**AVMA**

**Respiratory Complications of Trauma**

Traumatic injury can result in multiple respiratory complications, according to Lori Waddell, DVM, DACVECC, clinical professor of critical care medicine at the University of Pennsylvania School of Veterinary Medicine (PennVet) in Philadelphia. At the 2017 American Veterinary Medical Association Convention in Indianapolis, Indiana, Dr. Waddell drew from her years of specialty training and clinical experience to educate the audience on this important topic in emergency medicine.

The various causes of thoracic trauma, whether accidental or intentionally caused by abuse, are generally categorized as blunt or penetrating, she said. Blunt trauma most commonly occurs from a fall or accident. According to Lori Waddell, veterinary trauma can also be one of the most profitable. By doing so, she said, your practice will see an increase in complications, staff satisfaction, and revenue.

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**AVMA**

**Why “Dental” Is a Dirty Word**

About 75% of dogs and cats seen in practice have dental disease, according to Jennifer Pierro, MS, DVM, DACVIM (Oncology), an oncologist at Veterinary Cancer Group in Los Angeles, California. Presenting at the 2017 Purdue Veterinary Conference in West Lafayette, Indiana, Dr. Pierro discussed updates in feline lymphoma and shared some unique aspects of how the disease differs in cats compared with dogs.

In dogs, the typical presentation of lymphoma is high-grade multicentric nodal disease. However, cats more commonly develop gastrointestinal (GI) lymphoma, typically without generalized lymphadenopathy. Clinical signs of lymphoma in cats also tend to be nonspecific, mimicking those of a range of other conditions such as pancreatitis and renal failure.

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**Purdue**

**Unique Aspects of Feline Lymphoma**

Lymphoma is different in cats than in dogs, emphasized Jennifer Pierro, MS, DVM, DACVIM (Oncology), an oncologist at Veterinary Cancer Group in Los Angeles, California. Presenting at the 2017 Purdue Veterinary Conference in West Lafayette, Indiana, Dr. Pierro discussed updates in feline lymphoma and shared some unique aspects of how the disease differs in cats compared with dogs.

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**ACVC**

**Critical Care Nutrition**

Critically ill animals require nutritional support. Patients with chronic diseases also have nutritional requirements that should be addressed as part of their treatment plan. “When patients are critically ill, they are constantly in a breakdown state,” said David Liss, RVT, VTS (ECC, SAIM), CVPM, in a presentation at the 2017 Atlantic Coast Veterinary Conference in Atlantic City, New Jersey. Seriously ill patients burn calories constantly. If they do not receive adequate nutrients through feeding, their bodies begin to break down skeletal muscle in an effort to recruit protein. Catabolism of protein adversely affects wound healing, immune function, and strength.

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**AVMA**

**Special Feature**

**In Time of Need: Veterinary Practices and Natural Disaster Preparedness**

By Don Vaughan

As Hurricane Irma menaced South Florida in September 2017, Christina Wood’s thoughts turned to her dog, Loki. The 9-year-old mixed breed was so sensitive to loud noises that he would cower under the couch during thunderstorms. How, she wondered, would Loki react to hours of deafening wind and rain? “I was afraid it was going to be a rough ride,” recalled Wood, a freelance writer based in Delray Beach. “I had given Loki Xanax for the storm, but how many are receiving dental care? Dentistry is one of the most overlooked and underappreciated services in veterinary medicine. But it can also be one of the most profitable.

At the 2017 American Veterinary Medical Association Convention in Indianapolis, Indiana, Dr. Waddell drew from her years of specialty training and clinical experience to educate the audience on this important topic in emergency medicine.

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**INVMA**

**Managing Invertebrates in Practice**

According to Jörg Mayer, DVM, MS, DABVP (ECM), DECZM, DACZM, associate professor of zoological and exotic animal medicine at the University of Georgia College of Veterinary Medicine in Athens, invertebrates are becoming increasingly popular as pets. Presenting at the Indiana Veterinary Medical Association’s 2018 annual meeting in Indianapolis, Dr. Mayer discussed some common problems in invertebrates and shared some basic techniques for managing invertebrates.

(continued on page 25)

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**Pain Management**

**Tramadol: Limited Benefit for OA Pain**

Tramadol is commonly used in dogs to manage pain associated with osteoarthritis (OA), a condition estimated to affect more than 20% of the adult canine population. Recent study findings, however, suggest that tramadol may offer limited therapeutic benefit.

Tramadol hydrochloride is a weak μ-opioid receptor agonist that provides centrally acting analgesia via 2 major metabolites: O-desmethyltramadol and N,N-didesmethyltramadol. Although tramadol was so sensitive to loud noises that he would cower under the couch during thunderstorms. How, she wondered, would Loki react to hours of deafening wind and rain? “I was afraid it was going to be a rough ride,” recalled Wood, a freelance writer based in Delray Beach. “I had given Loki Xanax for the storm, but how many are receiving dental care? Dentistry is one of the most overlooked and underappreciated services in veterinary medicine. But it can also be one of the most profitable.

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ProZinc® insulin is contraindicated in cats sensitive to protem zinc recombinant human insulin or any other ingredients in the ProZinc product. ProZinc insulin is contraindicated during episodes of hypoglycemia.

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Precautions: Animals presenting with severe ketoads, anorexia, lethargy, and/or vomiting should be stabilized with short-acting insulin and appropriate supportive therapy until their condition is stabilized. As with all insulin products, careful patient monitoring for hypoglycemia and hyperglycemia is essential to attain and maintain adequate glycemic control and to prevent associated complications. Overdosage can result in profound hypoglycemia and death. Proptosesting, certain endocrinopathies and glucocorticoids can have an antagonistic effect on insulin activity. Proptosesting and glucocorticoids use should be avoided.

Reproductive Safety: The safety and effectiveness of ProZinc insulin in breeding, pregnant, and lactating cats has not been evaluated.

Use in Kittens: The safety and effectiveness of ProZinc insulin in kittens has not been evaluated.

Adverse Reactions: Effectiveness Field Study

In a 45-day effectiveness field study, 176 cats received ProZinc insulin. Hypoglycemia (defined as a blood glucose value of ≤50 mg/dL) occurred in 71 of the cats at various times throughout the study. Clinical signs of hypoglycemia were generally mild in nature (described as lethargy, sluggish, weak, trembling, uncoordinated, giddy, glazed-eyed or dazed). In 17 cases, the veterinarian provided oral glucose supplementation or food as treatment. Most cases were not associated with clinical signs and received no treatment. Some cats that were not available for evaluation at the time of hypoglycemia also had clinical signs of hypoglycemia and seizures. All cases of hypoglycemia resolved with appropriate therapy and, if needed, a dose reduction.

Three cats had injection site reactions, which were described as either small, punctate, red lesions; lesions on neck; or palpable subcutaneous thickening. All injection site reactions resolved without cessation of therapy.

Four cats developed diabetic neuropathy during the study as evidenced by plantigrade states. Three cats entered the study with plantigrade stance, one of which resolved by Day 45. Four cats were diagnosed with diabetic ketonemia during the study. Two were euthanized due to poor response to treatment. Five other cats were euthanized during the study, one of which had hypoglycemia. Four cats had received ProZinc insulin for less than a week and were euthanized due to worsening concurrent medical conditions.

The following additional clinical observations or diagnoses were reported in cats during the effectiveness field study: vomiting, lethargy, diarrhea, cystitis/hematuria, upper respiratory infection, dry coat, hair loss, ocular discharge, abnormal vocalization, black stool, and rapid breathing.

Extended Use Field Study

Cats that completed the effectiveness study were enrolled into an extended use field study. In this study, 144 cats received ProZinc insulin for up to an additional 136 days. Adverse reactions were similar to those reported during the 45-day effectiveness study and are listed in order of decreasing frequency: vomiting, hypoglycemia, anorexia, poor appetite, diarrhea, lethargy, cystitis/hematuria, and weakness. Twenty cats had signs consistent with hypoglycemia described as: sluggish, lethargic, unsteady, mobile, seizures, trembling, or dawned. Most of these were treated by the owner or veterinarian with oral glucose supplementation or food; others received intravenous glucose. One cat had a serious hypoglycemic event associated with seizures and blindness. The cat fully recovered after supportive therapy and finished the study. All cases of hypoglycemia received with appropriate therapy and if needed, a dose reduction.

Fourteen cats died or were euthanized during the extended use study. In two cases, continued use of insulin despite anorexia and signs of hypoglycemia contributed to the deaths. In one case, the owner decided not to continue therapy after a presumed episode of hypoglycemia. The next were due to concurrent medical conditions or worsening of the diabetes mellitus.

To report suspected adverse reactions, or to obtain a copy of the Material Safety Data Sheet (MSDS), call 1-888-636-8226.

Information for Cat Owners: Please refer to the Cat Owner Information Sheet for more information about ProZinc insulin. ProZinc insulin, like other insulin products, is not free from adverse reactions. Owners should be advised of the potential for adverse reactions and be informed of the associated clinical signs. Potential adverse reactions include: hypoglycemia, insulin anagogen resistance, rapid insulin metabolism, insulin-induced hyperglycemia, and local or systemic reactions. The most common adverse reaction observed is hypoglycemia. Signs may include: weakness, depression, behavioral changes, muscle twitching, ataxia, anorexia. In severe cases of hypoglycemia, seizures and coma can occur. Hypoglycemia can be fatal if an affected cat does not receive prompt treatment. Appropriate veterinary monitoring of blood glucose, adjustment of insulin dose and regimen as needed, and stabilization of diet and activity help minimize the risk of hypoglycemic episodes. The attending veterinarian should evaluate other adverse reactions on a case-by-case basis to determine if adjustment in therapy is appropriate, or if alternative therapy should be considered.

Effectiveness: A total of 187 client-owned cats were enrolled in a 45-day field study, with 176 receiving ProZinc insulin. One hundred and fifty-one cats were included in the effectiveness analysis. The patients included various purebred and mixed breed cats ranging in age from 3 to 19 years and in weight from 4.6 to 20.8 pounds. Of the cats included in the effectiveness analysis, 101 were castrated males, 49 were spayed females, and 1 was an intact female. Cats were started on ProZinc insulin at a dose of 0.1 – 0.3 IU/lb (0.2 – 0.7 IU/kg) twice daily. Cats were evaluated at 7, 14, and 30 days after initiation of therapy, and the dose was adjusted based on clinical signs and results of 9-hour blood glucose curves on Days 7, 14, and 30. Effectiveness was based on survival control of diabetes, which was defined as improvement in at least one blood glucose variable (glucose curve means, standard deviation, or fractiles) and at least one clinical sign (polyuria, polydipsia, or body weight). Based on this definition, 115 of 151 cases (76.2%) were considered successful. Blood glucose curve means decreased from 415.3 mg/dL on Day 0 to 201.2 mg/dL by Day 45, and the mean blood glucose nark decreased from 407.9 mg/dL on Day 0 to 142.2 mg/dL on Day 45. Mean fructosamine values decreased from 305.9 µmol/L on Day 0 to 281.7 µmol/L on Day 45. Cats that completed the effectiveness study were enrolled in an extended use field study. The mean fructosamine value was 34.2 µmol/L after a total of 181 days of ProZinc therapy.

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CONFERENCE COVERAGE

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Making Connections

The prevalence of diabetes mellitus in dogs and cats is on the rise. According to Banfield’s State of Pet Health 2016 Report, the incidence of feline diabetes increased by 18.1% between 2006 and 2015—from 57.2 to 67.6 cases per 10,000 cats. And, although the prevalence is not nearly as high in dogs, the spike in canine diabetes incidence over the same time period was much more drastic—from 13.1 to 23.6 cases per 10,000 dogs, or 79.7%.

Diabetes in pets requires lifelong care and monitoring. It’s a diagnosis that can be overwhelming for pet owners, particularly those who have no familiarity with the disease. To ensure the best care for these patients, it’s vital that veterinary teams remain up-to-date on all aspects of this disease to provide clients with the best support and most accurate advice on how to manage their pet’s condition.

Even with the best intentions, many problems can result from mistakes in insulin choice, handling, or administration; errors in monitoring; and inappropriate feeding protocols. In this issue, J. Catharine Scott-Moncrieff, VetMB, MA, MS, professor of small animal internal medicine and head of the Department of Veterinary Clinical Sciences at Purdue University’s College of Veterinary Medicine, outlines how to avoid the many common errors that can affect a diabetic pet’s response to treatment (page 29).

As part of our multifaceted approach to providing expert veterinary insight, we’re also proud to announce our inaugural Pet Connections™ video series. This innovative series—the first of its kind in veterinary medicine—features candid discussions between pet owners and veterinary professionals on diseases and conditions affecting companion animals.

Diabetes was purposefully selected as the first Pet Connections™ topic because of its pervasiveness and the important role the veterinarian-client relationship plays in ensuring that diabetic pets live long, happy lives.

The program, which focuses on home management of pets with diabetes, is as valuable for veterinary professionals as it is for pet owners. Moderated by Richard Goldstein, DVM, DACVM, executive director and chief medical officer of US diagnostics for Zoetis, the program features Ruth MacPete, DVM, a practitioner in San Diego, California, and Brittney Cirone, a veterinary technician in Langhorne, Pennsylvania. The group is joined by Azi Chegini and her 3-year-old dog, Spider, who has diabetes.

With the look and feel of an intimate talk show, Pet Connections™ is both informative and conversational, touching on advances in diabetes diagnosis and management, and addressing the concerns of pet owners caring for a diabetic animal. The 14 segments in the series range from 3 to 10 minutes in length and encompass an array of important topics, including the signs of undiagnosed diabetes, the important role of veterinary technicians in the management process, and how to educate pet owners about home monitoring.

“One of the things that has changed, one of the things we do so much better now than we used to, is monitoring,” Dr. Goldstein explained. “There was a time when I was a resident and the only really reliable piece of data we had was owner perception.”

Also included in the program are 2 in-clinic videos hosted by Gary Edelson, DVM, owner of Imperial Point Animal Hospital of Delray in Delray Beach, Florida. Dr. Edelson provides viewers with an overview of insulin, including how to handle, store, and administer it, and discusses why monitoring is so important. Included is a demonstration of how to set up, use, and read a glucose meter—invaluable hands-on information for pet owners. All of the Pet Connections™ videos are available at AmericanVETERINARIAN.com/Pet-Connections.

Of course, diabetes will also be covered in depth at the 2018 Atlantic Coast Veterinary Conference. American Veterinarian has the great privilege of hosting this long-running conference from October 8 to 11 at the Atlantic City Convention Center in Atlantic City, New Jersey. Check out ACVC.org for the complete conference agenda, and be sure to take advantage of early-bird registration, which is available until June 30.

Thank you for reading!
THE HEALTH RISK OF HERBS

“Several herbs can cause deleterious effects,” says Narda G. Robinson, DO, DVM, MS, FAAMA, president and CEO of CuraCore Integrative Medicine and Education Centers. Some herbs within the Chinese medical system can be toxic, including herbal strychnine, which can harm the nervous system, and aconite, which is neurotoxic and cardiotoxic. Some herbs dissolve tissue when applied topically, and others, such as comfrey and chaparral, could be toxic to the liver when ingested. “Something that is normal for a person to use, such as tea tree oil, could be lethal for a small dog or cat even when applied topically, depending on the amount and its concentration,” Dr. Robinson adds.

Her advice: “When asking about medications during a patient history, also inquire about any herbs the pet is taking,” she says. “It’s equally important, however, for veterinarians to understand the pharmacologic—and potentially toxic—effects of those herbs and not to rely on folklore and mysticism.”

SEIZURES: WHEN LONG-TERM MEDICATIONS ARE NEEDED

There are several indications for starting a long-term medication when a seizure is diagnosed, says Andrew Linklater, DVM, DACVECC, clinical instructor at Lakeshore Veterinary Specialists in Wisconsin. “If a patient presents in status epilepticus, is having cluster seizures, or experiences several seizures over a 3- to 4-month period,” he says, “those are indications that we should start the patient on medication so we can control the seizures and prevent the seizure disorder from affecting the patient more frequently later in life.” With few exceptions, he says, when a long-term oral antiepileptic drug is prescribed, the animal will need to remain on the medication for the rest of its life, although the dose and even the medication itself may be changed over time.

CARDIOLOGY CONCERNS? DON’T SKIP THIS QUESTION

H. Edward Durham Jr, CVT, RVT, LATG, VTs (Cardiology), senior anesthesia technician at Ross University School of Veterinary Medicine, says too often veterinary professionals fail to ask about clinical signs the patient displays at night. “Many people forget that orthopnea often presents as the inability to become comfortable and sleep at night,” he says. “Clients will often report that their dog is pacing at night or lying down and getting up repeatedly, and that’s actually a form of orthopnea.” In failing to ask about nighttime habits, a veterinarian might miss subtle signs that a patient might be in or on the verge of heart failure.

THE ROLE OF STAFF IN RADIOGRAPHY

“Performing proper orthopedic examinations and getting a diagnosis efficiently hinges a lot on your support staff,” says W. Preston Stubbs, DVM, DACVS, staff surgeon and owner of Mile High Veterinary Surgical Specialists. Empowering them to take a good patient history and follow up on that history is very important. “Your team also needs to be trained to assist in orthopedic examinations, understand proper restraint techniques, and know how to obtain high-quality, well-positioned radiographs,” he says.

MULTIMODAL ANESTHESIA MISCONCEPTION

Gregg M. Griffenhagen, DVM, MS, DACVAA, anesthesiologist and clinical instructor at Colorado State University, says the biggest misconception he hears from other veterinarians about multimodal anesthesia is that they must use it all the time. “Multimodal anesthesia or analgesia just refers to minimizing side effects by combining multiple drugs with different sets of pharmacologic actions,” Dr. Griffenhagen says.

“People think they have to use 7 different drugs with 7 different modes of action to accomplish a single goal.” While he acknowledges that there are certainly patients for which you may need to do this, “it’s not always necessary. Sometimes a single drug will do just fine to accomplish exactly what you need it to do,” he says.
Treatment Options for Feline Splenic Mast Cell Tumors

By Natalie Stilwell, DVM, MS, PhD

Splenic mast cell tumor (MCT) commonly affects geriatric cats, regardless of breed or sex. Generally classified into 1 of 3 categories—cutaneous, splenic, or intestinal—this neoplasia typically causes anemia and mastocytemia, an increase in circulating mast cells. Splenectomy is considered the treatment of choice, yet it is unknown whether additional therapies, including adjuvant chemotherapy and steroids, further increase survival.

Recently, a group of investigators from several US veterinary hospitals conducted a retrospective study of 64 cases to evaluate the role of chemotherapy and supportive care on splenic MCT outcome in cats.

The investigators examined patient records from 3 veterinary teaching hospitals. Most cats presented with nonspecific gastrointestinal signs, and splenic MCT diagnosis was confirmed via cytology or histopathology after splenectomy. Cases included those with concurrent cutaneous MCT and/or visceral involvement. Chemotherapy included steroid treatment, and histamine blockers and proton pump inhibitors were designated as supportive care. Cases were categorized according to treatment group: splenectomy (n = 20), splenectomy with adjuvant chemotherapy (n = 20), chemotherapy alone (n = 15), and supportive care (n = 9). Of the 64 cats that met the inclusion criteria, the median age was 13 years and there was an equal distribution of males and females.

The most commonly recorded clinical signs were weight loss (56%), anorexia (48%), vomiting (45%), and lethargy (42%). Physical examination revealed splenomegaly in 44% of cats, and 30% had concurrent cutaneous MCT. Anemia and mastocytemia were noted in 47% and 35% of evaluated blood samples, respectively, and metastasis to the liver was present in 52% of biopsy or fine-needle aspirate samples. Abdominal lymph node involvement was noted in 40% of the cases evaluated via abdominal ultrasound or laparotomy.

Median survival was significantly longer for cats that had a splenectomy (856 vs 342 days); however, adding adjuvant chemotherapy after splenectomy did not further increase survival rates; 70% died from tumor-related causes.

Concurrent cutaneous MCT regressed in 4 of 19 cats, including 3 after splenectomy alone and 1 after adjuvant chemotherapy. Complete regression of metastasis to the liver or lymph nodes was noted in 19% of cats treated with chemotherapy alone, and 39% of cats treated with adjuvant chemotherapy. The conclusion: Splenectomy significantly improves survival time for cats with splenic MCT, making it the treatment of choice. The role of chemotherapy and supportive care in the outcome of feline splenic MCT remains unclear.

Feline Mesenchymal Stem Cells: What’s Known and What’s Possible

By JoAnna Pendergrass, DVM

Since their initial isolation and characterization from bone marrow in 2002, feline mesenchymal stem cells (MSCs) have been isolated from fat and fetal fluid. Because adipose-derived MSCs (aMSCs) are simple to obtain and proliferate easily, they have been used commonly to evaluate potential clinical applications.

For a recent review paper, Jessica M. Quimby, DVM, PhD, DACVIM, associate professor of internal medicine in the Department of Veterinary Clinical Sciences at The Ohio State University in Columbus, and Dori L. Borjesson, BA, DVM, MPVM, PhD, professor of pathology, microbiology, and immunology at the University of California, Davis, School of Veterinary Medicine, described what is known about feline MSC biology and immunology and highlighted studies that evaluated the cells’ therapeutic potential in cats.

BIOLoGY AND IMMUNOLOGY
Feline MSCs resemble fibroblasts and express the cell surface antigens CD44 (involved in cell–cell interactions and cell adhesion) and CD105 (vascular development and remodeling). Biological functions of feline MSCs include enhanced angiogenesis, tissue generation and repair, and inhibition of fibrosis in damaged organs.

Up to 80% of cats have feline foamy virus, which can infect up to 50% of feline MSC lines, ultimately causing cell death. These infected MSC lines can limit in vitro expansion and clinical application in cats.

The immunomodulatory properties of feline MSCs include downregulation of T-cell activity, reduced production of reactive oxygen species by neutrophils, and gene expression upregulation of numerous immunomodulatory mediators. Feline MSCs share many biological and immunologic functions with human, equine, and canine MSCs.

CLINICAL APPLICATIONS
Feline MSCs’ immunomodulatory properties suggest therapeutic potential for inflammatory, immune-mediated, and degenerative feline diseases. Studies evaluating this possibility have used autologous and allogeneic MSCs and tested variations of other associated factors, including cell dose and administration route. Variable overall efficacy warrants the need for an optimal combination of MSC-associated factors for clinical use, the authors noted.

Feline Chronic Gingivostomatitis
Feline MSCs’ ability to downregulate T-cell activation could provide therapeutic benefit for feline chronic gingivostomatitis (FGCS), a debilitating disease with lesions characterized by a predominance of T and B cells. Investigators who administered autologous or allogeneic aMSCs intravenously in cats with FGCS marked a clinical improvement and even cure. The autologous aMSCs may be more effective, the authors noted.

Feline Asthma
Feline asthma treatment involves lifelong bronchodilator and corticosteroid therapy with no guarantee of adequate disease management. Notably, MSCs administered intravenously can reach the lungs, easing airway inflammation. Several pilot studies evaluating this approach for induced feline asthma showed markedly reduced airway eosinophilia and hyperresponsiveness for acute asthma and decreased airway remodeling for acute and chronic asthma.

Chronic Enteropathies
Current treatments for chronic enteropathies (dietary management and corticosteroids) do not lead to satisfying clinical responses. Intravenous (IV) administration of aMSCs to cats with chronic enteropathies reportedly improved clinical outcome with few adverse events.

Kidney Disease
Early studies of MSCs for chronic kidney disease (CKD) treatment determined that intrarenal administration is not clinically practical, and sufficiently expanding autologous MSCs from elderly diseased cats is ultimately unrewarding. IV administration of allogeneic aMSCs in cats with CKD produced variable efficacy.

“At this time,” the authors noted, “MSC therapy for feline CKD should be considered an experimental and unproven therapy.”

Treatment with aMSCs also has been evaluated for acute kidney injury, but results did not indicate improvement with aMSC administration.
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Gonadectomy Status and Aggression in Dogs

By Natalie Stillwell, DVM, MD, PhD

Gonadectomy has historically been recommended as a modification for behavioral issues in both male and female dogs; however, existing literature provides conflicting information on this method's level of benefit. According to the authors of a new study, "every prospective, controlled study that examined the effects of gonadectomy on the aggressive behavior of dogs demonstrated either no change in aggressive behavior or an increase in aggressive behavior after gonadectomy."

For the present study, the investigators examined the relationship between canine gonadectomy and aggression toward familiar people, strangers, and other dogs. Multiple age classes of dogs were examined using a validated behavioral questionnaire known as the Canine Behavioral Assessment and Research Questionnaire (C-BARQ). Developed by researchers at the University of Pennsylvania, C-BARO is used to assess canine behavior and temperament and can evaluate dogs in preparation for service and guide work. The survey is available online for owners to complete and includes 26 questions related to aggression toward familiar humans, strangers, and other dogs. Questions address various forms of aggressive behavior, including food and toy guarding, behavior toward children, and lunging or barking at others while leashed or in the car.

Owner responses to the questionnaire were compiled and examined for the major variables examined were gonadectomy versus intact status and age at gonadectomy. Dog ages were categorized as follows:

- Puppy (6 weeks to 6 months)
- Juvenile (7 to 12 months)
- Adolescent (13 to 18 months)
- Adult (older than 18 months)

Survey responses were excluded from the study if signalment or health information was incomplete or if gonadectomy was performed either before 6 weeks of age or to correct a behavioral problem. Answer scores ranging from 0 to 4 categorized aggression level as none, mild, moderate, or severe, respectively. C-BARQ questionnaires completed by 15,370 dog owners between 2004 and 2001 were included in the study. Of the responses, 13,795 (89.7%) reported some level of aggression toward familiar people, 13,498 (87.8%) toward strangers, and 13,237 (86.1%) toward other dogs.

The investigators determined that gonadectomy status generally had no effect on aggressive behavior toward familiar people, strangers, or other animals. Similarly, the age at which gonadectomy was performed had no significant relationship with aggressive behavior. However, the investigators noted that gonadectomy during the juvenile (7 to 12 month) stage correlated with a low but significant (22%) increase in moderate or severe aggression toward strangers compared to aggression levels in intact dogs.

According to the results of this study, intact dogs are not more likely to display aggression toward humans or other dogs, and gonadectomy is not protective against aggressive behavior. The authors emphasized that canine aggression is likely influenced by a complex combination of factors, including genetics, owner behavior (e.g., level of training and a history of neglect or abuse), lifestyle (isolation vs socialization), and medical issues. ■

Tick Exposure and Kidney Disease Risk in Dogs

By Kerry Lengyel

With another higher-than-average tick season looming, veterinarians should prepare for an onslaught of related veterinary visits—even pet owners who know about the dangers of tickborne illnesses continue to put off annual screenings. New study findings aim to change that narrative.

Conducting a retrospective study, Idexx investigators set out to determine whether exposure to tickborne disease is associated with an increased risk of chronic kidney disease (CKD) in dogs in endemic areas.

A total of 846,626 canine chemistry and urinalysis samples were obtained from the Idexx Reference Laboratories database between July 13, 2015, and January 17, 2017. Dogs ranged in age from 1 to 25 years, with all breeds and genders represented.

For the samples evaluated, patients exposed to infected ticks were defined as having at least 1 positive vector-borne disease test result in their available history. CKD was defined as concurrent increased symmetric dimethylarginine (SDMA; >14 mcg/dL) and creatinine (>1.5 mg/dL) for a minimum of 25 days with inappropriate urine specific gravity (<1.030) during that time.

Patient results were analyzed according to geographic location for transmission of both *Borrelia burgdorferi* and *Ehrlichia canis*, and then CKD risk was calculated. An association was identified between dogs with positive Lyme disease or *Ehrlichia* test results and an increased risk of CKD in endemic areas.

The investigators found that dogs from endemic areas with 1 vector-borne disease had a 300% increased risk of developing kidney disease when *Ehrlichia* antibodies were present and a 43% increased risk when *Borrelia* antibodies were present. These results reinforce the need to screen dogs annually to identify exposure to infected ticks and various tickborne diseases.

From a public health perspective, annual screening is critical to help people better understand potential tick-related risks in their area, as well as help veterinarians provide better care for their pets, according to Jennifer Ogeer, DVM, MSS, MBA, MA, medical affairs marketing manager for Idexx Laboratories, Inc. “By doing that, we’re in a much better position as veterinarians to identify if these dogs are going to develop kidney disease,” Dr. Ogeer said. “Then we’re able to have a discussion with those pet owners to build compliance around managing and monitoring that disease earlier, potentially improving outcome and maybe even life expectancy for these dogs.”

The investigators acknowledged several limitations that should be addressed in future research. The study design indicated a statistically significant association between tickborne disease and CKD but did not allow inference of a causal relationship. In addition, the data did not identify the time of tick exposure or onset of tickborne disease, nor did it evaluate clinical presentation, treatment, or patient outcome.

Unregulated Backyard Chickens Pose Health Risk, Results Find

By Amanda Carrozza

Although not considered part of the poultry industry, chicken ownership among US households has risen over the past decades. Some poultry fanatics have even gone so far as to declare the chicken the new dog.

But investigators and health advocates are calling foul. The chief complaint: When it comes to chickens being raised in homes and backyards, local ordinances and laws do not address human and animal health adequately.

Recently, a University of California, Davis (UC Davis), study called for more laws to mandate the proper care of chickens in nonfarm settings. The study’s primary author, Catherine Brinkley, PhD, said current laws for urban farming do not keep pace with those for commercial growers. “Ironically, as people seek to take control of the way their food is grown, most ordinances fail to ensure basic health and welfare for birds and humans,” she said.

It is difficult to pinpoint the number of Americans who are raising chickens in urban and suburban environments, but a US Department of Agriculture (USDA) survey of homeowners in 4 major US cities (Denver, Colorado; Los Angeles, California; Miami, Florida; and New York, New York) found that 0.8% owned chickens in 2013. An additional 4% said they planned to own chickens in the next 5 years, and nearly 40% were in favor of allowing chickens in their communities and would not mind if their neighbors owned the birds.

But what are the health ramifications? “Provisions governing animal slaughter and routine veterinary care are rare, presenting a concern for monitoring and intervening in public health crises,” according to the UC Davis study. Yet, although over half of the USDA survey respondents believed that the presence of chickens in urban areas will lead to more illnesses in humans, most believed that eggs from home-raised chickens are healthier than those purchased at a grocery store. Just 10.5% of Denver respondents to the USDA survey strongly agreed with the statement that chickens in urban areas will lead to more illnesses in humans.

The CDC begs to differ. In an October 2017 report from the Associated Press, the CDC confirmed that more than 1100 people that year had contracted *Salmonella* poisoning from chickens and ducks. Almost 250 were hospitalized, and 1 person died—an overall infection rate that was 4 times higher than in 2015.

The UC Davis study focused on 100 municipalities in Colorado, the only state to compile public data for animal shelter surrenders and other statistics. According to the investigators, the most common guidelines for poultry regulations focused on housing design, placement, and gender. Ordinances pertaining to the sex of the birds varied greatly from town to town, with some municipalities banning roosters altogether and others permitting 1 rooster per a certain number of hens; still others had no related laws.

Regulations were also lacking regarding cleanliness, ventilation, and food and water requirements. Investigators found that just half of the Colorado municipalities had ordinances governing the slaughter of backyard chickens—and many were vague. Even with the seemingly slim decrees surrounding chicken ownership, Dr. Brinkley said, “more poultry ordinances have been passed or modified in Colorado in the last five years than in the previous 100.”

Dr. Brinkley recommends passing more laws that mandate vaccinations, manure management, and general animal welfare in urban and suburban settings—similar to policies and regulations imposed on commercial chicken ranches.
How “The Pet Effect” Can Affect Your Practice

By Kerry Lengyel

Most pet owners are intuitively aware of the many physical and mental benefits of pet ownership, but backing up these instinctive beliefs with real data can have a massive effect—The Pet Effect, to be exact. A joint venture by Zoetis and the Human Animal Bond Research Institute, The Pet Effect campaign promotes the idea that by keeping pets healthy, veterinarians and other pet health professionals play key roles in both human and public health.

“How much more relevant is the veterinarian when the pet owner becomes acutely aware of the impact that a healthy relationship with a pet can have on their own health and well-being or their family’s health and well-being?” asked Michael McFarland, DVM, DABVP, executive director of pet care marketing at Zoetis.

The Pet Effect website (thepeteffect.org) promotes pets’ positive impact on people by providing research-backed evidence—presented in clever, fun, and unique ways—of the many health benefits of having a furry friend. Pets can help people with:

- Childhood allergies: Having a dog early in life can affect immune development and may reduce the development of certain allergies.
- Cardiovascular disease: Being around pets can lower cholesterol and triglyceride levels. Also, people who never owned a cat have a 40% higher relative risk of death from a heart attack.
- Autism: Children with autism spectrum disorder often exhibit positive behavioral changes when around animals.
- Obesity: Adults who walk their dogs regularly may be less likely to become obese.
- Blood pressure: People with pets may have lower resting blood pressure.
- Depression: Pets can help alleviate several symptoms of depression.

Although these health effects are important, it is at least as vital that veterinarians understand how The Pet Effect can benefit their practice. In the age of Dr. Google, pet owners often seek pet care information from online sources. The Pet Effect has the power to change that. “The more the veterinarian can educate the pet owner about their pet’s needs, [as well as] how their pet can influence the health and well-being of their family, [the more] that veterinarian becomes relevant in the eyes of the pet owner,” Dr. McFarland said.

The Pet Effect better defines the relationship between the veterinarian and pet owner, and actively discussing The Pet Effect can encourage clients to schedule more wellness visits for their pets. Research shows that top-performing practices put more stock in improving the bond between the practice and pets. “Companion animal veterinarians...are also a key contributor to public health,” Dr. McFarland said. “The more pet owners understand that, the more I think they are going to consider veterinarians first and foremost as a credible source of information about their pet.”

Living Environment Influences Allergy Risk in Dogs, People

By JoAnna Pendergrass, DVM

For humans, the relationship between living environment and allergies is well established. Interestingly, interactions between a host’s microbiota and environmental microbes are thought to influence allergy development—specifically, urban living decreases exposure to immune-modulating environmental microbes, altering a person’s microbiota and increasing allergy risk.

The effect of living environment on canine allergies, though, has been a confounding factor, the investigators controlled for those effects by creating 2 study subsets that excluded known allergy-prone breeds: allergy-tolerant breeds and common breeds (the 5 most represented breeds in the study data).

About 70% of dogs were born in rural areas, and about 50% lived in rural and urban environments during the survey period. For dogs with either low or high allergy scores, living in a rural environment decreased allergy risk. Birth environment did not influence risk, possibly because puppies are removed from it at an early age.

Several aspects of rural living were associated with lower allergy scores in dogs: never visiting city areas, outdoor exposure and activities, frequent contact with farm animals, and 3 or more children in the family. The finding on family size could suggest bidirectional protection, the investigators believed, given previous studies reporting pet dogs’ ability to provide allergy protection.

Analysis of the relationship between house type (farm, house, row house, flat) and allergy score revealed higher scores in urban than in rural areas. However, because house type was significantly associated with both allergy score and living environment, interpretation of these allergy scores was not clear, the investigators acknowledged.

For dog owners and their families, allergies were more common in urban areas than in rural areas. Allergies in dogs and their owners were often present concurrently, even when controlling for breed.

The study results suggest that, overall, rural living lowers the risk of allergies in dogs. At the individual level, though, the effect of breed is likely evident, the researchers believed. The similar findings on allergy risk in dog owners indicates a general influence of living environment and lifestyle on mammalian health, the investigators noted. To improve pet health and decrease allergy risk, they recommended incorporating more green space into cities to increase time spent outdoors.

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Critical Care Nutrition

Nutrition is a vital aspect of treatment planning for hospitalized patients with severe illnesses and those with chronic diseases.

By Laurie Anne Walden, DVM, ELS

Dr. Walden received her doctorate in veterinary medicine from North Carolina State University in 1994. After an internship at Auburn University College of Veterinary Medicine, she returned to North Carolina, where she has been in companion animal general practice for over 20 years. Dr. Walden is also a board-certified editor in the life sciences and owner of Walden Medical Writing.

(continued from front cover)

All hospitalized patients should receive nutritional assessment, said Liss, who directs the veterinary technology program at Platt College in Los Angeles and works as a relief intensive care unit technician at VCA Veterinary Specialists of the Valley in Woodland Hills, California. Nutritional management should be included in the treatment plan from the beginning, not added as an afterthought.

FEEDING ROUTES

Hospitalized patients can receive nutrients through either enteral or parenteral feeding. Enteral feeding—nutrition delivered via the gastrointestinal tract—is preferred when possible because it supplies nutrients directly to the cells of the digestive tract.

Enteral Nutrition

Voluntary feeding, force feeding, and tube feeding are all methods of enteral feeding. Liss does not recommend force feeding because it increases the risk of aspiration and can cause patients to develop food aversion. Force-fed patients also may not receive the intended amount of food, because rejected food tends to be slung onto walls or into towels. However, he noted that oral feeding via syringe is suitable if a patient readily accepts it.

Feeding tubes are helpful for many hospitalized patients, Liss noted. Nasoesophageal tubes can be placed noninvasively and are usually well tolerated, especially by cats, he added. Nasogastric, esophagostomy, gastrostomy, and jejunostomy tubes can also be used. Tube selection depends on the patient’s needs. For example, nasoesophageal tubes are intended for short-term use, whereas gastrostomy tubes can be used long term and require endoscopic or surgical placement. Various calorie-dense diets are available for tube feeding. The amount to feed is based on the patient’s resting energy requirement.

Parenteral Nutrition

Parenteral nutrition, which bypasses the digestive tract, is delivered intravenously. This type of feeding is used for patients who cannot receive enteral nutrition. Total parenteral nutrition typically requires a central venous catheter. Patients receiving parenteral nutrition need intensive monitoring because of the increased risk of sepsis and metabolic complications.

NUTRITION IN CHRONIC ILLNESS

Nutrition can be part of the treatment of nearly every disease, Liss said. He discussed the nutritional management of 5 diseases common in veterinary patients.

Kidney Disease

Chronic kidney disease (CKD) progresses slowly over time, and patients may not present for treatment until they are quite sick. Testing blood symmetric dimethylarginine (SDMA) levels may enable practitioners to diagnose the disease earlier, Liss said.

The International Renal Interest Society (IRIS) has published guidelines for staging kidney disease. IRIS kidney disease
classifications are based on blood creatinine levels, with suggested modifications based on blood SDMA concentrations. IRIS treatment recommendations for each stage include dietary modifications that may mitigate the clinical effects and slow disease progression.

Patients with CKD often have hyperphosphatemia as a result of decreased renal excretion of phosphorus. Elevated blood phosphate levels can lead to secondary hyperparathyroidism. Some patients have elevated parathyroid hormone levels even if they have normal blood phosphate levels. Reducing phosphate intake is recommended for patients in all but the earliest stage of CKD. Phosphate restriction can be accomplished in 2 ways: feeding a phosphate-restricted diet and adding enteric phosphate binders to the food.

Strict dietary protein restriction is not recommended for patients with CKD, Liss said, as dietary protein deficiency can lead to muscle wasting. However, mild protein restriction may be indicated in some stages. Dietary protein should be highly digestible.

Serum potassium levels are often low in patients with CKD. For this reason, most clinical renal diets include extra potassium.

Patients with CKD also may develop metabolic acidosis, which can be diagnosed with blood gas analysis. Renal diets usually contain alkalinizing agents to help restore the acid-base balance. Polyunsaturated fatty acids, such as omega-3 fatty acids, can help preserve renal blood flow, Liss said. They are typically added to clinical renal diets.

Because patients with renal disease are polyuric, their stores of water-soluble vitamins, particularly B and C vitamins, become depleted. Some need supplementation of B vitamins beyond the levels included in renal diets, Liss noted.

Liss recommended monitoring body condition scores to ensure that patients are receiving sufficient calories. Appetite stimulants, such as mirtazapine, can help in the short term but are not intended for long-term use. He stressed the importance of continuing to monitor calorie intake in patients receiving appetite stimulants. “Just because you give mirtazapine and the patient eats a couple of kibbles doesn’t mean it’s eating the full calorlic requirement,” he said.

Pancreatitis

Pancreatitis occurs when pancreatic enzymes that usually digest food are activated abnormally and begin autodigesting the pancreas. The disease is often idiopathic, and the initiating causes are not fully known, but dietary fat has not been proven definitively to cause pancreatitis, Liss said.

In the past, the mainstay of pancreatitis treatment was fasting the patient to “rest the gut.” The idea was that the taste, or even odor, of food could stimulate pancreatic enzyme production, exacerbating inflammation. Liss said that this theory was based on results from decades-old studies in humans that show that patients with acute pancreatitis became nauseated when they smelled food. However, prolonged fasting is no longer recommended.

Current evidence suggests that patients with acute pancreatitis should receive enteral nutrition as early as possible. Feeding does not appear to worsen nausea or abdominal pain and may help patients recover, Liss said. Patients with acute pancreatitis should first be stabilized and treated with intravenous fluids and antiemetics. Ideally, feeding should begin within 48 hours after presentation; however, it can be initiated within 12 to 24 hours in some patients, he said.

Extremely low-fat diets have traditionally been recommended for dogs with acute pancreatitis. Liss suggested that unless patients have a known disorder of fat metabolism (eg, hypertriglyceridemia in schnauzers), strict fat restriction may not be necessary. Highly digestible diets, preferably with polyunsaturated fatty acids as the fat component, should be used. Cats with pancreatitis do not require dietary fat restriction, he said.

Patients with acute pancreatitis often benefit from feeding tube placement. Liss said in his practice nasogastric tubes are typically placed in patients with acute pancreatitis within 1 to 2 days of presentation. Patients with acute pancreatitis may not need dietary protein restriction. In these diseases, the dietary protein levels should be adjusted depends on the type of liver disease and the patient's protein tolerance.

Liver Disease

The liver is responsible for metabolizing and synthesizing protein. It also regulates the detoxification process. Dietary protein is the main concern in patients with liver disease, Liss said. Whether dietary protein levels should be adjusted depends on the type of liver disease and the patient's protein tolerance.

Patients with some liver diseases, such as cholangitis and feline hepatic lipidosis, may not need dietary protein restriction. In these diseases, the liver does not metabolize amino acids normally. If patients with these conditions do not receive enough dietary protein, their bodies will catabolize their own lean muscle for protein, potentially increasing blood ammonia levels. If the disease progresses, patients who did not need dietary protein restriction at first may require it later.

Patients with portosystemic shunts, congenital or acquired, require a protein-restricted diet. These patients’ livers cannot adequately detoxify ammonia in the blood. Elevations in blood ammonia can cause hepatic encephalopathy, which is characterized by neurologic signs ranging from mild dullness to seizures. Patients with portosystemic shunts or evidence of hepatic encephalopathy also may need diets with dairy- or vegetable-based protein rather than meat protein because the former are less likely to increase blood ammonia levels.

Complex carbohydrates and soluble fiber reduce nitrogen production by gut bacteria and therefore are helpful for patients with liver disease, Liss said. Patients may also need mineral supplementation. However, those with copper storage disease (which is hereditary in Bedlington terriers) or elevated blood copper levels secondary to liver disease require dietary copper restriction and possibly chelation therapy. Vitamin supplements, particularly vitamins E and K, may help patients with liver disease. Nutraceuticals, such as S-adenosylmethionine, are often part of the treatment plan and have few adverse effects, Liss said.

Urinary Tract Disorders

Liss discussed 2 dietary modifications for patients with urinary tract disorders: increasing water intake and, if applicable, acidifying the diet to help dissolve stones. Urinary tract diets typically have elevated sodium levels to encourage water drinking, he said. For this reason, these diets are not suitable for patients who also have heart disease. Liss also discussed increasing cats’ water intake by feeding a canned diet, using a water fountain, or adding flavorings to water.

Struvite calculi form in alkaline urine. They can often be dissolved over time by feeding a diet that acidifies the urine and is low in the minerals that make up struvites, Liss said. Calcium oxalate calculi form in a wider range of pH levels and cannot be dissolved with diet. These stones require surgical or other types of physical removal.

Heart Disease

Nutritional goals for patients with heart disease include restricting sodium, maintaining protein intake, and correcting nutrient deficiencies, Liss said. Salt intake increases intravascular volume, which can lead to pulmonary edema in patients with cardiac insufficiency. The degree of dietary sodium restriction depends on the patient's stage of heart disease. Because these patients may lose muscle mass, it is important to ensure that they continue to eat and that their diets contain sufficient protein.

Taurine is a dietary requirement for cats. A deficiency of this amino acid causes dilated cardiomyopathy. Complete and balanced commercial cat foods include taurine, but cats that eat homemade or vegetarian diets can develop taurine deficiency. This deficiency can also occur in certain canine breeds, so dogs that develop dilated cardiomyopathy may need to have their blood tested for taurine level. Omega-3 fatty acids may benefit patients with heart disease. Some cardiologists recommend fatty acid supplementation, and some diets formulated for patients with heart disease contain fatty acids.

CONCLUSION

Hospitalized critically ill patients and those with chronic diseases need nutritional support to recover from illness and to prevent breakdown of fat and lean muscle. Nutrition affects outcome in patients with chronic illnesses and can be part of the treatment plan for most conditions.
Respiratory Complications of Trauma

Thoracic injury can cause a variety of complications in the small animal patient, including pneumothorax, diaphragmatic hernia, and rib fracture.

By Natalie Stilwell, DVM, MS, PhD

(continued from front cover)

vehicle strike, whereas penetrating trauma may involve a gunshot, knife, or bite wound, or impalement by a foreign object such as a stick or rod.

INITIAL PATIENT ASSESSMENT

Physical Examination

A thorough physical examination is valuable for identifying and localizing respiratory distress in patients that have experienced trauma, Dr. Waddell emphasized. During the initial examination, the veterinarian must determine whether the injured patient is hypoxemic or hypoventilating.

Hypoxemia results from ventilation-perfusion mismatch in the lungs as the lungs fill with blood or fluid. As blood flow to the affected area continues, fluid accumulation may prevent normal ventilation and oxygen exchange from occurring. This often results from pulmonary contusion or pleural space disease such as pneumothorax, which can result in atelectasis of the lung.

Hypoventilation arises from a variety of causes, including airway obstruction, pleural space disease, and diaphragmatic hernia, as well as severe neurologic injury to the brain, cervical spinal cord, or peripheral nerves innervating the diaphragm and intercostal muscles.

Diagnostic Imaging

Thoracic radiography is often recommended after suspected trauma, but Dr. Waddell noted that ultrasound can be a helpful alternative for detecting certain complications, such as pulmonary contusions, pneumothorax, hemothorax, and diaphragmatic hernia, in patients that are too unstable for restraint or sedation.

Thoracic focused assessment with sonography for trauma (TFAST) examination serves as a rapid, noninvasive screening tool for triage of the thorax and can be performed in standing patients or in lateral or sternal recumbency if the patient is particularly stressed or compromised. Standard TFAST approaches include diaphragmatic-hepatic and bilateral pericardial and chest tube sites. “The pericardial and diaphragmatic-hepatic views are ideal for detecting smaller volumes of free fluid,” she said. The chest tube sites are used to detect pneumothorax as well as evaluate the lungs. She described normal lung movement as a smooth, gliding motion along the thoracic wall, whereas air or fluid between the lung and thoracic wall may impair movement. Ultrasound can identify pulmonary parenchymal disease (eg, pulmonary contusion) by the presence of so-called B lines or rocket tails that look like search spotlights within the lung.

Although rarely performed on her trauma patients, Dr. Waddell said computed tomography may be a useful diagnostic tool for patients that are stable enough for sedation or anesthesia.
COMPLICATIONS OF THORACIC TRAUMA

Thoracic trauma can lead to several common complications, Dr. Waddell said: pneumothorax, pulmonary contusion, hemothorax, diaphragmatic hernia, rib fracture, and tracheal injury. She offered details for each.

Pneumothorax

Pneumothorax— an abnormal collection of free air in the pleural space—is the most common complication Dr. Waddell encounters in patients suffering from blunt trauma to the thorax (Figure 1). She estimated that 45% to 50% of patients with fractured bones after being hit by a car experience pneumothorax, which she frequently observes in dogs and cats that fall from a height.

Pneumothorax is classified as open or closed, depending on the presence of a penetrating wound. An open pneumothorax is a life-threatening emergency; the patient may not be able to ventilate due to loss of the normal negative pressure within the pleural space. Blunt thoracic trauma can lead to closed pneumothorax by causing rupture of the pulmonary parenchyma or small airways. Open pneumothorax typically occurs due to a bite, gunshot, or knife wound, or from impalement. In the case of impalement, keeping the impaling object in place may actually aid ventilation by maintaining negative pressure within the chest, while removing it may lead to respiratory collapse. She recalled a case at Penn Vet involving a 2-year-old poodle that, despite presenting with a large rod impaling the cranial thorax, appeared in minimal respiratory distress on physical examination. The rod was removed carefully under anesthesia, the chest was lavaged and the wound closed, and the patient was discharged successfully from the hospital 3 days later.

Tension pneumothorax, a potentially life-threatening complication that occurs due to progressive air buildup within the thoracic space, gradually increases intrathoracic pressure and can compress the lungs, reduce venous return to the heart, and lower blood pressure, resulting in cardiovascular compromise. “Positive-pressure ventilation can exacerbate tension pneumothorax,” she said, “so it should be used with extreme caution in affected patients.”

Dr. Waddell suspects pneumothorax whenever a penetrating chest wound is present, but she says it is also common in patients with blunt thoracic trauma. The patient typically takes rapid, shallow breaths and has dull lung sounds on physical exam; if a tension pneumothorax is present, the animal may develop a barrel-chested appearance. Thoracic radiography may reveal an abnormally elevated heart position off the sternum, collapsed and retracted lungs, and decreased visibility of the peripheral vessels and airways.

“Thoracentesis can be a lifesaving treatment for pneumothorax,” she said, offering reassurance that the procedure is straightforward and requires minimal equipment. After the patient is placed in sternal or lateral recumbency and the site is prepped aseptically, the veterinarian inserts a needle attached to extension tubing, a 3-way stop-cock, and syringe cranial to a rib and advances it until positive pressure indicates correct placement into the pleural space. “When the tubing fogs up a little bit,” she said, “that’s how you can tell you’re in the right spot.”

Most patients with closed pneumothorax will respond to thoracentesis. Severe cases may also require placement of a chest tube with continuous suction. Open pneumothorax (eg, from bite wounds) necessitates surgical lavage and cleaning.

Pulmonary Contusion

Hemorrhage within the lung caused by damage to the pulmonary vasculature usually results from a direct crushing injury to the chest (see Figure 1). Dr. Waddell said this is the second most common complication of thoracic trauma she observes and is often associated with rib fracture and/or pneumothorax. Contusions range from mild to severe, and associated hemorrhage can impair normal lung function significantly.

Pulmonary contusion is typically diagnosed on physical examination, which reveals increased respiratory effort and harsh lung sounds (crackles). She emphasized that abnormal lung sounds may seem minor initially and worsen with time. Also, severe contusions may actually decrease lung sounds, as the presence of blood hinders normal air exchange. Patients with pulmonary contusion also may cough up blood or blood-tinged fluid. TFAST examination can aid in identifying pulmonary contusions.

Treatment includes oxygen supplementation and, if severe, positive-pressure ventilation to recruit the lung. Dr. Waddell warned that intravenous fluids should be administered with caution, because increasing blood volume may worsen bleeding into the lung and exacerbate contusions. Fluids should be administered slowly until the cardiovascular system is stabilized, after which maintenance fluid doses are acceptable. “When choosing fluid therapy in patients with pulmonary contusion,” Dr. Waddell said, “assume that administered fluids will enter the lung.” Synthetic colloids are more difficult to absorb than blood products and should be avoided. Crystalloids should be used only as needed, and hypertonic saline may increase blood pressure dramatically and worsen bleeding.

Pulmonary contusions can cause pneumonia in rare cases, as blood serves as an ideal medium for bacterial growth. Dr. Waddell added. Because the risk is low, however, she advised against using prophylactic antibiotic therapy in these patients—resistant bacteria may overgrow and develop into pneumonia. Pneumonia should be treated only if it occurs, she said.

Hemothorax

Accumulation of blood in the pleural space, or hemothorax, is an uncommon but clinically significant complication of thoracic trauma. Dr. Waddell said that thoracic radiographs often indicate a small volume of fluid after trauma; however, 1 study indicated that less than 10% of dogs that sustained fractures from being hit by a car had clinically significant hemothorax.

She cautioned that these patients may present in severe hypovolemic shock, with respiratory compromise and low blood volume. Autotransfusion is an acceptable therapy for hemothorax because blood in the thoracic cavity is protected from potential contamination from the urinary bladder and gastrointestinal tract. Severe hemothorax, although uncommon, necessitates emergency thoracotomy.

Diaphragmatic Hernia

Diaphragmatic hernia occurs in 2% to 5% of trauma patients, Dr. Waddell estimated. Traumatic rupture typically occurs

Thoracic radiography is often recommended after suspected trauma, but ultrasound can be a helpful alternative for detecting certain complications.
Diaphragmatic hernia is typically diagnosed by a combination of physical examination and imaging. Affected patients usually show increased abdominal effort and distress with respiration. Auscultation may reveal cranially shifted heart sounds and comparatively dull respiratory sounds on the injured side of the chest. Although extremely useful, thoracic radiographs may be difficult to obtain until the patient is stabilized. “We use a standing lateral radiographic view or TFAST ultrasound for particularly compromised patients,” Dr. Waddell said. A gastrointestinal barium series can help identify herniated stomach or intestine within the thoracic cavity in stable patients.

Diaphragmatic hernia should be repaired surgically once the patient is stable enough for anesthesia. Dr. Waddell revealed creative methods for replacing herniated abdominal organs. One method involves standing the patient on its hind legs to shift abdominal contents using gravity, which reduces pressure on the lungs. She recalled Lucky, a canine patient at PennVet that, after being struck by a vehicle, herniated the entire stomach through the diaphragm and into the thorax. “Lucky had a smooth recovery after surgical replacement of the stomach and closure of the diaphragm,” Dr. Waddell said, “but many patients aren’t so fortunate, and gastric or intestinal dilation within the thorax can be a life-threatening complication of diaphragmatic hernia.”

**Rib Fracture**

Both blunt and penetrating forms of trauma can fracture ribs (Figure 3). The presence of a rib fracture always causes Dr. Waddell to search for nearby soft tissue lesions, she said, including pulmonary contusions. On physical examination, animals with rib fractures are typically painful, exhibit shallow respiration, and may have conformational changes of the chest. Patients with flail chest, which occurs when consecutive rib fractures cause paradoxical chest movement, are especially likely to be hypoxic due to extensive contusions and pain. Interestingly, she noted, patients with flail chest appear to be more comfortable when placed in lateral recumbency with the affected side down.

Radiographs are key for diagnosis, and Dr. Waddell shared a few tricks of the trade to better visualize fractures. For example, she flips film radiographs upside down to better focus on the ribs, and she inverts the color on digital images to view bones as black instead of white.

Dr. Waddell emphasized the importance of providing analgesia and managing associated injuries such as pulmonary contusions. Surgical stabilization, including internal fixation to realign the ribs, may rarely be required for severe fractures.

**Tracheal Injury**

Tracheal injury typically results from penetrating trauma but can also be seen with blunt trauma. A classic clinical sign is subcutaneous emphysema in the neck that can progress to the rest of the body. Patients may also exhibit a variety of nonspecific signs, such as respiratory distress, lethargy, gagging, excessive drooling, vomiting, coughing, and shock. Imaging tools, including radiography and tracheoscopy, can be helpful for diagnosis.

Treatment should be tailored to whether the patient is stable or compromised, Dr. Waddell said. Although oxygen therapy may be adequate for mild tracheal defects, surgical repair is usually indicated for severe cases. As with cases of tension pneumothorax, positive-pressure ventilation can worsen emphysema and should be avoided during surgery. Subcutaneous emphysema associated with tracheal injury can be resolved more quickly by placing the patient into a 100% oxygen chamber for approximately 4 hours, she said—oxygen will replace nitrogen in the tissues and absorb more quickly.

**REFERENCES**


Why “Dental” Is a Dirty Word

Providing quality oral care to your patients and conveying the value of that care to your clients will improve compliance, staff satisfaction, and practice profit.

By Kerry Lengyel

(continued from front cover)

DON’T CALL IT A “DENTAL”

Dr. Bannon explained that by referring to all dental procedures simply as “dentals,” veterinarians are doing a disservice to themselves, their staff, and their clients, because “this simplistic term negates the value of what you are doing.” The word dental is an adjective, she noted. “If you were to say ‘I’m going to do a ‘cardiac’ right now,’ what would that mean?”

A good dental cleaning takes time, Dr. Bannon noted. Beyond lowering the value of the services being provided, the term dental also likely blocks the time incorrectly. Instead, she suggested several alternate phrases that are easy to record in a scheduler:
- Complete dental cleaning (CDC)
- Comprehensive oral health assessment and treatment (COHAT)
- Oral assessment, treatment, and prevention (oral ATP)
- Periodontal therapy and surgery
- Prophylactic (prophy; although this is often a misnomer because it’s unlikely that oral disease is being prevented)

“In most cases, this is oral surgery,” she said, “and veterinarians need to start thinking of it as such.” Portraying it in this light to pet owners highlights its importance and the amount of time and skill it will take to complete.

TRAIN YOUR SUPPORT STAFF

“The support staff in dentistry is huge, huge, huge,” Dr. Bannon said. “I could not do my job without my technicians, without my support staff. It is important that they are trained well.”

In most of the United States, veterinary technicians are not legally allowed to extract teeth, but they can conduct and assist with other aspects of the exam. Dr. Bannon recommended that support staff do 90% of the work during oral procedures, allowing the veterinarian to focus on what only he or she can do. “Veterinarians are the ones making the decisions about what needs to be done and how it can be of value,” she said, “but the technicians make the procedure valuable by doing a fantastic job.”

SHOW CLIENTS THE VALUE

Most clients are worried about the cost of veterinary dental care, Dr. Bannon said, but what they really want is value. “Value means quality, which is vastly different than cost,” she said.

“Cost is important, but don’t just talk about the bottom line. Talk about the value of what they’re getting.” Dr. Bannon laid out a few steps that will help veterinarians show clients the real value of oral procedures.

The Exam

Conduct a thorough oral exam before the pet is placed under anesthesia, checking as much as you can in the awake patient so the owner is well prepared for what will happen when the pet is anesthetized. “Do a good thorough awake exam and show the owner what you find,” Dr. Bannon said.
- Open the mouth and check the temporomandibular joint for crevices and pain.
- Check for malocclusion and related problems.
- Count the teeth, checking for missing, fractured, or extra teeth.
- Look for oral masses, lacerations, and foreign bodies.

Scaling above the gum line is an important part of a dental cleaning, she said, but scaling below the gum line is more important. “If you’re not going under the gum line, then you’re going to have progression of gum disease,” Dr. Bannon said, “and that’s the spot you want to focus on.”

Dr. Bannon recommended dedicating an anesthesia technician specifically for dental procedures and staying on top of blood pressure monitoring, intubation, and fluids during the procedure. While the pet is anesthetized, conduct a detailed physical examination. Use a probe to wiggle each tooth during the exam, Dr. Bannon suggested; otherwise, you won’t pick up subtle mobility. Check each tooth for fractures, cavities, irregular surfaces, signs of resorption, and discoloration, and photograph any abnormalities.

“There are 42 teeth in the dog mouth, 30 in the cat mouth. That is 42 different physical exams that you’re doing,” Dr. Bannon said. “Palpate the tongue, the palate, the tonsils, the inside of the cheeks, the buccal mucosa, the sublingual tissues. This is the best time to examine all that because you’re right there.”

Full-mouth intraoral radiographs should be taken as a baseline, then as needed thereafter, Dr. Bannon said. She urged veterinarians: “Don’t give the owner the option to decline the radiographs.”

Results and Follow-Up

One of the most important steps in showing the value of an oral procedure to clients is providing them with the results.

“Don’t let the clients pay their bill until you or the technician has talked to them about what was wrong and what was done to correct the problem,” Dr. Bannon said. Showing the before photos, the radiographs, and the after photos helps clients better understand why they now have a $1000-plus bill and makes them more willing to pay it.

Dr. Bannon noted that on-site follow-up is important. At her clinic, this is done at no charge 1 to 2 weeks after the procedure. “During the follow-up, let your technicians talk to the client about healing, home care, and helpful dental products.” She also advises her entire team to remind the clients that dental care is an ongoing need. “They have to keep coming back,” she said.

CONCLUSION

If you stop thinking, “It’s just a dental” and remember the important steps of conducting a valuable oral procedure, your clients will be happier and more loyal, your staff will be more excited about coming to work, and your bottom line will reflect your success.
Managing Invertebrates in Practice

When veterinarians are presented with an invertebrate animal, what they need most is an understanding of the husbandry needs and behaviors of that particular species.

By Nicola M. Parry, BVSc, MRCVS, MSc , DACVP, ELS

(continued from front cover)

approaches and techniques to help general practice veterinarians manage these patients.

When dealing with invertebrates in practice, he explained, veterinarians must tailor their management approach depending on whether they are presented with an individual pet animal or a problem in a collection of invertebrates. For an individual animal, the approach is similar to that for a dog or cat. “Examine the patient systematically, just as you would with a mammalian patient,” he said. “But when dealing with a collection of invertebrates, think herd health. You may need to sacrifice a few normal or sick animals as part of your investigation.”

He also stressed the importance of knowing the sex of the animal because this can affect the approach to certain health problems. For example, the typical life span of a male tarantula is 2 years, whereas a female can live to age 25. If an owner requests help because several tarantulas have died between 18 months and 2 years of age, the veterinarian will need to investigate whether the deceased spiders were all female. If they were male, however, the veterinarian can explain that this merely reflects the typical life span of a male tarantula.

When investigating any health problem, veterinarians should initially examine the animal and its behavior while it is still in the container, said Dr. Mayer. If the animal needs to be handled, veterinarians should do so with care. Be aware of the dangers involved in handling invertebrates, including what weapons (stinger, fangs, etc) they have. “Be gentle and move slowly–most invertebrates that bite or sting will only do so if they feel threatened,” he said. “And avoid breathing on the animal. A tarantula, for example, sees this as a threat.” The number 1 rule is “do no harm” to either the patient or yourself, Dr. Mayer emphasized.

HUSBANDRY ISSUES

Many diseases of invertebrates kept as pets are related to poor husbandry, which often is associated with provision of an inappropriate substrate for the animal to live on. A substrate that is too wet may result in fungal disease, Dr. Mayer said; one that is too dry may lead to dysecdysis (abnormal shedding of the outer skin in reptiles). “Correcting the husbandry issue can often cure the presenting problem.”

Inappropriate husbandry is common in the spider trade, he said, and often results in dehydration of the animals. Dr. Mayer noted that the abdomen of a healthy tarantula should be rounded. A deflated-balloon appearance indicates that the animal is dehydrated. In this case, do not offer the spider a water bowl because it may be weak and could drown in the bowl. Instead, soak a sponge in water, he advised, and place it on a dish for the spider to drink from. In severe cases of dehydration, lactated Ringer solution can be injected to replenish the spider’s fluid levels.

Dr. Mayer also reminded veterinarians to check invertebrate patients for mite infestations and to be aware of which invertebrates carry beneficial symbiotic mites. For example, centipedes do not carry beneficial mites, he said, so the presence of any mites on these animals should prompt the veterinarian to check the husbandry conditions. Disinfection of the insect’s environment, and quarantine, might be necessary.

“And don’t mess around with a tarantula that is shedding,” Dr. Mayer said. This is a vulnerable time for the animal, and its new exoskeleton is very soft. “For a few days, avoid feeding it crickets, which may eat the spider’s new soft exoskeleton. Let the new exoskeleton harden before feeding,” he stressed.

Another husbandry-related problem for many invertebrates in captivity relates to stress associated with exposure to visitors and continual handling. In such cases, an animal may flick its legs as a stress response when it feels threatened. This action results in loss of hair on the dorsal abdomen, which produces bald spots, Dr. Mayer explained.

Similarly, excessive handling often leads to animals being dropped. These traumatic incidents can present as emergencies, Dr. Mayer said, because the resulting hemolymph loss is a big problem. Hemolymph is not contained in vessels in the invertebrate body, so it just leaks from the traumatized exoskeleton.

SIMPLE WOUND REPAIR

Dr. Mayer discussed how to repair simple wounds on the exoskeleton of a tarantula. To anesthetize the tarantula, he advised soaking a piece of cotton wool in isoflurane and simply placing it in the container with the spider. Wait about 5 minutes, he added, until a sufficient plane of anesthesia results. Veterinarians should not be too concerned about using too much isoflurane because this is difficult to achieve in spiders, he added.

When repairing wounds, veterinarians should avoid using sutures, Dr. Mayer said. The spider’s body naturally responds to injury by producing a mold that has wound-healing properties. “Suture material can interfere with shedding of the old mold,” he explained.

Instead, when repairing wounds on insects or spiders, he advised using surgical tissue glue, bone wax, or household superglue to stop hemolymph leakage.

CONCLUSION

To deal effectively with an uncommon species, Dr. Mayer highlighted the need for veterinarians to familiarize themselves with what different invertebrates’ behaviors mean in different environments. When faced with an uncommon patient, it is important to know what normal behavior and body condition look like for that species, he said. Plenty of literature and books are available to help with this, he stressed. “Knowledge is power.”
They already have a lot to remember. Give them one less thing to forget.

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*BRAVECTO® kills fleas and prevents flea infestations for 12 weeks. BRAVECTO® Chew kills ticks (black-legged tick, American dog tick, and brown dog tick) for 12 weeks and also kills lone star ticks for 8 weeks.

Important Safety Information
BRAVECTO Chews for Dogs: The most common adverse reactions recorded in clinical trials were vomiting, decreased appetite, diarrhea, lethargy, polydipsia, and flatulence. Bravecto has not been shown to be effective for 12-weeks’ duration in puppies less than 6 months of age. Bravecto is not effective against lone star ticks beyond 8 weeks after dosing. Please see Prescribing Information on following page.
Flavored chews for dogs.

Caution:
Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

Description:
Each chew is formulated to provide a minimum dose of 11.4 mg/lb (25 mg/kg) body weight.

The chemical name of fluralaner is (E)-2-[(3,5-dichlorophenyl)-5-(trifluoromethyl)-4-sulfinyl]-2-methyl-N-(2-oxo-2-(2,2,2-trifluoroethyl)ethyl) benzamide.

Indications:
Bravecto kills adult fleas and is indicated for the treatment and prevention of flea infestations (Ctenocephalides felis) and the treatment and control of tick infestations (Ixodes scapularis [Black-legged tick], Dermacentor variabilis [American dog tick], and Rhipicephalus sanguineus [Brown dog tick]) for 12 weeks in dogs and puppies 6 months of age and older, and weighing 4.4 pounds or greater. Bravecto is also indicated for the treatment and control of Amblyomma americanum (Lone star tick) infestations for 8 weeks in dogs and puppies 6 months of age and older, and weighing 4.4 pounds or greater.

Dosage and Administration:
Bravecto should be administered orally as a single dose every 12 weeks according to the Dosage Schedule below to provide a minimum dose of 11.4 mg/lb (25 mg/kg) body weight.

Bravecto may be administered every 8 weeks in case of potential exposure to Amblyomma americanum ticks (see Effectiveness).

Bravecto should be administered with food.

Dosage Schedule

<table>
<thead>
<tr>
<th>Body Weight Ranges (lb)</th>
<th>Fluralaner Content (mg)</th>
<th>Chews Administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4 - 9.9</td>
<td>112.5</td>
<td>One</td>
</tr>
<tr>
<td>&gt;9.9 - 22.0</td>
<td>250</td>
<td>One</td>
</tr>
<tr>
<td>&gt;22.0 - 44.0</td>
<td>500</td>
<td>One</td>
</tr>
<tr>
<td>&gt;44.0 - 88.0</td>
<td>1000</td>
<td>One</td>
</tr>
<tr>
<td>&gt;88.0 - 123.0*</td>
<td>1400</td>
<td>One</td>
</tr>
</tbody>
</table>

*Dogs over 123.8 lb should be administered the appropriate combination of chews.

Treatment with Bravecto may begin at any time of the year and can continue year round without interruption.

Contraindications:
There are no known contraindications for the use of the product.

Warnings:
Not for human use. Keep this and all drugs out of the reach of children. Keep the product in the original packaging until used, in order to prevent children from getting direct access to the product.

Do not eat, drink or smoke while handling the product. Wash hands thoroughly with soap and water immediately after use of the product.

Precautions:
Bravecto has not been shown to be effective for 12-weeks duration in puppies less than 6 months of age. Bravecto is not effective against Amblyomma americanum ticks beyond 8 weeks after dosing (see Effectiveness).

Adverse Reactions:
In a well-controlled U.S. field study, which included 294 dogs (224 dogs were administered Bravecto every 12 weeks and 70 dogs were administered an oral active control every 4 weeks and were provided with a tick collar); there were no serious adverse reactions. All potential adverse reactions were recorded in dogs treated with Bravecto over a 168-day period and in dogs treated with the active control over an 84-day period. The most frequently reported adverse reaction in dogs in the Bravecto and active control groups was vomiting.

Percentage of Dogs with Adverse Reactions in the Field Study

<table>
<thead>
<tr>
<th>Adverse Reaction (AR)</th>
<th>Bravecto Group: Percentage of Dogs with the AR During the 182-Day Study (n=224 dogs)</th>
<th>Active Control Group: Percentage of Dogs with the AR During the 84-Day Study (n=70 dogs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting</td>
<td>7.1</td>
<td>14.3</td>
</tr>
<tr>
<td>Decreased Appetite</td>
<td>6.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>4.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Lethargy</td>
<td>5.4</td>
<td>7.1</td>
</tr>
<tr>
<td>Polydipsia</td>
<td>1.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Flatulence</td>
<td>1.3</td>
<td>0.0</td>
</tr>
</tbody>
</table>

In a well-controlled laboratory dose confirmation study, one dog developed edema and hyperemia of the upper lips within one hour of receiving Bravecto. The edema improved progressively through the day and had resolved without medical intervention by the next morning.

For technical assistance or to report a suspected adverse drug reaction, contact Merck Animal Health at 1-800-224-0318. Additional information can be found at www.bravecto.com. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at http://www.fda.gov/AnimalVeterinary/SafetyHealth/

Clinical Pharmacology:
Peak fluralaner concentrations are achieved between 2 hours and 3 days following oral administration, and the elimination half-life ranges between 9.3 to 16.2 days. Quantifiable drug concentrations can be measured (lower than necessary for effectiveness) through 112 days. Due to reduced drug bioavailability in the fasted state, fluralaner should be administered with food.

Mode of Action:
Fluralaner is for systemic use and belongs to the class of isoxazoline-substituted benzamide derivatives. Fluralaner is an inhibitor of the arthropod nervous system. The mode of action of fluralaner is the antagonism of the ligand-gated chloride channel (GABA-A receptor) and glutamate receptor.

Effectiveness:
Bravecto began to kill fleas within two hours after administration in a well-controlled laboratory study. In a European laboratory study, Bravecto killed fleas and Ixodes ricinus ticks and reduced the number of live fleas and Ixodes ricinus ticks on dogs by >98% within 17 hours for 12 weeks. In a well-controlled laboratory study, Bravecto demonstrated 100% effectiveness against adult fleas 48 hours post-infection for 12 weeks. In well-controlled laboratory studies, Bravecto demonstrated <93% effectiveness against Dermacentor variabilis, Ixodes scapularis and Rhipicephalus sanguineus ticks 48 hours post-infection for 12 weeks. Bravecto demonstrated >90% effectiveness against Amblyomma americanum 12 hours post-infection for 8 weeks, but failed to demonstrate >90% effectiveness beyond 8 weeks.

In a well-controlled U.S. field study, a single dose of Bravecto reduced fleas by >99.7% for 12 weeks. Dogs with signs of flea allergy dermatitis showed improvement in erythema, alopecia, papules, scales, crusts, and excoriation as a direct result of eliminating flea infestations.

Potability: In a well-controlled U.S. field study, which included 559 dogs administered to 224 dogs, 80.7% of dogs voluntarily consumed Bravecto within 5 minutes, an additional 12.5% voluntarily consumed Bravecto within 5 minutes when offered with food, and 6.8% refused the dose or required forced administration.

Animal Safety:
Margin of Safety Study: In a margin of safety study, Bravecto was administered orally to 8 to 9-week-old pups at 1, 3, and 5X the maximum labeled dose of 56 mg/kg at three, 8-week intervals. The dogs in the control group (0X) were untreated.

There were no clinically-relevant, treatment-related effects on physical examinations; body weights, food consumption, clinical pathology (hematology, clinical chemistry, coagulation tests, and urinalysis), gross pathology, histopathology, or organ weights. Diarrhea, mucoid and bloody feces were the most common observations in this study, occurring at a similar incidence in the treated and control groups. Five of the twelve treated dogs that experienced one or more of these signs did so within 6 hours of the first dosing. One dog in the 3X treatment group was observed to be dull, inappetent, with evidence of alopecia, diarrhea, vomiting, and weight loss beginning five days after the first treatment. One dog in the 1X treatment group vomited food 4 hours following the first treatment.

Reproductive Safety Study: Bravecto was administered orally to intact, reproductively-sound male and female Beagles at a dose of up to 168 mg/kg (equivalent to 5X the maximum labeled dose) on three to four occasions at 8-week intervals. The dogs in the control group (0X) were untreated.

There were no clinically-relevant, treatment-related effects on the body weights, food consumption, reproductive performance, semen analysis, litter data, gross necropsy (adult dogs) or histopathology findings (adult dogs and puppies). One adult treated dog suffered a seizure during the course of the study (45 days after the second treatment). Abnormal salivation was observed on 17 occasions; in six treated dogs (11 occasions) after dosing and four control dogs (6 occasions).

The following abnormalities were noted in 7 pups from 2 of the 10 dams in only the treated group during gross necropsy examination: limb deformity (4 pups), enlarged heart (2 pups), enlarged spleen (3 pups), and cleft palate (2 pups). During veterinary examination at Week 7, two pups from the control group had inguinal testes, and two and four pups from the treated group had inguinal and cryptorchid testes, respectively.

No undescended testes were observed at the time of necropsy (dogs 50 to 71).

In a well-controlled field study Bravecto was used concurrently with other medications, such as vaccines, anthelmintics, antibiotics, and steroids. No adverse reactions were observed from the concurrent use of Bravecto with other medications.

Storage Information:
Do not store above 85°F (30°C).

How Supplied:
Bravecto is available in five strengths (112.5, 250, 500, 1000, and 1400 mg) (fluralaner per chew). Each chew is packaged individually into aluminum foil blister packs sealed with a peelable paper backing foil/PET stock. Product may be packaged in 1, 2, or 4 chews per package.

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154545 R1
Unique Aspects of Feline Lymphoma

Diagnosis, treatment, and prognosis of this common cancer are more successful with an understanding of the many differences in the disease between dogs and cats.

By Nicola M. Parry, BVSc, MRCVS, MSc, DACVP, ELS

(continued from front cover)

PROGNOSIS

“The prognostic factors in cats are very frustrating and not quite as cut-and-dried as in dogs,” Dr. Pierro said. In dogs, lymphoma immunophenotype (B cell vs T cell) is the most important prognostic factor: “B is better, and T is tougher,” she said. However, in cats, different lymphoma immunophenotypes tend to be “associated with different disease locations but don’t affect the outcome.”

According to Dr. Pierro, histologic subtype is an important prognostic factor in cats, with small cell (also known as low-grade) lymphoma carrying a better prognosis than that of large cell (high-grade) lymphoma. Small cell lymphoma is composed of proliferations of mature lymphocytes, and the disease usually has an indolent course. It most commonly arises in the GI tract but can also occur in other locations, Dr. Pierro said.

Disease location is another prognostic indicator, she added. For example, cats with nasal lymphoma can survive for years, whereas those with renal lymphoma tend to survive only months.

Response to treatment is a third prognostic indicator. Cats with lymphoma do not respond as well to chemotherapy as dogs do, Dr. Pierro said. “Between 50% and 75% of cats will go into remission, but those that go into complete remission can do better than dogs,” she emphasized.

She also noted that cats with feline leukemia virus that develop lymphoma are more difficult to treat—and they are about 40 times more likely to develop lymphoma in the first place.

SMALL CELL GASTROINTESTINAL LYMPHOMA

Dr. Pierro noted that affected cats with small cell GI lymphoma typically present with a variety of nonspecific clinical signs, including weight loss, appetite changes, vomiting, and diarrhea. Ultrasonographic findings in these cases commonly include thickening of the intestinal muscularis layer, altered wall layering, and lymphadenopathy, she said.1

Dr. Pierro reminded veterinarians that a diagnosis of small cell lymphoma cannot be made on the basis of fine-needle aspiration cytology of lymph nodes alone. However, she recommended still collecting an aspirate from enlarged lymph nodes to rule out other diagnoses such as large cell lymphoma and mast cell tumor.

Definitive diagnosis of small cell GI lymphoma requires biopsy, she said, especially to differentiate it from inflammatory bowel disease. Biopsy samples can be obtained surgically or...
endoscopically. Endoscopy is less invasive and requires a shorter hospitalization time. Although endoscopy allows visualization of the intestinal mucosa, Dr. Pierro noted that it does not allow access to every region of the GI tract. Because lymphoma may arise only in the ileum in some cats, using endoscopy to obtain biopsies requires both upper endoscopic and colonoscopic approaches. Additionally, endoscopy does not allow for collection of full-thickness biopsy samples, she said.

In addition to enabling collection of full-thickness samples from multiple parts of the small intestine, surgical biopsy allows veterinarians to obtain samples of lymph node and liver, she added. And although the surgical approach is more invasive than endoscopy, Dr. Pierro noted that cats with lymphoma do not seem to be at high risk for postoperative dehiscence after full-thickness GI surgery.

**CHEMOTHERAPY PROTOCOLS FOR LYMPHOMA**

Although most dogs will achieve clinical remission with standard-of-care CHOP chemotherapy (vincristine, cyclophosphamide, doxorubicin, and prednisone) for a median survival time of 1 year, she noted that cats with large cell lymphoma that receive CHOP respond to treatment 50% to 75% of the time, with a median survival time of 6 to 9 months.

However, cats with lymphoma that do go into remission with CHOP frequently relapse dogs that go into remission, she emphasized. Data from a 2005 study showed that overall median survival time of cats treated with CHOP was 7 months, but the median survival time for those achieving complete remission was almost 2 years.

The CHOP protocol is also generally well tolerated in cats, said Dr. Pierro. In dogs, doxorubicin is the most effective drug in the CHOP protocol and is sometimes used as single-agent therapy. However, single-agent doxorubicin does not seem to be as effective for high-grade feline lymphoma as it is for dogs with lymphoma.

However, a COP-based protocol (vincristine, cyclophosphamide, prednisone) has been shown to be effective in many cases of feline lymphoma. And, as with CHOP protocols, cats that go into clinical remission with COP chemotherapy can have extended survival times, Dr. Pierro said.

Treatment of cats with small cell lymphoma includes prednisone and the oral chemotherapy agent chlorambucil. This protocol has minimal adverse effects, and most cats respond well, with a median survival of 1 to 3 years, Dr. Pierro said. “I find that most of these cats do not die because of their lymphoma,” she added.

**CHEMOTHERAPY-ASSOCIATED TOXICITIES**

In cats receiving CHOP chemotherapy, “anorexia is by far the most common toxicity that we see,” said Dr. Pierro. Dogs receiving CHOP have unique toxicities associated with cyclophosphamide and doxorubicin, she noted. Cyclophosphamide can cause sterile hemorrhagic cystitis in dogs as a result of an inactive metabolite of the drug, but this does not occur in cats, Dr. Pierro said. And although doxorubicin can cause cumulative cardiac toxicity in dogs, it does not cause clinical cardiac toxicity in cats, she added. However, it can cause cardiac muscle damage in cats, which may be seen histologically after postmortem examination. Nevertheless, Dr. Pierro stressed that doxorubicin therapy is associated with renal toxicity in cats and advised veterinarians to monitor urine specific gravity in their feline patients that receive this drug.

Lomustine tends to be associated with an unpredictable neutropenia in cats, she noted, compared with a more predictable neutropenia in dogs. However, this drug causes minimal hepatotoxicity in cats, unlike in dogs.

Myelosuppression most commonly arises in cats receiving prednisone and chlorambucil, Dr. Pierro said, although rare cases of idiosyncratic liver toxicity have been reported, as well as 1 case of central nervous system toxicity.

**OTHER UNIQUE LYMPHOPROLIFERATIVE DISEASES**

In concluding, Dr. Pierro also discussed 2 other lymphoproliferative diseases that may arise in cats.

**Hodgkin-like Lymphoma**

Hodgkin-like lymphoma is similar clinically and histologically to Hodgkin lymphoma in humans. It is a localized disease that involves lymph nodes of the head and neck and typically carries a relatively favorable prognosis. Histologically, Hodgkin-like lymphoma predominantly comprises proliferations of small lymphocytes, along with the presence of characteristic large Reed-Sternberg-like cells. Dr. Pierro emphasized that this form of lymphoma is considered slowly progressive and treatment usually involves a combination of surgery, radiation, and, potentially, chemotherapy.

**Cutaneous Lymphocytosis**

Cutaneous lymphocytosis (also known as pseudolymphoma) presents as seborrheic and plaque-like lesions of the skin. In some cases, this condition can look like allergic skin disease, Dr. Pierro said. Histologically, cutaneous lymphocytosis comprises proliferations of heterogeneous but well-differentiated lymphocytes. Because the diagnosis is not always cut-and-dried, however, she advised veterinarians to submit biopsy specimens to a dermatopathologist for evaluation. This disease progresses slowly, but “we don’t really know how to treat it,” she noted. As a consequence, no established treatment protocols exist to help veterinarians manage these cases. However, according to Dr. Pierro, treatment often involves using prednisone and oral chemotherapy agents. Although chemotherapy may not always be very effective, it may help slow progression of the disease, she added. In general, this disease has a waxing and waning nature, but it does not seem to cause many problems long term, Dr. Pierro said, and most cats with cutaneous lymphocytosis can live a long time.

References available at AmericanVeterinarian.com.
first time on July 4. He was still frightened, but it did help, so I was hoping it might help him through the hurricane as well."

Wood reached out to her veterinarian, who answered Wood’s questions about dosing and worked with her to figure out a medication schedule that would keep Loki calm. “As the storm approached, I was taking Loki outside to do his business as often as I could,” Wood said. “I was afraid that once things really started getting rough, he wouldn’t want to go outside, but the medicine was so effective that the rough weather didn’t bother him at all. He was running around in the yard, and I was the one anxiously clinging to the doorframe.”

But there was more: Wood’s 17-year-old domestic shorthair cat, Tut, was on prescription medications for a thyroid condition. That, too, was a concern. “My veterinarian was really good about making sure I had an adequate supply of all prescriptions,” Wood said. “But I think the most important thing my veterinary office gave me was confidence and peace of mind in the face of a pending natural disaster. I was very glad I called.”

Hurricane Irma was just one of several extreme weather events to hit the United States in 2017, a cycle that also included devastating wildfires, tornadoes, floods, ice storms, and more. During such times of need, veterinarians have a unique opportunity to assist both their clients and their communities, experts say. It takes forethought, planning, and dedication, but the end result—happy clients and healthy patients—makes it worth the effort.

**TYPES OF NATURAL DISASTERS**

Natural disasters occur throughout the United States, but some events are more common to specific regions. The South and Northeast, for example, face a greater risk from hurricanes, while western states such as California traditionally see more wildfires and mudslides. In the Midwest, the greatest concerns are tornadoes and winter blizzards, with the latter also affecting the New England states. And flooding can occur almost anywhere.

Each type of natural disaster presents a unique threat to pets and their owners, noted John Haven, CPA, executive director of the University of Florida College of Veterinary Medicine.
in Gainesville and head of the college’s Veterinary Emergency Treatment Service (VETS), which deploys throughout Florida whenever a natural disaster occurs. Hurricanes and tornadoes can result in blunt-force trauma and lacerations from flying debris, drowning and contamination issues from flooding, encounters with panicked wildlife fleeing the storm, and disease from insects that flourish in the aftermath. Wildfires can result in burns and smoke inhalation, and blizzards and ice storms can cause frostbite and hypothermia.

BEFORE THE EVENT
Tornadoes and earthquakes occur with little to no warning, but hurricanes, wildfires, floods, and blizzards usually offer residents time to prepare. Grant Miller, DVM, director of regulatory affairs for the California Veterinary Medical Association and state coordinator for the California Veterinary Medical Reserve Corps, encourages veterinarians to become familiar with the disaster plan for their city or county before a disaster strikes.

"Many municipalities have written plans that are available to the public, and some even have annexes specific to animals," Dr. Miller noted. "The plans often address evacuation and transportation procedures and name animal-specific shelter locations. Veterinarians should share this information with clients because this type of information helps guide people during critical times in disasters."

When veterinarians talk with clients about disaster planning, Dr. Miller advised that they take an “all hazards” approach. "This means that no matter what type of disaster occurs, animal owners have anticipated their needs and created a plan of action to respond," he explained. "Of course, if a certain type of disaster is more likely than others to occur in a geographic area, such as a hurricane being more likely than an earthquake, those types of disasters should be considered first."

Beyond distributing the local animal disaster plan to clients, veterinarians should discuss some of the anticipated needs for their clients’ pets, such as a provision for food, water, and medications; identification for the animal and proof of ownership; and a crate or carrier (Box 1). "Setting these aside ahead of time in a convenient, single, ‘grab and go’ location may make the difference between life and death for their animal," Dr. Miller said. "Having enough supplies for at least 72 hours is a solid start, but the more an owner can do to prepare, the better."

Veterinarians can spread the word by making disaster preparedness a frequent topic in office newsletters and on practice websites. These platforms are the perfect place to promote links to reputable sites that offer additional preparedness information and advice, such as the Red Cross, the Centers for Disease Control and Prevention, and the American Society for the Prevention of Cruelty to Animals.

DURING THE EVENT
It’s vital that veterinary practices have a disaster plan in place (Box 2) and that staff members know what their responsibilities are when an event occurs, Lorna Lanman, DVM, a member of the Texas-based Veterinary Emergency & Critical Care Foundation, said. "A written disaster plan is very important," she explained. "Once we have taken care of ourselves, we can help our clients prepare for their own issues."

The services a practice can offer during a natural disaster are predicated on the type of disaster and how it will affect the practice itself. A practice in the path of a Category 4 hurricane, a rapidly moving wildfire, or a raging flood isn’t in a position to assist anyone—their thoughts are only of self-preservation. But practices that will be lightly or not at all affected can assist in many ways.
One of the most appreciated services is boarding animals for clients facing relocation. The PETS Act, enacted following Hurricane Katrina, ensures that state and local emergency preparedness operational plans address the needs of individuals with household pets and service animals following a major disaster or emergency. However, owners with older animals or pets with chronic illnesses may feel better if their veterinarian can provide temporary boarding. Clinics in a safe zone may also assist colleagues whose practices are in danger by taking some or all of the endangered practice’s boarded patients.

“If a veterinarian is faced with the responsibility of having to shelter animals during a disaster, the veterinarian should keep up periodic contact with animal authorities to inform them of any stray animals being sheltered,” Dr. Miller advised. “Veterinarians should document and photograph stray animals being sheltered, since there is a very good chance that they are a beloved pet and that someone is desperately searching for them.”

Another suggested service is a hotline that concerned pet owners can call if they have questions or concerns about their pet’s health during a natural disaster. This kind of access can give clients tremendous peace of mind, as demonstrated by Wood’s experience with the approach of Hurricane Irma.

AFTER THE EVENT
Veterinarians can expect animals to come in for several weeks following a natural disaster. “The nature of the illnesses and injuries varies widely depending on the type of disaster that has occurred,” Dr. Miller observed. “Generally, dehydration, GI issues, eye and skin injuries, malnutrition, and stress-related illness are common. In the wake of disasters, veterinarians often must contend with patients being off medications that they otherwise would have received. For instance, animals with diabetes or epilepsy may not be medicated adequately due to not receiving medications on their regular schedule.”

Box 2. Disaster Preparedness for Veterinary Practices
All veterinary practices should have a preparedness plan in place well before a disaster occurs. The American Veterinary Medical Association and other agency websites offer guidelines on what such a plan should entail, but the basics include:

- Continuity of operations
- The emergency relocation of animals
- Fire prevention
- General emergency planning
- Insurance and legal issues
- Medical records backup
- Security

With this in mind, veterinarians seeing patients after a disaster must ensure that their staff is ready to handle the anticipated uptick in cases, that the clinic is adequately supplied, and that electricity, water, and other vital utilities are unaffected. Veterinarians should also be prepared to deal with the emotional issues that occur commonly in the aftermath of a natural disaster. “You’re dealing with a lot of really stressed-out people,” Haven said. “They have no power, no water, perhaps no home, so they are on their last nerve when they come to see you. And your staff may also be stressed because of issues going on in their own homes post disaster.” In addition, animals may exhibit signs of stress because their routine has been severely disrupted.

“Addressing fatigue is a huge part of managing stress,” Dr. Lanman noted. “We go and go and forget to take care of ourselves. Then the exhaustion sets in, and stress really hits us hard.” Self-care includes getting plenty of rest and not taking on more than the practice can handle safely, Dr. Lanman said.

A final consideration is what to charge for services in the aftermath of a natural disaster. Clients may be facing financial calamity because of the cost of recovery and/or long-term unemployment, which can make it difficult for them to pay for services. But at the same time, no practice can afford to provide services pro bono for an extended period.

“Practitioners have to decide where they are going to draw the line and how they will do that,” Haven said. “Perhaps they could charge a minimum fee to help offset expenses. This is something they must consider and determine before a disaster hits.”

Haven added that it’s sometimes possible for practices to enter into an agreement with their county under the PETS Act to provide care following a disaster and later seek reimbursement from the county and the Federal Emergency Management Agency. However, such arrangements must be made in advance. Reimbursement for pro bono or reduced-fee care may also be obtained through grants provided by the American Veterinary Medical Foundation and some state veterinary medical associations.

Emergency and disaster preparedness should be an ongoing discussion with staff so that everyone understands what to do and where to go should a disaster strike. Make sure new hires are made aware of the plan as soon as possible after they begin employment.
Tramadol: Limited Benefit for OA Pain

Recent study findings show that this popular pain reliever offers no improvement over placebo treatment for elbow and stifle joint pain.

By Natalie Stilwell, DVM, MS, PhD

(continued from front cover)

O-desmethyltramadol is the primary metabolite associated with μ-opioid receptor effects, results of a 2011 pharmacokinetic study in greyhound dogs demonstrated that it had low peak plasma concentrations and a short half-life, indicating low bioavailability.3

Then, in 2012, researchers at the University of Wisconsin-Madison School of Veterinary Medicine compared 3 medications—ABT-116, carprofen, and tramadol—with a placebo control for their relative therapeutic effect on OA-associated pain of the hip joint in dogs.4 In the study, owners were asked to rate their dogs’ perceived levels of pain before and after each treatment. Although the owners noted improved pain levels with tramadol use, kinetic data obtained from force-plate analysis indicated similar values between placebo and tramadol treatments, suggesting the possible involvement of caregiver bias in perceived pain improvement.

STUDY DESIGN

Citing the limited availability of pharmacokinetic data and peer-reviewed support for tramadol, investigators at the University of Georgia recently examined the effectiveness of tramadol for elbow and stifle OA pain in dogs.5 The study took place from January 2015 to May 2017 at the University of Georgia College of Veterinary Medicine. Client-owned dogs were eligible for study participation if they weighed between 15 and 50 kg and had OA-affected signs in the elbow and/or stifles. Owners were required to maintain a stable activity routine for their dogs throughout the study, and the dogs were unable to receive corticosteroid medications or polysulfated glycosaminoglycans 30 days before or during the study. Washout periods for analgesic medications were performed before the study and between treatment periods. Codeine-acetaminophen, chosen for its short-acting effects, was given to owners to use as a rescue medication to be dosed at 1 to 2 mg/kg every 8 hours in the event of unacceptable pain. Dogs were withdrawn from the study if they were intolerant of the medications or if the owners perceived them to have an unacceptable level of pain.

Baseline health data were recorded via physical examination, complete blood count, serum biochemical analysis, and urinalysis. Radiography was also performed to confirm OA in at least 1 elbow or stifle joint, and the most clinically affected joint was designated the joint of interest for the duration of the study. Dogs were further excluded from the study if they demonstrated OA in joints other than the elbow or stifle or had any other systemic or local diseases, joint instability, or joint surgery within the previous 12 months.

The study was randomized and blinded and had placebo and positive treatment controls. The crossover design allowed each dog to serve as its own control by receiving 3 treatments in random order. Owners and investigators were blinded to treatment, and medications were dispensed by the pharmacy to owners in identical opaque capsules that were administered 3 times per day (morning, midday, and night) for 10 days. The negative control (placebo) treatment consisted of lactose powder, and the positive control (carprofen 2.2 mg/kg) was administered at morning and night, with a placebo capsule for the midday dose. Tramadol hydrochloride was dosed at 5 mg/kg. A baseline gait assessment was performed by 1 of 2 board-certified veterinary surgeons before each treatment period and on the final day (day 10) of treatment. Two established parameters for kinetic gait analysis, vertical impulse and peak vertical force, were measured by trotting dogs over force platforms at similar velocity and acceleration rates. Five valid trials per dog were used for analysis, and values were recalculated to represent percentage of body weight to normalize the data for statistical analysis.

In addition to kinetic gait analysis, owners were asked to assess pain levels in their dogs at the beginning and end of each treatment period. Owners provided scores ranging from 0 to 10 for the degree of perceived pain severity and the degree to which pain interfered with daily activities.

COMPARISON OF TRAMADOL, CARPROFEN, AND PLACEBO TREATMENTS

Thirty-five dogs completed the study, satisfying the a priori sample size calculation for 80% statistical power to detect treatment differences. Participants included 11 (31%) dogs with elbow joint OA and 24 (69%) dogs with stifle joint OA. Age and body weight did not differ significantly between the 2 groups, and the order in which dogs received treatment had no influence on outcome.

Rescue medication was necessary for 3 dogs during the placebo session and 1 dog during the carprofen session; however, no dogs were withdrawn from the study due to adverse treatment effects or unmanageable pain levels.

Kinetic Gait Analysis

Vertical impulse and peak vertical force scores were statistically similar at baseline (pretreatment) and at day 10 after placebo and tramadol treatments. By contrast, values increased significantly from baseline after treatment with carprofen, and this change was significantly higher than the changes after tramadol or placebo treatment.

Owner-Perceived Pain Levels

The owners of 33 of 35 dogs completed the pain inventory assessment. They perceived that 14 (42%) dogs had a positive response with carprofen treatment, which was statistically significantly higher than the 8 (24%) dogs that had a positive response with tramadol treatment and 7 (21%) with placebo treatment.

IMPlications FOR Tramadol USE

These study results indicated that tramadol offered no therapeutic improvement over placebo for elbow or stifle OA pain in the participating dogs. Kinetic gait analysis values were similar at baseline and after 10 days of tramadol use, and owners perceived similar rates of success with tramadol and placebo treatment. Carprofen was the only treatment that resulted in improved vertical ground reaction force values and significantly decreased pain levels, as perceived by owners.

This latest study supports the growing evidence for tramadol’s limited analgesic properties for canine OA. The drug has a brief half-life in dogs, and plasma tramadol values are shown to decrease with repeated doses.6,7 Also, tramadol use does not significantly alter thermal or mechanical nociception in dogs.7 Nevertheless, the drug has been widely promoted in veterinary medicine during the past 10 to 15 years for the treatment of OA-associated pain. The caregiver placebo effect, which has now been observed in multiple animal studies,4,6 may play a role in tramadol’s perceived benefits. This latest study further emphasizes the importance of using scientific, peer-reviewed evidence to avoid bias when choosing and promoting treatments in veterinary medicine.

References available at AmericanVeterinarian.com.
Diabetes mellitus (DM) is a common disorder in dogs and cats. Learning how to care for a pet with diabetes can overwhelm clients, especially those with no prior medical experience. To ensure appropriate patient care and provide clients with the best support and advice, the entire veterinary team should be well informed about the diagnosis and treatment of this disease.

Treatment of DM requires attention to detail and a consistent protocol. It is very easy for small errors to creep into a management protocol, leading to poor glycemic control and potentially life-threatening events such as diabetic ketoacidosis and hypoglycemia. An understanding of appropriate protocols and potential treatment errors by the entire team will improve patient care and lead to better outcomes for diabetic patients and their owners. 1

ABOUT DIABETES MELLITUS
DM is caused by an absolute or relative insulin deficiency that results in decreased glucose uptake into cells, increased hepatic glucose production, hyperglycemia, and glucosuria. Type 1 DM, the more common form in dogs, is caused by irreversible loss of beta cell function, whereas type 2 DM results from impaired insulin secretion and insulin resistance and is seen more often in cats. At diagnosis, most cats have type 2 DM, but progressive loss of beta cells may lead to type 1 disease.

Diagnosis of DM relies on identification of characteristic historical and physical examination findings, such as polyuria, polydipsia, polyphagia, and weight loss, together with documentation of hyperglycemia and glycosuria. Detection of serum or urine ketones also supports the diagnosis. In cats, it is particularly important to differentiate stress hyperglycemia from DM. Increased serum fructosamine concentration is suggestive of DM, whereas in stress hyperglycemia, fructosamine is typically within reference range.

Treatment of DM in dogs and cats should include insulin administration, dietary manipulation, obesity management, treatment of concurrent illness, and withdrawal of medications that cause insulin resistance. Insulin treatment is the cornerstone of therapy.

COMMON TREATMENT ERRORS
Many common errors can interfere with the response to treatment of a diabetic dog or cat. Common problems include poor insulin choice, errors in insulin handling or administration, errors in monitoring, and inappropriate feeding protocols (Box).

How to Avoid Common Insulin Therapy Errors
Giving proper advice to clients of diabetic pets requires an understanding of the many problems that can result from mistakes made in the choice, use, and monitoring of insulin.

By J. Catharine Scott-Moncrieff, VetMB, MA, MS

Insulin administration errors are a common cause of poor patient response.
Clinical Focus

Box. Common Errors in Diabetes Management

**INSULIN-RELATED ERRORS**

**Insulin Choice**
- Inappropriate insulin type
- Use of compounded insulin
- Mixing of different insulin products

**Insulin Handling**
- Inappropriate dilution
- Inadequate mixing
- Inappropriate storage

**Insulin Administration**
- Incorrect insulin syringes
- Incorrect/inaccurate dosing
- Once- vs twice-daily dosing
- Failure to rotate insulin injection site
- Poor injection technique

**MONITORING ERRORS**

**BG Curve Errors**
- Missing hypoglycemia
- Missing diabetic remission
- Relying on spot-check BG measurements
- Obtaining BG curves in stressed patients
- Obtaining BG curves in noisy or stressful locations
- Not keeping same routine between home and clinic
- Using BG meters not validated for dogs and cats
- Failure to recognize expected day-to-day variability in BG curves

**Treatment Errors**
- Increasing insulin dose too rapidly or frequently

**Other Errors**
- Not performing regular physical examinations
- Missing signs of concurrent illness
- Administering medications that cause insulin resistance

**INAPPROPRIATE FEEDING PROTOCOLS**
- Relying on dietary management alone
- Not feeding when insulin is administered
- Failing to consider other health conditions when making a dietary change
- Feeding an unpalatable prescription diabetic diet

**Insulin Choice**

The most common insulin products used for initial management of diabetic dogs and cats are shown in the Table.2-4 Neutral protamine Hagedorn (NPH) insulin is not recommended for diabetic cats because it is very short acting in that species and usually does not result in good glycemic control. Use of compounded insulin products is also not recommended. In a study of compounded protamine zinc insulin (PZI), the authors documented incorrect insulin concentration, incorrect pH, inter-lot variability in potency, and inappropriate zinc content in insulins purchased from many compounding pharmacies.4 Inadequate concentrations of free insulin in solution and inappropriate endotoxin concentrations were also documented. These deviations from United States Pharmacopeia guidelines for compounded insulin products have the potential to cause clinically significant adverse effects in diabetic pets.

In dogs, long-acting insulins such as PZI and glargine are not recommended for initial treatment of newly diagnosed diabetic patients; however, these insulins may be useful in select patients with rapid insulin metabolism.

Lastly, it is important to remember that different brands of the same insulin formulation (eg, Humulin N and Novolin N) are not interchangeable because of differences in manufacturing techniques. It is also important to avoid mixing different insulin formulations together.

**Insulin Handling**

Dilution of insulin products is not recommended as standard practice for most diabetic patients, not only because communication errors can lead to mistakes but also because dilution shortens the insulin’s shelf life. Insulin dilution does, however, make it easier to draw up small volumes of insulin accurately. Unfortunately, most commercial insulin products cannot be diluted because dilution changes critical parameters such as pH, pharmacokinetic properties, and stability of insulin formulations. NPH is the only insulin product that can be diluted with either a commercial diluent or sterile saline, but doing so decreases the stability of the insulin. For small insulin doses, it is preferable to use U40 insulin and syringes or insulin pens with 0.5U markings.

Another important aspect of handling—depending on the type of insulin used—is how to mix insulin prior to administration. Some insulin products such as insulin zinc suspension (Lente) should be shaken thoroughly; others, such as PZI and NPH insulin, should be rolled or inverted gently until fully suspended. Insulin solutions such as glargine do not need to be mixed.

Although most insulin products are stable at room temperature, it is recommended that they are stored in the refrigerator in an upright position. Refrigeration prolongs the shelf life and decreases the likelihood of bacterial growth. Refrigeration is particularly important for clients who—because of both the small insulin doses needed by many patients and the cost of insulin—do not always discard the insulin at the time recommended by the manufacturer.

It is very important to inspect insulin products before each injection. Insulin suspensions such as PZI, Lente, and NPH should be uniformly white and cloudy, with no particulate matter or crystals. Insulin solutions such as glargine should be clear with no particulate matter or crystals present. If abnormalities are noted, the insulin bottle should be discarded and replaced.
Insulin Administration

Because the concentration of insulin products varies, it is very important to use the appropriate insulin syringe for each formulation. If U40 syringes are used to deliver U100 insulin, the insulin dose will be 2.5 times the intended dose, whereas if U100 syringes are used to deliver U40 insulin, the dose will be 2.5 times too low.

Table. Common Insulin Products for Dogs and Cats

<table>
<thead>
<tr>
<th>Species</th>
<th>Insulin Type</th>
<th>Trade Name</th>
<th>Characteristics</th>
<th>Starting Dose</th>
<th>Shelf Life After Opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs</td>
<td>NPH, neutral protamine Hagedorn; PZI, protamine zinc insulin.</td>
<td>Humulin N, Humulin N</td>
<td>Human recombinant insulin, 40 U/mL</td>
<td>0.25-0.5 U/kg every 12 hours</td>
<td>42 days</td>
</tr>
<tr>
<td>Cats</td>
<td>Lantus</td>
<td>Human recombinant analog insulin, 100 U/mL</td>
<td>1-2 U/cat every 12 hours</td>
<td>28 days</td>
<td></td>
</tr>
</tbody>
</table>

Adjusting the insulin dose to account for use of incorrect insulin syringes is not recommended because this can lead to serious dosing errors.

Poor administration technique is a common cause of poor response to insulin. Numerous resources, including videos available online, outline the correct technique for insulin injection. Instructions for use of insulin pens are also available online. Owners should be taught proper injection technique and appropriate injection locations by veterinarians or veterinary technicians. If there is any concern about a good response to treatment, the owner’s technique should be reevaluated. Common injection errors include not ejecting air bubbles from the syringe, not priming insulin pens, and not rotating the site of insulin injection.

Most diabetic cats and dogs should be treated with insulin twice daily. Although clinical signs may be controlled using once-daily insulin in some animals, the risk of hypoglycemia is higher and it is less likely that good glycemic control will be achieved. In cats, once-daily insulin treatment may decrease the chance of diabetic remission.

COMMON MONITORING ERRORS

Response to insulin treatment should be assessed by evaluation of clinical signs, blood glucose (BG) concentrations, and measurement of urine glucose and fructosamine concentrations. In dogs and cats predisposed to development of ketoacidosis, urine ketones should also be measured. Common errors in insulin monitoring include failing to identify hypoglycemia or diabetic remission, increasing the insulin dose too quickly, and relying on spot-check BG measurements alone to adjust insulin therapy.

In most patients, BG curves should be performed every 3 to 6 months to adjust insulin dose and detect occult hypoglycemia (Figure). BG curves should also be performed in any diabetic patient with poor control of clinical signs and 10 to 14 days after a dose or formulation change. BG curves are ideally performed using home monitoring but can be performed in the clinic. Day-to-day variability should be expected whether the cat or dog is in the clinic or at home.

It is very important not to evaluate the pet’s response to insulin until adequate time has elapsed. The insulin dose should not be increased more frequently than every 7 days. If BG is measured in the first few days, the measurement should be used only to detect hypoglycemia. When performing a BG curve, every attempt should be made to minimize the stress of the experience and keep the conditions as similar as possible to a normal day. BG is typically measured every 2 hours for 8 to 12 hours, starting 2 hours after the morning insulin dose and finishing just before the evening dose. In some circumstances, BG measurement every 3 to 4 hours is adequate. Even if the curve is performed in the clinic, it is ideal if the patient is fed and dosed at home prior to arrival. The most important parameters to evaluate when performing a BG curve are the BG nadir and the duration of effect. The BG nadir should be between 80 and 150 mg/dL, and the duration of effect should ideally last 10 to 12 hours (BG <300 mg/dL). It is important to remember that the BG curve should be interpreted in light of the clinical signs, serum fructosamine concentration, and any other information such as urine glucose.

COMMON DIETARY ERRORS

Low-carbohydrate, high-protein diets are recommended in newly diagnosed diabetic cats, while most dogs should be fed high-fiber and low- to moderate-fat diets. Diets for diabetic dogs and cats must be palatable and, if appropriate, calorie restricted to control obesity. It is recommended that the daily portion is divided into 2 meals fed at the time of each insulin injection, although many cats prefer to nibble throughout the day.

Common errors in feeding diabetic dogs and cats include relying on diet alone to control BG in a newly diagnosed diabetic cat, failing to feed at the time of the insulin injection, not taking into account the dietary requirements of other medical conditions, and continuing to feed a prescription diabetic diet that is not palatable. Excessive use of snacks and snacks that contain simple sugars may also cause problems in diabetes control.

SUMMARY

Management of diabetic patients requires attention to detail, and errors may lead to poor diabetic management. Some of the most common errors that lead to poor glycemic control in veterinary patients include failing to account for stress hyperglycemia on a BG curve, missing diabetic remission in cats, and misinterpretation of BG curves in both dogs and cats. Insulin-induced hypoglycemia is also a common cause of poor glycemic control in both dogs and cats.

References available at AmericanVeterinarian.com.
In the Trenches: The Veterinarian’s Role in the One Health Movement

By the nature of their knowledge and expertise, it is incumbent on veterinarians to promote this global initiative and educate medical doctors as equal partners in improving health around the world.

One Health—the global initiative to achieve optimal health for people, animals, and the environment—is more important today than ever. Experts estimate that more than two-thirds of emerging and reemerging infectious diseases are vector-borne or zoonotic, and that most of these zoonoses originate from wildlife.1,2

There is no doubt that this collaborative, species-spanning approach to health care has grown exponentially over the past 2 decades, but there remains much ground to cover for full acceptance and application. Audrey Ruple, DVM, MS, PhD, DACVPM, MRCVS, assistant professor of One Health epidemiology at the Purdue University College of Veterinary Medicine in West Lafayette, Indiana, spoke with American Veterinarian® about this important health care initiative and how it is incumbent on veterinarians—who, by the nature of their work, play a significant role in both human and animal health—to advance the cause.

Are veterinarians thinking as much as they should about One Health?

Audrey Ruple, DVM, MS, PhD, DACVPM, MRCVS: The One Health mindset is inherent to being a veterinarian. I think all veterinarians are One Health practitioners, trained to see the entire world through a One Health lens, but some veterinarians may not be consciously aware that this is their perspective. Veterinarians are an integral part of the One Health movement, and we are seeing a change in how other medical professionals are recognizing our value as part of the entire medical community, which I like to think of as a puzzle with many interlocking pieces. Veterinarians own a big part of this One Health puzzle that physicians don’t have, as physicians are not routinely trained in zoonotic diseases in the same way veterinarians are.

How can veterinarians spread the word to MDs?

When I do One Health talks for veterinarians and I ask if people have heard of One Health, almost everyone raises their hand. When I ask the same question in a room full of MDs, almost no one has ever heard of One Health. It’s a message that our profession has done a really good job in communicating to each other, but we haven’t been as great about spreading the word outside of our profession. I think many veterinarians see themselves as working in a silo rather than seeing how their work interlocks with the rest of the puzzle.

To get the message out, we should talk to our counterparts in human medicine as our equal partners in health care. We should say: “Here’s the entire health landscape—here’s this piece that you have, and here’s this piece that we have, let’s work together to see how they fit together.” We have some really good examples in the past few decades where we have formed very successful teams of One Health practitioners: MDs and DVMs with different specialties like oncology, toxicology, and virology. When we bring a whole team together we can solve the puzzle faster than any one of us could on our own.

Lyme and other vector-borne diseases are great examples of this as the geographic ranges of vectors are changing. Say you’re seeing the incidence of Lyme disease increase in your practice area. Do you keep that information in your silo, or do you share it with other health care professionals in your area either by contacting physicians directly or by talking to the local health department? Missing that opportunity to work with other health care professionals can have real consequences, as MDs may not have Lyme disease on their differential list if they are not yet aware of its spread into the area. In a sense, animals can serve as sentinels of disease spread for humans, and it is part of our job to ensure the right alarm bells are rung on the human side of health care to ensure accurate diagnoses are being made in the human population in the area.

Are some medical specialties more in tune than others with One Health?

Obviously, any veterinarian working with zoonotic diseases is closely attuned to the overlap between human and animal health, but one specialty that has really embraced the One Health approach is oncology. In this field, the canine spontaneous tumor model is gaining traction as a model for human health because many cancers are molecularly identical between the 2 species. This makes it possible for us to leverage the data from 1 species to provide help for the other and vice versa. By utilizing data from both dogs and humans, we can get a complete picture of what’s happening in terms of both the prevention and treatment of many cancers.

The One Health approach has been embraced by the National Institutes of Health, which has created a comparative oncology program that studies cancers in dogs as models for human health.7 Another example of this is Stephen Withrow, DVM, DACVS, DACVIM (oncology), surgical oncologist and retired founding director of the Colorado State University Flint Animal Cancer Center, who pioneered a treatment for canine patients with bone cancer in which the diseased area of bone is replaced with healthy bone. This was developed in parallel with human limb-sparing techniques, and the procedure is now used across the nation to prevent amputation in both dogs and children diagnosed with osteosarcoma.8
How are zoos working with public-health professionals to address conservation and public-health issues?

Zoos have become increasingly active in conservation measures as well as in research and education—almost all of which involves the One Health perspective. The St. Louis Zoo, for example, has demonstrated how zoos can partner with schools of public health to create a learning environment in which students integrate their public-health knowledge into the environmental and animal health model provided by zoologic societies. The zoo’s partnership with the School of Public Health at the University of Missouri–Columbia has led to collaborations in which human health outcomes associated with visiting the zoo are examined. Through this collaboration they have noted health outcomes such as lowered blood pressure and decreased stress in humans following a zoo visit. The zoo has also done projects in Africa and on the Galapagos Islands. This approach provides a One Health educational experience for students of public health, veterinary medicine, human medicine, and environmental health.

How else can veterinarians get involved, or more involved, in One Health?

Veterinarians need to recognize that they own a part of the One Health landscape. There is a big piece of this puzzle that is completely ours, and no other health practitioner can do what we do. We also need to do a better job at communicating what we are already doing in One Health. We need to continue to be active, show up, and speak the One Health language, because the importance of the communication part can’t be understated. We need to tout our own horn as a profession, because we don’t do a very good job at that. If people don’t know what we are doing and how important our piece of this puzzle is, how can we complain when they don’t take us seriously as health care professionals?

I think there are still opportunities in veterinary medicine that we haven’t created yet. It’s going to take a person—and it often literally comes down to a single individual—what is known as a “gap hero.” With a little imagination and hard work, a gap hero can find a way to close the gap for the betterment of both humans and animals. I believe a lot of progress in terms of One Health is going to happen at a grassroots level. It is going to happen at the local levels where individuals are willing to dig in and do the work of creating a healthier society. On a national level, we need to do a better job at representing what we are doing not just at veterinary conferences but at physician conferences as well. We need to come to the table as their equals, their peers.

Research has shown that 50% of physicians acknowledge that they don’t know anything about zoonotic diseases or that they are uncomfortable with their knowledge of zoonotic diseases. Those same doctors also recognize that veterinarians are the best sources of information on zoonotic disease. So while there may be some physicians who will be resistant to seeing us as their peers, there are others who will walk with us to the table and work together to solve major health problems in all species. We will never know how much support we will get in this One Health adventure until we begin to show up consistently and speak up about our piece of the puzzle.

References available at AmericanVeterinarian.com.
Veterinary Students Stand Together for Suicide Awareness

Veterinary students have created the #VetMedUnited movement to spread awareness of suicide and break down the stigma associated with asking for help.

By Kerry Lengyel

Nearly 1 in 6 veterinarians will consider suicide at some point during their career, according to CDC survey data. This startling statistic, and others like it, has sparked the #VetMedUnited movement, which aims to remember the veterinarians and veterinary students who have been lost to suicide, raise awareness about mental health in the profession, and promote more wellness initiatives throughout veterinary schools and hospitals.

Every year on April 4, the Student American Veterinary Medical Association (SAVMA) Wellness Committee encourages chapters across the globe to participate in this day of remembrance in whatever way they can. Among the many campus events this year, students held vigils, made signs, participated in wellness seminars, and more to stand up against mental health stigmas and demonstrate their hope for the future of the profession.

Here is a sampling of the many #VetMedUnited events SAVMA chapters organized on and about April 4.

MICHIGAN STATE UNIVERSITY
A week of wellness and awareness at MSU started with a talk on signs and stressors related to suicide given by DASIUM, an organization dedicated to the prevention of depression, addiction, and suicide in teens and young adults. Then, a group from High Performance Vets, which helps coach veterinarians on how to succeed professionally, educated students one-on-one about starting their careers on the right foot. The chapter also organized a dinner talk on self-care and the tools students can use to help to manage their well-being.

Students also tye-dyed 600 #VetMedUnited T-shirts and wore them when they gathered for a moment of silence outside their classrooms, commemorating the week of wellness with a group photo. “In addition to all of this,” MSU SAVMA President Chelsea Woodcock said, “we distributed #VetMedUnited ribbons, badge holders, silicon bracelets, stickers, and buttons throughout the MSU Veterinary Medical Center for faculty, staff, [and] third- and fourth-year veterinary students, and in the veterinary medical building for first- and second-year veterinary students, faculty, and staff.”

LOUISIANA STATE UNIVERSITY
The LSU SAVMA board partnered with the LSU Wellness Committee to sponsor several events for #VetMedUnited Day.

“The main event was a wellness picnic to encourage students to get outside and take a break from the classroom,” Morgan
Richard, LSU SAVMA senior delegate, said. Veterinary students played various outdoor games, flew kites, and participated in different sports activities.

“We also made a sign and asked students to share encouraging words for their fellow students on it,” Richard said. This #VetMedUnited sign now hangs proudly in a hallway near the veterinary school classrooms and will remain there until summer break.

NORTH CAROLINA STATE UNIVERSITY
NC State SAVMA celebrated #VetMedUnited Wellness Week right before finals week. Students made wellness kits filled with reusable heating pads, stress balls, and facial scrubs and listened to a #StoptheStigma talk on wellness by NC State College of Veterinary Medicine Dean David Paul Lunn, BVSc, MS, PhD, MRCVS, DACVIM.

“We incorporated students, faculty and staff with the events and focused on taking time for what makes you happy,” Madeline Zurowsky, NC State SAVMA delegate, said, “and finding your ‘why’—why you chose veterinary medicine.”

The dean, along with university faculty and counseling staff, spoke to students about the rising levels of suicide, how to reduce stress after difficult cases of euthanasia, and the importance of stopping the stigma associated with discussing mental health issues.

OHIO STATE UNIVERSITY
OSU SAVMA brought its university community together for #VetMedUnited Day to raise awareness for suicide across the board. The event consisted of one-on-one discussions between interested students and a clinical therapist or clinical psychologist about available mental health resources as well as posters for veterinary students to sign and pledge their support for their peers.

But the student group wasn’t just raising awareness for veterinarian suicide prevention. “Since SAVMA has a large community outreach component,” Megan Parry, health and wellness chair for OSU SAVMA, said, “we worked that into the event by raising money for Mission 22, a suicide prevention organization that aims to provide resources to veterans and their families.” Participants could donate to the organization by purchasing raffle tickets, which put them in the running to win gift baskets.

“Overall, the event went very well,” Parry said. “We had many students stop by and sign the posters and meet the clinical therapist and psychologist, and I felt that we were able to bring awareness to the issue.”

PURDUE UNIVERSITY
The theme of #VetMedUnited Day at Purdue was “Togetherness Is Sweet.” To fit with that theme, the Purdue SAVMA chapter created an ice cream bar, stocked to the brim with blue toppings—one of the colors of suicide awareness. Students could also sign a poster and express what they love about the veterinary profession.

“We wanted to bring greater awareness to this day and educate our students on what it signifies,” Purdue SAVMA President-elect Kristi Mariko said. “We wanted to make this an interactive event where veterinary students, veterinary technician students, faculty and staff could come together and remind each other of why they got into veterinary medicine and what they love about the veterinary community.”

Mariko said this event was extremely important to her because she has taken an interest in mental health in the veterinary industry. “I am excited to grow this event for future years,” she continued.

LINCOLN MEMORIAL UNIVERSITY
Every veterinary student and faculty member received a #VetMedUnited pin to commemorate this special day, according to Lincoln Memorial SAVMA Treasurer Cortney Curtis.

“We also had a really awesome US map up for the week,” she continued. “Students would pin the locations where they lived or had a connection to, as well as where they thought they might end up in the future. After that, they tied a string connecting all of their pins.” This allowed the students to see where everyone would be located and to remind them that there will always be classmates close by to help out in a time of need.

WASHINGTON STATE UNIVERSITY
WSU veterinary students showed their support by placing purple and teal handprints for suicide prevention on a #VetMedUnited banner.

“It was incredible to see such great support from our faculty and staff as well,” Jacqueline Alford, WSU SAVMA senior delegate, said. “Our counselors, faculty, and staff, and our media crew all came out to support the event.”

Students also wrote on poster boards labeled “What’s Your Why?” to encourage one another to share why they chose veterinary medicine.

“Overall, it was an awesome opportunity for the WSU College of Veterinary Medicine to come together and break the stigma behind mental health and seeking help for issues that students may be facing,” Alford said.

REFERENCE
Heartworm and Lyme Disease Forecasts Look Gloomy

THE COMPANION ANIMAL PARASITE COUNCIL (CAPC) has released its annual parasite forecast, and the outlook for 2018 is not optimistic. Heartworm disease will continue to “aggressively spread” across the United States, the groups says, and Lyme disease prevalence will increase in areas east of the Rockies.

Heartworm prevalence has increased 20% over the past 5 years, according to CAPC, and the upward trend is expected to continue. Hot, wet conditions and shifting weather patterns over the past 2 years have created ideal breeding conditions for mosquitoes. In addition, many heartworm-positive dogs were relocated across the country following last year’s hurricanes, potentially adding to the spread of the disease. CAPC predicts the following geographic spread of heartworm disease this year:

- Heartworm infections are expected to be above average nationwide.
- Prevalence in the lower Mississippi River region will be much higher than normal.
- Northern states, from Washington to Vermont, may experience a rise in heartworm infections.

Although Lyme disease occurs more commonly in areas with dense tick populations—New England, the East Coast, and the upper Midwest and West Coast states—CAPC predicts that non- endemic areas will start to see a rise in Lyme disease cases, including in North Dakota, South Dakota, Iowa, Missouri, southern Illinois, Ohio, Kentucky, Tennessee, North Carolina, western Pennsylvania, eastern Ohio, West Virginia, and the Appalachian region in Virginia. A less active year is predicted for areas from Washington, DC, to Philadelphia, Pennsylvania, and eastward, as well as the Boston/ Cape Cod, Massachusetts region.

CAPC also notes 2 other parasitic diseases that may cause trouble. Anaplasmosis prevalence is forecasted to be average for much of the United States, except for Minnesota, which is expected to have an active year. The Wisconsin/Minnesota border area and the Boston/Cape Cod region should see less activity than normal. Ehrlichiosis prevalence is expected to be higher than normal in the southern Virginia and northern North Carolina regions, with normal prevalence elsewhere.

Feline Tickborne Pathogen Prevalence in the United Kingdom

UK RESEARCHERS RECENTLY PERFORMED a nationwide survey to determine the prevalence of several pathogens in ticks collected from domestic cats. Although most (93.5%) of the ticks were pathogen-free, several tickborne pathogens were widely distributed throughout the country.

A total of 540 ticks were collected during examination at 278 veterinary hospitals in 2016, most removed from cats in England. Before processing, each tick was spiked with an internal amplification control to monitor successful DNA extraction and rule out polymerase chain reaction (PCR) inhibition. The researchers also used primers for feline 28S rDNA to serve as an endogenous positive control. Several conventional and quantitative PCR assays for tickborne pathogens were performed.

Specific qualitative PCR assays targeted *Anaplasma phagocytophilum*, *Bartonella* spp (positive samples were also screened for *B henselae*); and 3 hemoplasma species (*Mycoplasma hemofelis*, “*Candidatus Mycoplasma hemominutum*,” and “*Candidatus Mycoplasma turicensis*”). *Hepatozoon* spp were detected using conventional PCR. DNA sequencing was performed to identify pathogens in positive samples to the species level.

The internal amplification control successfully amplified in all 540 samples, while 473 (88%) samples detected feline 28S rDNA, suggesting that most ticks had a blood meal prior to collection. Nineteen tick samples (3.5%) were positive for a single pathogen: 5 (0.9%) with *A phagocytophilum*, 7 (1.3%) with *Bartonella* spp, 5 (0.9%) with hemoplasma DNA, and 2 (0.4%) with *Hepatozoon* spp. All pathogens were distributed widely throughout the United Kingdom except for *Hepatozoon* spp, which were detected only in Wales and southeastern England. In a previous study with the same 540 tick samples, investigators determined that 6 (1.1%) samples contained *Babesia* spp and 10 (1.9%) contained *Borrelia burgdorferi*.

Borrelia burgdorferi Infection in Metropolitan New York City

RESULTS OF A RECENT STUDY SHOWED that canine seroprevalence for antibodies to *Borrelia burgdorferi* accurately predicted the risk of Lyme disease infection in humans in metropolitan New York City, including 30 counties and about 20 million people.

The investigators used categorical analysis to analyze multiple factors, including SNAP3Dx and SNAP4Dx test results, population density, percent forested area, and CDC-reported human Lyme disease cases. Regression analysis was performed for detailed variables, such as precipitation, fall temperatures and vegetation, and level of urbanization in each county. Finally, the investigators performed a backward-stepwise regression analysis to determine whether the variables could accurately predict the prevalence of Lyme disease in dogs or humans.

A total of 234,633 SNAP test results from 2001 to 2010 were analyzed. Positive tests for *B burgdorferi* ranged from 1.2% to 27.3% by county, while human Lyme disease cases ranged from 0.3 to 438.7 cases per 100,000 people by county.

The percentage of positive canine tests was significantly higher in counties with low population density (18%) than in those with moderate (8%) or high (5%) populations. Positive tests were also more likely in counties with high amounts of forested area (21%) than in those with medium (15%) or low (6%) forestation.

Similarly, human Lyme disease prevalence was significantly higher in counties with low and medium population densities than in counties with high population densities (113, 10, and 3 cases per 100,000 people, respectively). Also, more cases were reported in counties with high or medium forestation than in counties with low forestation (165, 66, and 11 per 100,000 people, respectively). Human and canine cases correlated strongly with each other on both categorical and regression analyses.

Regression analysis also revealed that several environmental factors known to influence tick populations, including forest cover and November temperatures, significantly correlated with positive canine SNAP tests and human Lyme disease cases.

Backward-stepwise regression revealed 3 factors that could be used to accurately predict the percentage of positive canine tests: human case reports and population density, maximum temperature and precipitation during November, and deciduous or mixed forest areas. Likewise, the percentage of positive canine tests can also accurately predict the prevalence of human Lyme disease.

The authors cautioned that these results may not apply to other regions of the United States, however, given the unique, endemic nature of Lyme disease in the Northeast.


Lucy’s Project shines a light on a largely unaddressed—and often unrecognized—issue: animals affected by domestic violence. Lucy’s Project, a network of services for victims of domestic violence and their companion animals, was created after its founder, Anna Ludvik, experienced a tragic but eye-opening event. Grieving for her stillborn daughter, Lucy, in 2013, Ludvik struggled to make sense of it all. She ultimately realized that despite her suffering, she was alive and she was safe—unlike the many women who face every day in fear and pain as a result of domestic abuse. Ludvik decided that, in her daughter’s name, she would help domestic violence victims and their pets.

“I didn’t want [Lucy’s] life and death to be in vain, and I wanted to turn such tragedy into beauty,” Ludvik said. “I loved the idea that her beautiful name could shine a light on a relatively unheard-of issue—animals affected by domestic violence—and help protect other innocent animals, children, and women.”

As an animal advocate, Ludvik saw how poorly understood this aspect of domestic violence was, with no movement around it in her home country of Australia. “I found out quickly that ours is an ‘aha!’ cause,” she said. “As soon as people hear about it, it makes sense to them, and they get on board.”

With the help of like-minded individuals across Australia, Ludvik got Lucy’s Project off the ground. Today, with an extended network of more than 200 domestic violence and animal welfare organizations, it leads the global movement to raise awareness about the grave effect of domestic violence on pets.

**GROWING A NETWORK OF SUPPORT**

Lucy’s Project promotes the work of member organizations and recognizes that animal abuse can be an indicator of abuse against people. Although the project doesn’t help domestic violence survivors and their pets directly, it supports organizations around the world that do. For example, if a domestic violence refuge wants to become companion animal-friendly, Lucy’s Project helps it access the necessary resources, information, tools, and skills. The project also ensures that domestic violence organizations are established when a community may be in need.

“When visiting a local no-kill animal shelter recently, I was horrified to hear how 50% of their surrenders were due to domestic violence and that the shelter was already beyond capacity and forced to turn people in need with animals away,” Ludvik said. If a domestic violence victim returns home with his or her pet after being turned away from a shelter or abandons the pet, both of their lives will be at risk, Ludvik said, so Lucy’s Project helped set up a local crisis foster care network that allows animals and survivors to stay together. “No one wants to surrender a beloved companion animal, but [people] often feel they have no choice,” she said.

Safe Pets Safe Families, which offers foster care services for pets and people leaving domestic violence situations, is currently unfunded and run entirely by volunteers in Adelaide and surrounding areas. But Lucy’s Project is helping to pilot a chapter in Lismore, and eventually plans to create an operational template that would enable other communities in Australia to set up chapters.

**FOCUSING ON THE FUTURE**

Activism is the lifeblood of Lucy’s Project, but the network also started holding conferences in 2015, with its first international conference about domestic violence and pets held in 2016. These conferences attract a wide range of people, from domestic violence service providers to animal refuge workers to veterinarians to the general public looking to get more involved. “We all work together so we find it beneficial to hear the many perspectives,” Ludvik said. “Anyone with an interest in the field is welcome.”

This year’s Lucy’s Project Domestic Violence and Animal Abuse Strategic and Practical Perspectives conference will be held in November in Melbourne, Australia. “We are focusing on practical aspects of building the infrastructure needed to support human domestic violence victims and their animals,” Ludvik said.

The conference will also host crisis foster care workshops to help those who wish to set up similar networks in their regions, as well as sessions led by cohousing refuges, shelters, transitional homes, and more. A specific workshop for veterinarians will cover how to react when they suspect that an animal, and possibly its owner, may be victims of domestic violence. “There are so many considerations for veterinarians, and it can be daunting, so we want to support them,” she said.

The project has no US chapters, but Ludvik encourages anyone based in the United States to become involved in the National Link Coalition (nationallinkcoalition.org), a network of US organizations that addresses the intersection between animal abuse and domestic violence. Lucy’s Project held its 2016 conference in conjunction with the coalition and prides itself on being the coalition’s Australian counterpart.

Much of the work done by Lucy’s Project involves helping people make connections that allow them to aid people and animals in need. The more the endeavor grows, the more lives are saved, Ludvik said. “When I hear that the work of Lucy’s Project inspired someone to build animal housing, make all future buildings animal-friendly, or take on projects to support domestic violence victims and their animals, I imagine the lives saved as a consequence,” she said. “Every time, that floors me, because that’s why I do what I do.”
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Adaptil Junior is similar to Ceva Animal Health’s Adaptil behavioral product for dogs—just formulated especially for puppies. Adaptil Junior is a translucent blue collar that releases an artificial pheromone identical to the naturally occurring pheromone with which mother dogs calm and reassure their puppies. Designed to be worn continuously for up to 4 weeks, this product provides puppies with much-needed anxiety relief.

**For More Information:** adaptil.com

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This stand-alone chemistry diagnostic instrument was designed to bring reference-lab quality testing into the veterinary practice. Carysta HVC offers 37 routine and specialty parameters, available as singly selected tests or fully customizable panels, in a single system. With Carysta HVC, practices will also be able to run multiple patient samples simultaneously with minimal sample volumes.

**For More Information:** zoetisus.com

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**For More Information:** bluebuffalo.com

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**MARKETED BY: Zoetis**

This dermatologic supplement provides allergic dogs with a concentrated source of PEA—a naturally occurring lipid compound that supports skin health. This hypoallergenic formula, which contains no wheat, beef, or chicken, can be added to a canine dermatology treatment protocol to help maintain the health of the dog’s skin.

**For More Information:** dechra-us.com

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**MARKETED BY: Animal Necessity**

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**For More Information:** animalnecessity.com

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**MARKETED BY: ELE-VET Technologies**

This smart stethoscope with integrated electrocardiographic capabilities enables veterinarians to see the heartbeats they record with the device as visualizations on a mobile app. These recorded visualizations of heart sounds can be shared with specialists via the cloud for instant remote diagnosis or a second opinion.

**For More Information:** ele-vet.com

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**MARKETED BY: Dechra**

This dermatologic supplement provides allergic dogs with a concentrated source of PEA—a naturally occurring lipid compound that supports skin health. This hypoallergenic formula, which contains no wheat, beef, or chicken, can be added to a canine dermatology treatment protocol to help maintain the health of the dog’s skin.

**For More Information:** dechra-us.com
I have clients who notice a great response with VETMEDIN. Their animal feels perkier at home, they’re brighter, their heart failure is well-controlled, they really feel like themselves. Or they feel like a puppy again, a lot of people say. Which I think is what we all want for our pet.

–Dr Danielle Laughlin
Cardiologist
Blue Pearl Specialty + Emergency Pet Hospital
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See more stories at DecadeOfVetmedin.com.

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