

# Chylothorax – Feline

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## Definition

*Chylothorax* is the accumulation of a chylomicron-containing effusion in the pleural space.

## Key Diagnostic Tools and Measures

The presence of pleural effusion will be noted on thoracic radiography. Patients with sufficient effusion to impede lung expansion will present with clinical signs of tachypnea, dyspnea, exercise intolerance, and muffled heart sounds on auscultation. Diagnosis is confirmed by performing a thoracocentesis and an analysis and cytology on the resulting fluid. Further imaging, blood work, and diagnostic testing may be indicated to determine an underlying cause.

A complete diet history should be taken that includes information about typical food intake and any commercial pet foods and treats that the patient receives including table foods or scraps (see Appendix II).

The patient's nutritional status should be assessed with special attention paid to the presence and duration of anorexia, evidence of weight loss (in particular, muscle wasting), feasibility of assisted feeding, and concurrent medical conditions.

## Pathophysiology

Normally the chyle, which originates from intestinal lymphatic drainage, flows into the thoracic duct via the cisterna chyli and, in turn, empties into the venous system in the cranial thorax. Any condition causing an imbalance between chyle production and clearance that leads to increased pressure within the lymphatics can result in leakage of chyle into the pleural space. Underlying causes reported in cats include heart disease and the presence of a cranial mediastinal mass; however, idiopathic disease is not uncommon.

Patients with chylothorax are often lethargic and have a poor appetite. The impact of poor food intake on nutritional status is exacerbated by the loss of protein, fat, vitamins, electrolytes, and water if repeated palliative thoracocentesis becomes necessary to relieve respiratory distress.

## Signalment

Older cats and oriental breeds (Siamese and Himalayan) are reported to be at increased risk of developing chylothorax.

## Key Nutrient Modifications

Fat-restricted diets have been advocated as part of the medical management of chylothorax, the rationale being that a reduction in dietary fat absorption could translate into a reduction in chyle production. In addition to fat restriction, dietary supplementation with medium chain triglycerides (MCT) has been recommended. The rationale for MCT use is that these triglycerides can be absorbed directly into the portal blood and therefore can serve to increase the energy density of the diet without increasing chyle production.

While there have been case reports and retrospective studies of patients that were fed fat-restricted diets as part of the treatment they received, there are no prospective clinical trials investigating the efficacy of dietary fat restriction in companion animals. An investigation of normal dogs found that while varying the quantity and type of fat in the diet could affect the triglyceride makeup of the chyle, it did not alter the rate of lymph flow.<sup>1</sup> Furthermore, studies have found that when the diet of normal dogs

is supplemented with MCT, significant amounts of MCT appear in the chyle.<sup>2,3</sup>

In conclusion, there is neither strong evidence nor a strong rationale for the use of dietary fat restriction for the management of feline chylothorax. It may be possible that by reducing the amount of chylomicrons in the lymph through dietary fat restriction, the resulting effusion is more readily resorbed from the pleural space. However, cat foods that are fat-restricted are also low in caloric density and this must be taken into consideration when managing a patient that is likely to have a poor appetite and may have already experienced significant deterioration in nutritional status.

## Recommended Ranges of Key Nutrients

Nutrient	% DM	mg/100 kcal	% DM	mg/100 kcal
	Recommended dietary level		Minimum dietary requirement*	
Total dietary fat	9–12	<3.5	9.0	2.25

Modified intake of these nutrients may help address metabolic alterations induced by disease states. The recommended dietary composition is shown as percent of dietary dry matter (DM) and as g or mg per 100 kcal metabolizable energy. All other essential nutrients should meet normal requirements adjusted for life stage, lifestyle, and energy intake.

\* Nutrient requirement for adult animals as determined by the Association of American Feed Control Officials

Note that nearly all fat-restricted cat foods have been purposely calorie-restricted for weight control and are not indicated for patients that are experiencing anorexia and weight loss.

## Therapeutic Feeding Principles

Therapeutic options for patients with idiopathic chylothorax include both medical and surgical management. In some cases, the effusion may spontaneously resolve after several weeks or months; however, the prognosis for cats with this condition should be considered guarded.

As previously stated, there is neither strong evidence nor a strong rationale for the use of dietary fat restriction for the management of feline chylothorax and the use of such a feeding strategy may further compromise nutritional status in a patient with poor food intake, particularly if it is undergoing repeated palliative thoracocentesis.

Diet selection should be predicated on finding a complete and balanced cat food that is acceptable to the patient. Unless contraindicated due to a concurrent condition, a high-protein diet may be beneficial, particularly for patients that are undergoing repeated thoracocentesis.

If a patient's weight is stable and the patient is in good body condition, a fat-restricted diet (<30% fat, energy basis) could be introduced on a trial basis. Care should be taken to give specific feeding directions and to monitor food intake and body weight to ensure that the patient is able to consume enough of the food to meet energy needs.

Patients who refuse food or have inadequate voluntary intake should be evaluated as candidates for assisted feeding. Ideally these patients should receive a complete and balanced diet by the enteral route. Parenteral nutritional support has been used to treat human patients with chylothorax. The etiology of this condition in humans, however, generally differs from that in cats so there is no clear rationale to feed by the parenteral route when enteral nutrition is feasible.

■ **Treats** – When selecting treats, it is relatively easy to avoid very high-fat

items (e.g., fat trimmings from meat, fried foods, cream) and it may be prudent to do so. Acceptable treats would include lean meats or fish (e.g., baked chicken breast, tuna packed in water), low-fat dairy products, and fresh fruits and vegetables (with the exception of grapes and onions).

■ **Tips for Increasing Palatability** – Unless there are clear indications for feeding a fat-restricted food (<30% fat, energy basis), diet selection should be predicated on finding a complete and balanced cat food that is acceptable to the patient. Adding some warm water to a dry food or slightly warming a canned food may enhance acceptance.

■ **Diet Recommendations** – Many cats diagnosed with chylothorax will present with a history of anorexia. It is essential to monitor the patient's food intake and body weight to ensure that the patient's voluntary consumption is adequate. The goal will be to find a diet that the patient eats readily and is appropriate for any concurrent condition that the patient may have (e.g., heart disease). Low-fat, calorie-restricted diets should only be used in patients that will readily consume them in amounts sufficient to meet their energy needs

For patients in good body condition, feeding portions should be based on previous caloric intake. For underweight patients, calories offered should be increased by 20% above previous intake to promote weight gain and adjusted as necessary based upon response.

### Client Education Points

- All members of the household should understand that while dietary management may not play a direct role in the management of chylothorax, patients with this condition are at risk of becoming malnourished. Therefore, it is of particular importance to monitor the patient's food intake and body condition to enable early detection of weight loss.

## Common Comorbidities

**Heart Disease.** Feline chylothorax has been reported in association with cardiomyopathy (particularly secondary to hyperthyroidism), heartworm disease, congenital cardiac abnormalities, and pericardial effusion. Therefore a complete cardiac workup is indicated in cats diagnosed with a chylous pleural effusion as treatment of the underlying heart condition could lead to resolution of the chylothorax.

**Neoplasia.** Conditions causing an anterior mediastinal mass including lymphosarcoma and other forms of neoplasia can lead to chylothorax. If a mass is identified it should be biopsied or aspirated to obtain a diagnosis in order to permit appropriate therapeutic measures to be taken.

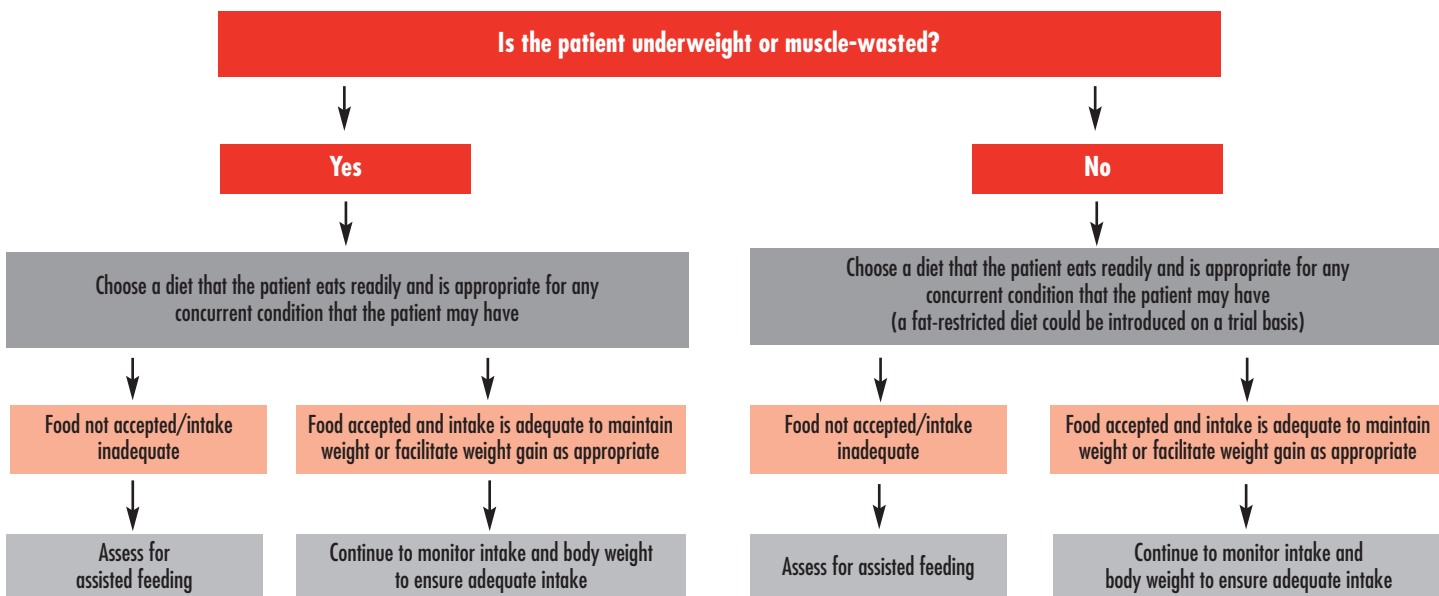
## Interacting Medical Management Strategies

As previously mentioned, patients with chylothorax may require repeated palliative thoracocentesis leading to the loss of fluid, electrolytes, protein, fat, and vitamins. Patients with chylothorax secondary to an underlying condition such as heart disease may benefit from dietary therapy targeted at that condition.

## Monitoring

Patients with idiopathic chylothorax will require monitoring on a regular basis to assess the rate of accumulation of fluid in the pleural cavity and whether there is a need for repeat thoracocentesis or other therapeutic intervention. Patients undergoing repeated thoracocentesis are at risk of developing dehydration, electrolyte imbalance (hyponatremia, hyperkalemia), hypoproteinemia, and malnutrition. Therefore, assessment of fluid and electrolyte balance as well as voluntary food intake, body weight, and body condition should be performed during patient rechecks.

## Algorithm – Nutritional Management of Feline Chylothorax



# Critical Care Nutrition – Canine

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## Definition

*Critical illnesses* have a significant impact on nutritional status of dogs and often lead to overt malnutrition. Nutritional support of critically ill dogs is an important part of medical therapy and may play a role in improving outcome. Dogs with critical illnesses often have reduced nutritional intake, vomiting, diarrhea, and possibly altered nutritional requirements, all of which can impact their nutritional status.

## Key Diagnostic Tools and Measures

Designing a nutritional plan entails performing a nutritional assessment to establish the specific needs and considerations for the patient. Body Condition Scoring (BCS) is an important part of nutritional assessment. Biochemistry profiles are also helpful in identifying important considerations for the nutritional plan. For the majority of critically ill dogs, nutritional support should be aimed at meeting resting energy requirements (RER) initially and adjusting the calories provided based on frequent re-assessment.

## Pathophysiology

Critical illness imparts various changes in metabolism that impact the nutritional state of the patient. In a response to inflammation and injury, there are alterations in carbohydrate, protein, and lipid metabolism. The various changes in metabolism, combined with the effects of reduced dietary intake, result in a negative energy balance or a catabolic state. Dogs in a catabolic state may experience more complications and may have poorer rates of recovery. Reversal of the catabolic condition requires addressing the primary cause of disease and provision of adequate nutritional support.

## Signalment

Patients that may be at greater risk for malnutrition include very young and geriatric patients. This may reflect the relative greater difficulty in providing nutritional support for patients in these age categories.

## Key Nutrient Modifications

- Critically ill patients with a negative energy balance may have a greater need for protein to maintain lean body mass.
- Protein should be of good quality and highly digestible.
- Special considerations may include patients with comorbidities such as renal or hepatic failure, where increased protein may be contraindicated.
- More specific nutrient requirements will depend on the nature of the underlying disease.
- Antioxidants may be an important component of therapies intended for critically ill animals, however, specific dosages have not been determined.
- Other nutrients such as glutamine, arginine, omega-3 fatty acids may also be helpful in certain conditions, but specific or optimal dosages have not been established.

## Recommended Ranges of Key Nutrients

Nutrient	% DM	g/100 kcal	% DM	g/100 kcal
	Recommended dietary level		Minimum dietary requirement*	
Protein	20–45	6–9	18	5.1
Fat	25–35	5–7	5	1.4

Modified intake of these nutrients may help address metabolic alterations induced by disease states. The recommended dietary composition is shown as percent of dietary dry matter (DM) and as g or mg per 100 kcal metabolizable energy. All other essential nutrients should meet normal requirements adjusted for life stage, lifestyle, and energy intake.

\*Nutrient requirement for adult animals as determined by the Association of American Feed Control Officials

Correction of negative energy balance is critical.

## Therapeutic Feeding Principles

An important part of the nutritional plan is establishing the most appropriate route of nutritional support. In the absence of a contraindication, it is preferable to feed the dog via the enteral route. Contraindications for enteral nutrition include protracted vomiting, regurgitation or diarrhea, inability to guard the airway, and intolerance for feedings (e.g., gastric atony). In patients that could tolerate enteral feedings but there is no adequate voluntary intake (approximately 75% of energy requirements), a feeding tube should be placed. For short-term assisted feeding (<3 days) a nasoesophageal feeding tube may be appropriate but this requires a liquid diet. Should nutritional support be required for longer than 3 days, use of an esophagostomy or gastrostomy feeding tube is usually indicated.

Once a feeding tube is in place, feedings should aim to provide 50% of calculated calories in the first day, and gradually increasing to 100% of calculated calories over next 2 days. In severely affected patients, initial nutritional support should start at 33% of calculated calories. Diets typically recommended for tube feeding are high in calories, protein, and fat. It is very important to ensure that the diet chosen is appropriate for the feeding tube being used (i.e., the consistency of the diet must not occlude the tube). In patients in which the enteral route cannot be used, parenteral nutrition is necessary. Formulation of parenteral nutrition is tailored to the patient and requires special formulation and handling.

■ **Treats** – For critically ill animals, the use of treats is usually ineffective at meeting energy and nutrient requirements and only delays more appropriate nutritional support. Animals receiving tube feedings may be offered treats to assess return of appetite. Provision of enteral and/or parenteral nutrition does not interfere with the assessment of appetite.

■ **Tips for Increasing Palatability** – The use of appetite stimulants in critically ill animals is not recommended as they are ineffective at restoring adequate nutritional intake. Techniques such as hand feeding or warming the food may be attempted but are also typically ineffective at achieving adequate nutritional support.

■ **Diet Recommendations** – Diets typically used in nutritional support of critically ill dogs are usually energy dense, high in protein and fat

content, and have high digestibility. Many prescription diets recommended for tube feeding are also very high in water content and are amenable for tube feeding with minimal modification. Most diets, however, will need to be modified in order to be used effectively with feeding tubes. With small-gauge tubes, typically used for nasoesophageal access, complete liquid diets are the only acceptable diets.

### Client Education Points

- As many recovering patients can be discharged from the hospital with the feeding tube in place (e.g., esophagostomy, gastrostomy tubes), clients need to be instructed how to use and care for the feeding tubes.
- Clients need to be made aware of possible complications and how to detect them.
- Clients should be provided with detailed and specific instructions for how to use feeding tubes. This should include instructions of how to prepare the diet and how to administer the feedings.

### Common Comorbidities

Patients with critical illness often have several affected organ systems which may impact the nutritional plan. More serious comorbidities include

concurrent congestive heart failure, renal failure, hepatic failure, respiratory failure, gastrointestinal dysfunction, neurologic dysfunction, and systemic infection.

### Interacting Medical Management Strategies

Various antibiotics may cause nausea, vomiting, or diarrhea. Chemotherapeutic agents may cause severe gastrointestinal complications. Diuretics and angiotensin-converting enzyme (ACE) inhibitors may also decrease appetite.

### Monitoring

All critically ill patients receiving nutritional support should be closely monitored for possible complications related to nutritional support. Patients with feeding tubes should be inspected for infection/inflammation at the surgical exit site. Biochemical and hematologic tests may also be helpful in identifying metabolic complications. Although body weight and body condition scores are essential in patients receiving nutritional support, weight gain per se is not necessary.

## Algorithm – Nutritional Support of Critically Ill Canine Patients

