

Vet-LIRN Update on Investigation into Dilated Cardiomyopathy

Updated June 27, 2019

This update describes FDA and Vet-LIRN's investigative efforts through April 2019 at a level of technical detail geared toward veterinarians. For more general information, please visit FDA Investigation into Potential Link between Certain Diets and Canine Dilated Cardiomyopathy ([/animal-veterinary/news-events/fda-investigation-potential-link-between-certain-diets-and-canine-dilated-cardiomyopathy](#)).

In July 2018, the FDA alerted ([/animal-veterinary/cvm-updates/fda-investigating-potential-connection-between-diet-and-cases-canine-heart-disease](#)) the public about an investigation into reports of canine dilated cardiomyopathy (DCM) in dogs eating certain pet food. DCM itself is not considered rare in dogs, but these reports are unusual because many of the reported cases occurred in breeds of dogs not typically genetically predisposed to the disease and were reported to have been fed diets containing legumes like peas or lentils, other legume ingredients (pulses) or potatoes as main ingredients. Many of these products are labeled as “grain-free” or “zero-grain.”

Since then, the FDA's Center for Veterinary Medicine (CVM) has taken a multi-pronged approach to the investigation. CVM veterinarians, nutritionists, pathologists and epidemiologists are collaborating with several sectors of the animal health world to collect and evaluate information about the DCM cases and the diets pets ate prior to becoming ill. A key partner in the investigation is the Veterinary Laboratory Investigation and Response Network (Vet-LIRN), a collaboration of government and veterinary diagnostic laboratories.

Case Investigation

Between January 1, 2014 and April 30, 2019, the FDA received 524 reports of involving 560 dogs and 14 cats diagnosed with DCM. The FDA additionally received many reports of non-DCM cardiac disease in dogs and cats during this timeframe. To better understand the reported cardiac diseases, FDA investigated many of the DCM cases, as well as some of these non-DCM cardiac cases, by reviewing medical records and performing dietary and environmental exposure interviews. Additionally, FDA is working to determine whether there is a disease continuum that includes early cardiac changes that could indicate developing DCM or if there are other cardiac changes of importance.

FDA’s review of medical records for reports is ongoing and the following data are a summary for only a subset of collected medical records for both DCM and non-DCM cardiac cases as of April 30, 2019. Of 340 dogs and 9 cats whose medical records were reviewed, 202 dogs and 6 cats were DCM cases with heart changes characteristic of DCM on cardiac ultrasound – including decreased ventricular systolic function and dilation. Approximately 61% of dogs (n=123) and 100% of cats (n=6) with confirmed DCM had progressed to congestive heart failure. Of the pets with confirmed DCM, approximately 15% (n=32) also had evidence of valvular degeneration and 12% (n=24) had atrial fibrillation. Approximately 38% (n=77) of dogs with DCM had a history of confirmed or suspected allergies or sensitivities to an environmental and/or food allergen that was manifested as dermatitis, otitis, or gastrointestinal disease. Approximately 9% (n=18) and 8% (n=17) of dogs with DCM had a history of hypothyroidism and one or more tick-borne diseases (e.g. Lyme, Anaplasmosis), respectively.

Non-DCM Cardiac Cases:

According to the medical records reviewed for the non-DCM cardiac disease cases, other cardiac changes were present on echocardiogram, including degenerative valvular disease, tricuspid and mitral valve regurgitation, and borderline to decreased left ventricular systolic function. For animals without DCM, there may be a spectrum of cardiac changes visualized on echocardiogram (e.g. borderline decreased left systolic function in the absence of left ventricular dilation) if the animal is progressing toward or recovering from DCM. While not DCM, these cases are important to report to FDA, so we may better understand if they could be related to development of DCM or associated with certain diets.

Taurine levels and cardiac disease status:

One hundred seventy-six dogs and 3 cats (including both DCM and non-DCM cases) had both a taurine measurement and an echocardiogram (Table 1). A full summary of the taurine status and echocardiogram findings for the pets with a taurine measurement and echocardiogram is included in Table 1. Approximately 64% of dogs with DCM had a taurine measurement. Of the pets diagnosed with DCM and tested for taurine, approximately 42% had at least one low blood taurine value (Table 3). Golden Retrievers represented approximately 37% of all dogs with low taurine and DCM and approximately 48% of all dogs with low blood taurine regardless of type of cardiac findings. Table 2 shows the reported breed frequency for each category by breed of dog. Table 3 shows the taurine results for all dogs and cats with DCM.

Table 1. Number of pets with various taurine levels (either whole blood and/or plasma) and echocardiogram changes based on medical record review for dogs with a taurine test.

Taurine Status	DCM	Non-DCM Cardiac Changes	Normal Heart
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Taurine Status	DCM	Non-DCM Cardiac Changes	Normal Heart
Low	53 (51 dogs, 2 cats)	21 dogs	10 dogs
Normal	38 dogs	10 dogs	4 dogs
High	28 (27 dogs, 1 cat)	1 dog	
Mixed*	6 dogs		
Unknown	8 dogs		

*Mixed values include a normal whole blood taurine with low plasma taurine, increased whole blood taurine with normal plasma taurine, or normal whole blood taurine with increased plasma taurine.

Table 2. Pet breeds grouped by taurine (Tau) status and echocardiogram changes for dogs with a Tau test.

Taurine Status	Diagnosis	Number of Pets by Breed (dogs) of Species*
Low	DCM	Golden Retriever (19), Labrador Retriever (4), Samoyed (3), 2 each: Cocker Spaniel, Goldendoodle, Mixed Feline, Pitbull Mix; 1 each: American Staffordshire Terrier, Australian Shepherd, Blueheeler Mix, Bluetick Coonhound, Doberman Mix, Boxer, Boxer mix, Coton de Tulear, French Bulldog, Golden Retriever Mix, Great Dane, Great Dane Mix, Maltese, Pitbull, Rhodesian Ridgeback Mix, Sheepadoodle, Standard Poodle, Standard Schnauzer, Vizsla Mix
Normal	DCM	Doberman Pinscher (5), Golden Retriever (4), Great Dane (4), Labrador Retriever (3), 2 each: Labrador Retriever Mix, Pitbull, Shetland Sheepdog; 1 each: Australian Shepherd Mix, Boston Terrier, Bulldog Mix, German Shepherd, German Shorthaired Pointer, Goldendoodle, Hound Mix, Miniature Schnauzer, Newfoundland Mix, Rhodesian Ridgeback, Shih Tzu, Standard Poodle, Wheaten Terrier, Welsh Terrier, Yorkshire Terrier, Yorkshire Terrier Mix
High	DCM	Great Dane (4), 2 each: American Staffordshire Terrier, Australian Cattle Dog, German Shepherd; 1 each: Akita, Australian Shepherd, Basenji, Beagle, Beagle Mix, Boston Terrier, Collie Mix, French Bulldog, German Shepherd Mix, Golden Retriever, Labrador Retriever, Mastiff, Miniature Australian Shepherd, Miniature Schnauzer, Mixed Feline, Pug, Unknown Crossbreed, Yorkshire Terrier
Mixed [^]	DCM	1 each: Boxer Mix, Catahoula Leopard Dog, German Shepherd, Great Dane, Pitbull, White Shepherd
Unknown	DCM	1 each: Beagle Mix, Chesapeake Bay Retriever, English Setter, German Shorthaired Pointer, Miniature Schnauzer, Pitbull Mix, Pomeranian, Unknown Crossbreed
Low	Non-DCM Changes	Golden Retriever (13), 1 each: American Staffordshire Terrier, Doberman Pinscher, Flat Coated Retriever, Golden Retriever Mix, Labrador Retriever Mix, Poodle-Wheaten Terrier Mix, Rough Collie, Wire Hair Pointing Griffon

Taurine Status	Diagnosis	Number of Pets by Breed (dogs) of Species*
Normal	Non-DCM Changes	Golden Retriever (4), Doberman Pinscher (2), 1 each: Chihuahua, Pitbull Mix, Shetland Sheepdog, Whippet
High	Non-DCM Changes	German Shepherd Mix (1)
Low	Normal	Golden Retriever (7), 1 each: Corgi, Goldendoodle, Labradoodle
Normal	Normal	Golden Retriever (4)

*Cats only

^ Mixed values include a normal whole blood taurine with low plasma taurine, increased whole blood taurine with normal plasma taurine, or normal whole blood taurine with increased plasma taurine.

Table 3. Taurine results by blood sample measured for dogs and cats with confirmed DCM.

Taurine Status*	Whole Blood only	Plasma only	Whole Blood and Plasma	Whole Blood with normal Plasma	Plasma with Normal Whole Blood	Unknown
Low	25 dogs	16 dogs, 2 cats	8 dogs		2 dogs	2 dogs
Normal	26 dogs	2 dogs	7 dogs			3 dogs
High	14 dogs	6 dogs	7 dogs, 1 cat	1 dog	3 dogs	
Unknown						7 dogs

*The taurine status is based on reference ranges used by the laboratory that performed the test.

Course of disease:

According to recheck echocardiograms in the medical records, some pets with DCM improved after veterinary treatment, diet change, and taurine supplementation, while others improved with appropriate veterinary care and diet change alone. Vet-LIRN has requested 30 additional repeat echocardiograms to better understand DCM heart changes over time. The repeat echocardiogram reports are being evaluated and compared to the initial echocardiogram parameters to better understand the effects of diet change and/or taurine supplementation on the heart.

Vet-LIRN is also reviewing medical records and recheck echocardiograms for dog breeds predisposed to develop DCM and consuming grain-free diets. In a few cases, predisposed dog breeds diagnosed with DCM have improved after diet change. One example involved two Doberman Pinscher littermate housemates fed a grain-free poultry and egg product for approximately 2 years. The 4-year-old castrated male presented first for dyspnea, weight loss, and cough. He was diagnosed with congestive heart failure and treated with furosemide and pimobendan. A cardiologist diagnosed DCM on echocardiogram and added enalapril and spironolactone to the treatment. The 4-year-old spayed female concurrently presented to the cardiologist with slight hyporexia and was diagnosed with occult DCM. She was treated with pimobendan, magnesium orotate, and enalapril. The male and female had normal whole blood taurine values of 335 and 342, respectively. On genetic testing, the male and female were positive (heterozygous and homozygous, respectively) for one mutation and negative for another. Both dogs were transitioned to a grain-containing food. At the 3-month recheck, both dogs had clinically and sonographically improved. Taurine and omega-3 fatty acids were then added to the treatment plan for both dogs, and magnesium orotate was added only for the male.

Table 4. Echocardiogram changes in two 4-year-old littermate, housemate Doberman Pinschers.

Dog	Initial Echocardiogram	3-month Recheck Echocardiogram*
Male	<ul style="list-style-type: none"> • Left ventricular dilation <ul style="list-style-type: none"> ◦ severe • Left ventricular systolic dysfunction <ul style="list-style-type: none"> ◦ severe • Left atrial dilation <ul style="list-style-type: none"> ◦ moderate • Mitral valve regurgitation <ul style="list-style-type: none"> ◦ mild to moderate • Right ventricular enlargement <ul style="list-style-type: none"> ◦ mild • Right ventricular systolic function <ul style="list-style-type: none"> ◦ mild 	<ul style="list-style-type: none"> • Left ventricular dilation <ul style="list-style-type: none"> ◦ moderate to severe • Left ventricular systolic dysfunction <ul style="list-style-type: none"> ◦ moderate-static • Left atrial dilation <ul style="list-style-type: none"> ◦ moderate • Mitral valve regurgitation <ul style="list-style-type: none"> ◦ mild to moderate

Dog	Initial Echocardiogram	3-month Recheck Echocardiogram*
Female	<ul style="list-style-type: none"> • Left ventricular dilation <ul style="list-style-type: none"> ◦ moderate to severe • Left ventricular systolic dysfunction <ul style="list-style-type: none"> ◦ moderate to severe • Left atrial dilation <ul style="list-style-type: none"> ◦ mild • Mitral valve regurgitation <ul style="list-style-type: none"> ◦ mild to moderate • Tricuspid valve regurgitation <ul style="list-style-type: none"> ◦ trace • Right ventricular enlargement <ul style="list-style-type: none"> ◦ mild • Right ventricular systolic function <ul style="list-style-type: none"> ◦ low normal 	<ul style="list-style-type: none"> • Left ventricular dilation <ul style="list-style-type: none"> ◦ mild • Left ventricular systolic dysfunction <ul style="list-style-type: none"> ◦ mild-static • Mitral valve regurgitation <ul style="list-style-type: none"> ◦ trace

*Approximately 3-months post diet change

Necropsy

As of April 30, 2019, Vet-LIRN has reviewed results of 19 gross necropsies from dogs with suspected heart disease, including 13 necropsies that Vet-LIRN coordinated from cases reported through the FDA Safety Reporting Portal. There is 1 additional necropsy pending evaluation. All dogs either died naturally or were euthanized and did not necessarily have a pre-mortem diagnosis of DCM. Vet-LIRN has completed 13 gross heart examinations and measured dimensions including chamber lumen diameter, chamber wall thickness, and valve circumference. Vet-LIRN collected other tissues for histopathology, including liver, kidney, gastrocnemius muscle, eye, lung, and spleen for 10 of the 13 requested necropsies. Histopathology results and data analysis are in progress. Preliminary findings from the hearts of dogs with DCM include cardiac muscle atrophy and degeneration, mild inflammation, and accumulation of fat. Two of three dogs that did not have DCM had cancer, and one dog had non-DCM chronic heart disease. Necropsy results and analysis will enable Vet-LIRN to evaluate the cases for any common histopathological lesions that could suggest a cause for illness and to confirm the antemortem diagnosis.

Prospective Diagnostic Sample Testing

Vet-LIRN has been collaborating with Chesapeake Veterinary Cardiology Associates (CVCA) to collect medical records, an owner interview, and diagnostic samples from pets with DCM diagnosed by a board-certified veterinary cardiologist by echocardiogram. These cases are included in the overall number of DCM cases, but were selected for further study because their ongoing program of care with the practice will be comprehensively documented and provided in full to Vet-LIRN.

Upon confirmation of a DCM diagnosis, CVCA will collect blood (whole blood and plasma), urine, feces, DNA swabs, and food, if the pet is not receiving any supplements (e.g. taurine, cystine, or methionine) and is still eating a diet labeled “grain-free.” Vet-LIRN will test the blood and urine for taurine, cystine, methionine, and other amino acids. Vet-LIRN is archiving feces and DNA from these cases for possible future testing.

CVCA will collect repeat urine, blood, and feces at 1 to 2 months and 6 months after the initial diagnosis and document any treatment or dietary changes, if any, that were recommended by the cardiologist. The repeat urine and blood samples will be tested for amino acid content and the feces archived. At the 6-month recheck, CVCA will also conduct a repeat echocardiogram to assess any changes to the heart. As of April 30, 2019, CVCA and Vet-LIRN have collected initial samples from 14 dogs, and 1 to 2-month samples from 10 dogs. CVCA is currently collecting the 6-month samples. Five dogs have been lost to follow-up, including 4 deaths, and will not complete the sample collection. Vet-LIRN is currently evaluating the heart histopathology for two of the deceased dogs. The initial and 1 to 2-month blood and urine samples have been tested and are being evaluated.

Vet-LIRN is also collecting food associated with each CVCA case and will test each diet for:

- protein, fat, moisture
- crude fiber, total dietary fiber, soluble fiber, insoluble fiber
- total starch, resistant starch
- free and total cystine, methionine, and taurine

As of April 30, 2019, the food testing is in progress.

Separate from the ongoing collaboration with CVCA, Vet-LIRN has contracted with a network lab to collect blood (whole blood and plasma), urine, feces, and DNA from healthy dogs without a known breed predisposition to DCM for comparison. The dog must also be consuming a grain-containing primary diet that meets the following criteria:

- not be labelled “grain-free”
- consuming the diet for at least 1 year before the samples are collected
- animal proteins are from either cattle, swine, poultry, and/or fish

- no more than 2 legume, pulse, or potato (including sweet potato) ingredients that must appear after the animal and grain ingredients
- the diet formulation was verified to be nutritionally adequate by animal feeding tests using AAFCO procedures

The blood and urine samples will be tested similarly to those collected in the cases from CVCA collaboration and compared to the values from the dogs diagnosed with DCM. As of April 30, 2019, Vet-LIRN has collected samples from 11 healthy dogs. The results are being tested and evaluated.

How You Can Help

FDA encourages veterinary professionals to report well-documented cases of DCM in dogs whose illness is suspected of having a link to diet. You can submit information by using the electronic Safety Reporting Portal (<https://www.safetyreporting.hhs.gov/>) or calling your state's FDA Consumer Complaint Coordinators (</safety/report-problem/consumer-complaint-coordinators>). The more information you can provide, particularly about feeding history, medical records, and diagnostic testing, the better. Detailed instructions can be found on [How to Report a Pet Food Complaint \(/animal-veterinary/report-problem/how-report-pet-food-complaint\)](/animal-veterinary/report-problem/how-report-pet-food-complaint). FDA will determine whether there is a need to conduct follow-up contact or to obtain diagnostic samples (e.g. tissue, blood, leftover food) for possible testing. While FDA does not necessarily respond to every individual complaint submitted, each report becomes part of the body of knowledge that helps to inform FDA on the situation or incident.

Additional Information

- [FDA Investigation into Potential Link between Certain Diets and Canine Dilated Cardiomyopathy \(/animal-veterinary/news-events/fda-investigation-potential-link-between-certain-diets-and-canine-dilated-cardiomyopathy\)](/animal-veterinary/news-events/fda-investigation-potential-link-between-certain-diets-and-canine-dilated-cardiomyopathy) (June 2019)
- [FDA Provides Third Status Report on Investigation into Potential Connection Between Certain Diets and Cases of Canine Heart Disease \(/animal-veterinary/cvm-updates/fda-provides-third-status-report-investigation-potential-connection-between-certain-diets-and-cases\)](/animal-veterinary/cvm-updates/fda-provides-third-status-report-investigation-potential-connection-between-certain-diets-and-cases) (June 2019)
- [Vet-LIRN Update on Investigation into Dilated Cardiomyopathy \(February 2019\) \(/animal-veterinary/science-research/vet-lirn-update-investigation-dilated-cardiomyopathy-february-2019\)](/animal-veterinary/science-research/vet-lirn-update-investigation-dilated-cardiomyopathy-february-2019)
- [Journal of American Veterinary Medical Association - Diet-associated dilated cardiomyopathy in dogs: what do we know? \(https://avmajournals.avma.org/doi/pdf/10.2460/javma.253.11.1390\) !\[\]\(448bd415caa8b52d2aeb4d58499267b2_img.jpg\)](https://avmajournals.avma.org/doi/pdf/10.2460/javma.253.11.1390)
(<http://www.fda.gov/about-fda/website-policies/website-disclaimer>)(December 2018)

