach.[7]

In this patient with idiopathic chylothorax, nutritional management using a homemade diet along with thoracocentesis and rutin successfully stabilized the patient before surgical intervention. There is currently a paucity of research on management of idiopathic chylothorax in small animals, especially regarding nutritional management, although diets that are very low in fat are often attempted as a nutritional intervention. In this patient, chronic enteropathy/protein-losing enteropathy was a potential differential that was not pursued but was considered as a comorbidity. Full discussion of chronic enteropathy in dogs is beyond the scope of this article; however, further reading can be found in **Additonal Resources**. It is not known whether the diet fed affected this patient's chylothorax, but because of improvements in his body weight and fecal scores, the homemade diet was continued for best management of suspected food-responsive chronic enteropathy. TVP

Additional Resources

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