December 2018

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CANCER PAIN IN A GERIATRIC CAT

IN THIS ISSUE

Volume 16 Number 12

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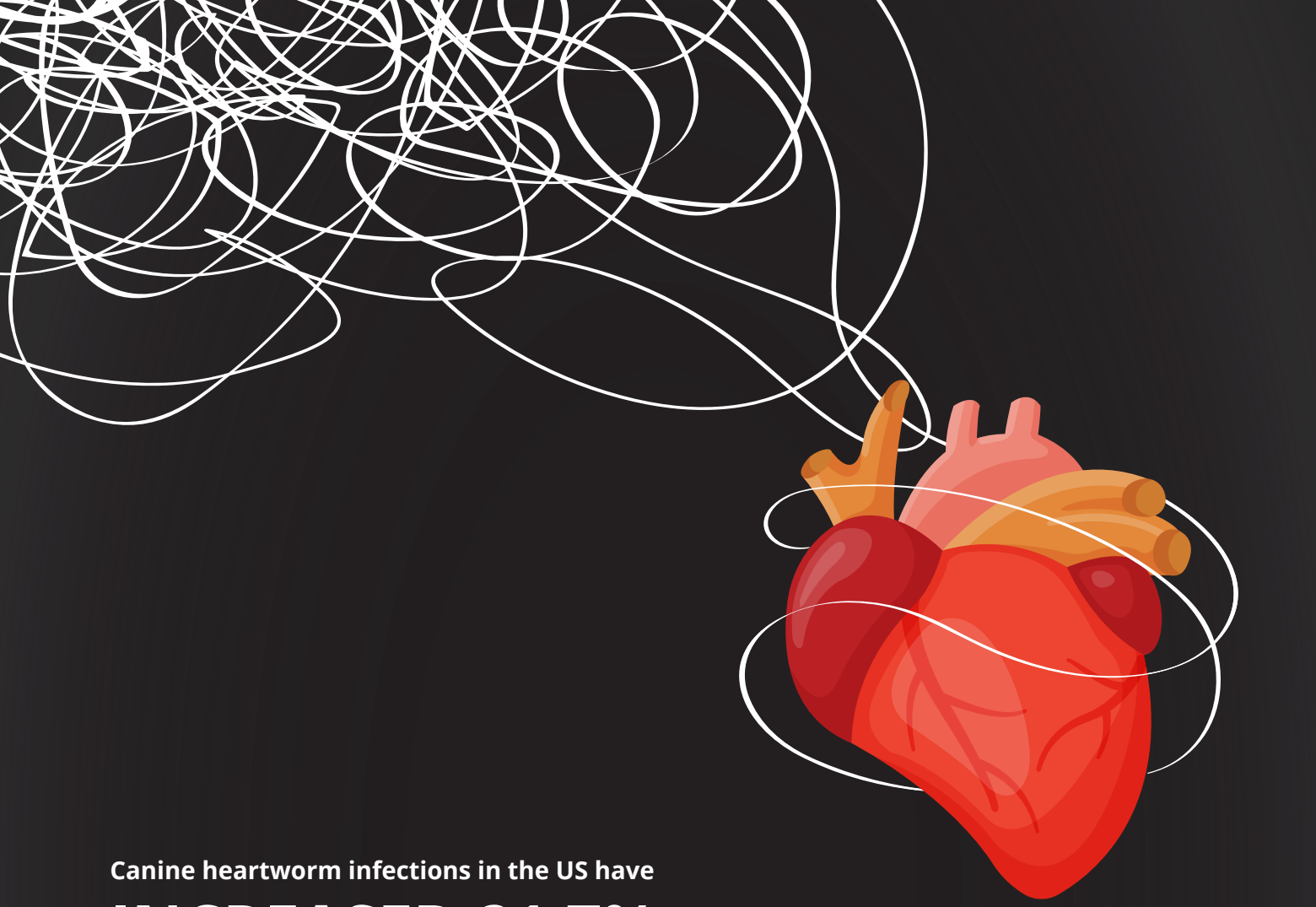

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1. American Heartworm Society - AHS Announces Finding of New Heartworm Incidence Survey. https://heartwormsociety.org/newsroom/in-the-news/347- ahs-announces-findings-of-new-heartworm-incidence-survey. Accessed 26 July 2017.

2. Drake and Wiseman Parasites & Vectors (2018) 11;39. https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-018-2631-0

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1. Steiner JM. Paradigm shift for cobalamin supplementation--Are we done with injections?, in *Proceedings*. North American Veterinary Conference 2016.
2. Toresson L, Steiner JM, Suchodolski JS, et al. Oral cobalamin supplementation in dogs with chronic enteropathies and hypocobalaminemia, in *Proceedings*. American College of Veterinary Internal Medicine 2014.

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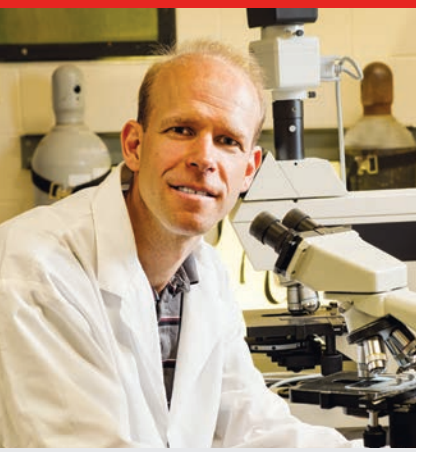

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WINTER 2018

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The Wrath and Aftermath of Hurricanes

What are the Implications for Heartworm Infection?


Photo courtesy of the ASPCA

Q. Historically, what do we know about the connection between devastating storms and heartworm incidence?

A. While high winds associated with hurricanes may reduce mosquito populations for a short period of time, resultant standing water and non-functioning mosquito abatement programs allow extensive mosquito blooms. Hurricanes also cause destruction, evacuation and financial misery in affected areas. Because of reduced care or abandonment (an estimated 250,000 dogs were abandoned in New Orleans alone after Hurricane Katrina), massive numbers of dogs miss doses of heartworm preventive and suffer exposure to mosquitoes 24 hours a day. In heavily endemic heartworm areas, where many dogs are already infected with heartworms, the result can be a heartworm epidemic.

Q. Do these conditions also spawn heartworm resistance?

A. Increases in lack of efficacy (LOE) cases have been noted after years with large storms, but I see this largely as a direct reflection of increased infection rates and greater scrutiny for LOEs. While heartworm resistance is real, the vast majority of LOEs are due to noncompliance rather than resistant heartworms. Nevertheless, strong winds have the potential to disperse mosquitoes, including mosquitoes that might carry resistant third-stage larvae, and storms can indirectly spread resistance when infected dogs are relocated

Q. What should veterinarians do if a patient experiences a lapse in prevention?

A. This depends on a number of factors that affect heartworm risk, including the prevalence of heartworm in the geographic region, the time of year the lapse occurred, the preventive being used and the number of doses missed.

- **If the lapse is one month or less**, reinstate the preventive and test for heartworm in approximately seven months. In highly endemic areas, consider giving doxycycline at 10 mg/kg twice daily for 30 days along with macrocyclic lactone (ML) therapy. This combination will kill L3 and L4 larvae, as well as immature adults resulting from infection during lapse. Because imidacloprid-moxidectin has a longer reach-back than other MLs, doxycycline is not needed for dogs on this preventive.
- **For lapses of two months or longer**, resume the preventive and consider doxycycline therapy for one month, regardless of the ML chosen, bearing in mind that benefits accrue only when the ML is given continuously for the following 12 months. Perform an antigen test seven months after the first missed dose.
- **For lapses of more than seven months**, follow the steps above and also perform an antigen test at that visit and yearly thereafter.

Regardless of whether veterinarians have recently experienced natural disasters in their practice area, veterinarians can and should use storms—along with the devastation and unpredictability they cause—as a reason to educate clients about heartworm and the importance of prevention and annual testing. ■

To access the complete set of AHS canine and feline heartworm guidelines, visit **heartwormsociety.org**

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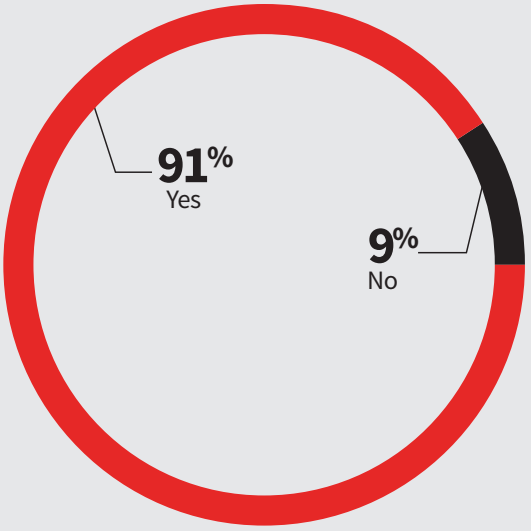

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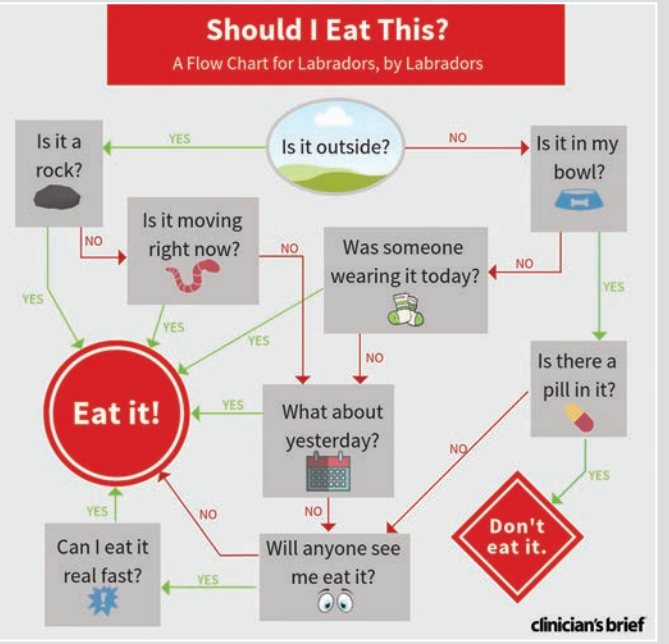

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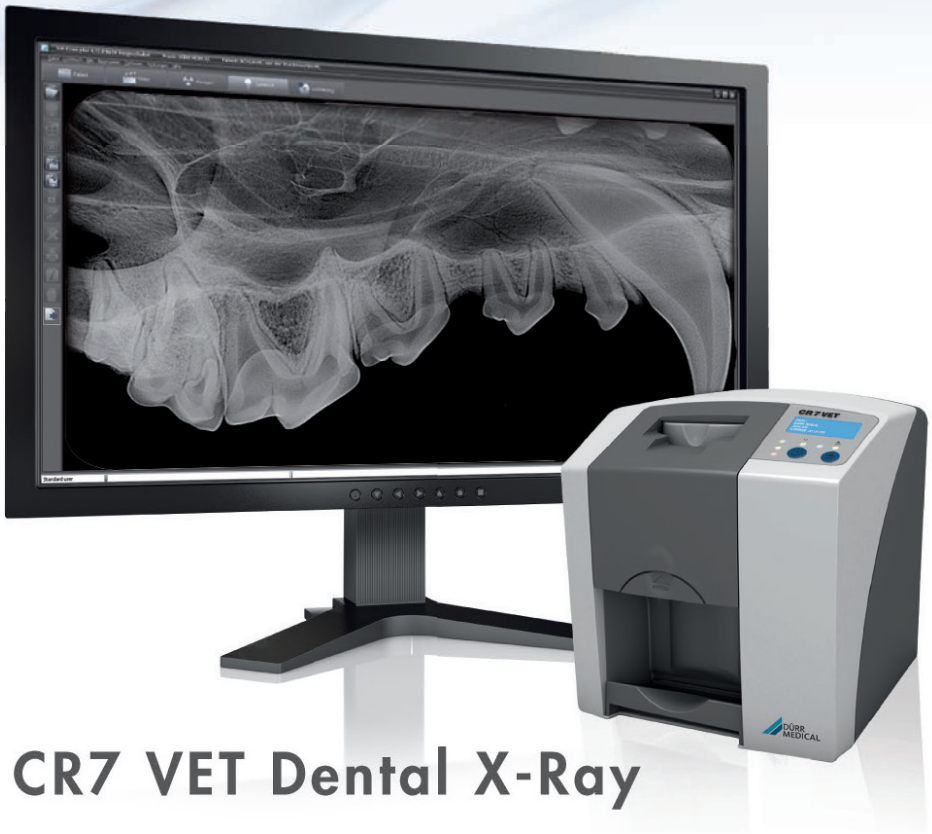

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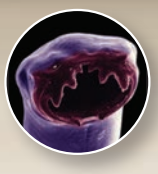
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See page 10 for product information summary.

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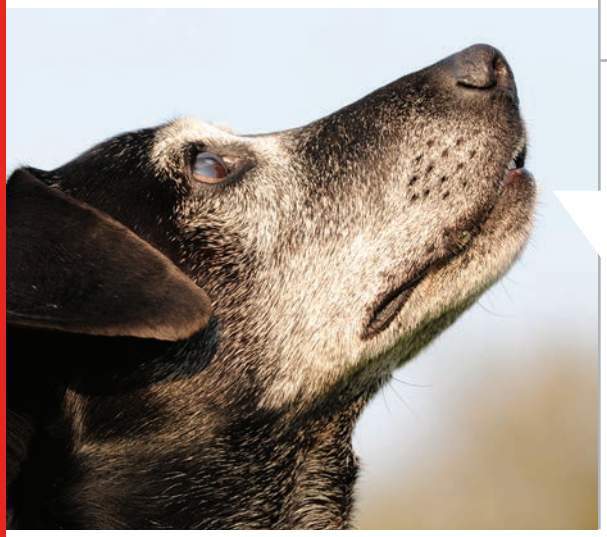

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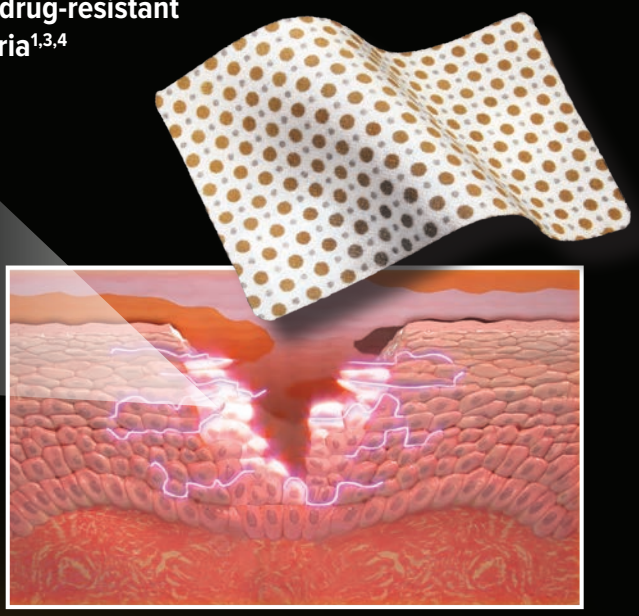

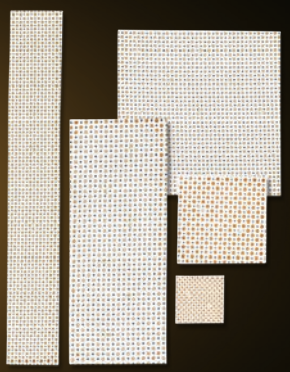

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References:

1. Kim H, Makin I, Skiba J, et al. Antibacterial efficacy testing of a bioelectric wound dressing against clinical wound pathogens. *Open Microbiol J.* 2014;8:15-21. doi:10.2174/1874285801408010015.

2. Banerjee J, Das Ghatak P, Roy S, et al. Improvement of human keratinocyte migration by a redox active bioelectric dressing. *PLoS One.* 2014;9(3):e89239. doi:10.1371/journal.pone.0089239.

3. Kim H, Izadjoo MJ. Antibiofilm efficacy evaluation of a bioelectric dressing in mono- and multi-species biofilms. *J Wound Care.* 2015;24(Suppl 2):S10-S14.. doi:10.12968/jowc.2015.24.Sup2.S10.

4. Banerjee J, Das Ghatak P, Roy S, et al. Silver-zinc redox-coupled electroceutical wound dressing disrupts bacterial biofilm. *PLoS One.* 2015;10(3):e0119531. doi:10.1371/journal.pone.0119531.

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OUR AUTHORS

SEBASTIAN ARLT, Dr.med.vet, DECAR, provides scientific assistance (ie, teaching, research, medical services) at Free University of Berlin in Germany and conducts research on clinical aspects of small animal reproduction. He developed and evaluated a German database for critically appraised topics and has been involved in several international evidence-based veterinary medicine (EBVM) projects. Dr. Arlt completed a doctoral thesis on the quality of literature on alternative medicine in livestock and a habilitation thesis on EBVM aspects of practicing and teaching animal reproduction. He has published several papers on critical appraisal of scientific literature and EBVM teaching.

TOP 5 PAGE 26

ERIC N. GLASS, DVM, MS, DACVIM (Neurology), is the section head of neurology and neurosurgery at Red Bank Veterinary Hospital in Tinton Falls, New Jersey, and of Compassion-First Pet Hospitals nationwide. Dr. Glass earned his DVM from Cornell University. He completed a rotating internship at the Animal Medical Center in New York City and a residency in neurology and neurosurgery at University of Pennsylvania. Dr. Glass has been published in multiple peer-reviewed journals and is a co-author of the textbook *Veterinary Neuroanatomy and Clinical Neurology*. His clinical interests include neurosurgery and correlation of neurologic signs with neuroanatomic diagnoses.

CASE IN POINT PAGE 57

MARGARET E. GRUEN, DVM, MVPH, PhD, DACVB, is a veterinary behaviorist and an assistant professor of behavioral medicine at North Carolina State University. Dr. Gruen earned her DVM from University of Illinois. Her PhD research focused on pain and behavior in naturally occurring diseases in dogs and cats, and she has spoken widely on topics related to pain, cognition, and behavior problems in pets. Dr. Gruen has particular interest in the interplay between pain and cognitive function.

RX SOLUTIONS PAGE 33

MARC KENT, DVM, DACVIM (Neurology), is a professor of neurology at University of Georgia. Dr. Kent earned his DVM from Cummings School of Veterinary Medicine at Tufts University and has published many scientific articles. His research interests include a wide array of subjects in clinical neurology and neuropathology.

CASE IN POINT PAGE 57

Continues on page 16

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Reference: 1. Mirataz™ (mirtazapine transdermal ointment) [package insert], Kindred Biosciences, Inc. (Burlingame, CA). Rev. 5/2018. **2.** Buhles W, Quimby JM, Labelle D, et al. Single and multiple dose pharmacokinetics of a novel transdermal ointment in cats. J Vet Pharmacol Ther. In press 2018.

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CASE IN POINT PAGE 18

MARCELLA D. RIDGWAY, VMD, MS, DACVIM (SAIM), is a clinical associate professor of small animal internal medicine at University of Illinois, where she earned her master's degree and completed an internship and small animal internal medicine residency. Her primary clinical interests focus on hepatobiliary and GI disorders and infectious disease.

RED LIGHT, GREEN LIGHT PAGE 62

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CASE IN POINT PAGE 57

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CASE IN POINT PAGE 18

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CASE IN POINT PAGE 57

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See page 16 for product information summary.

CASE IN POINT

PALLIATIVE MANAGEMENT OF CANCER PAIN IN A GERIATRIC CAT

Beatriz Monteiro, DVM
Paulo V. Steagall, DVM, MS, PhD, DACVAA
University of Montreal
Montreal, Canada

▶ **FIGURE 1** The patient on presentation

Luna, a 15-year-old, 8.6-lb (3.7-kg), spayed domestic shorthair cat with stable International Renal Interest Society stage 2 chronic kidney disease (CKD), was presented for evaluation of an enlarged right rostral mandible, decreased appetite, halitosis, and dysphagia of approximately a month's duration (*Figure 1*). The owners also reported recent changes in behavior: Luna had become irritable and could no longer jump onto windowsills.

Physical Examination

On presentation, Luna was quiet and shy. Vital parameters were within normal limits (temperature, 100.8ºF [38.2ºC]; pulse, 160 bpm; respiratory rate, 36 breaths per min). She was subclinically dehydrated (5%), and her hair coat was greasy. The right submandibular lymph node was enlarged. BCS was 3/9, which was similar to previous visits, with apparently stable body weight. Systolic blood pressure was 140 mm Hg (reference range, <150 mm Hg). Because Luna refused to walk, mobility could not be assessed.

Oral pain was assessed through gentle palpation of the mandible. Luna showed signs of hyperalgesia (ie, increased pain sensation to a painful stimuli) and clear avoidance of palpation while hissing at the clinician. Because osteoarthritis (OA) was suspected, OA-related pain was assessed using the Client Specific Outcome Measures instrument (see ***Suggested Reading***, page 23),[1] which consisted of choosing and scoring 3 activities that were specific to Luna (ie, jumping onto the kitchen's window sill in the morning, using the litter box after breakfast, jumping onto the bed in the evening). Luna performed these activities with severe, mild, and moderate difficulty, respectively. Although there is currently no validated instrument to assess quality of life that is freely available to veterinarians, a general quality-of-life assessment was performed by evaluating Luna's ability to perform daily activities, appetite and grooming habits, and social interactions and temperament.[2,3] Because Luna was showing progressively decreased levels of activity and socialization, it was determined that her quality of life was moderately affected.

CBC and serum chemistry profile results revealed mild anemia (hematocrit, 25%; reference range, 28%-47%) and elevated BUN (42.6 mg/dL; reference range, 11.5-30.2 mg/dL) and creatinine (2 mg/dL; reference range, 0.4-1.9 mg/dL) levels. Urine specific gravity was 1.029 (reference range, ≥1.035), symmetric dimethylarginine was 15 µg/dL (reference range, 0-14 µg/dL), and total thyroxine was 1.6 µg/dL (reference range, 1.0-4.4 µg/dL).

OA = osteoarthritis

Diagnosis

Luna was anesthetized for additional diagnostics. Premedication was administered intramuscularly with a combination of acepromazine (0.02 mg/kg) and buprenorphine (0.02 mg/kg). Thoracic radiography and abdominal ultrasonography were performed with the patient under sedation and revealed no evidence of metastasis. Approximately an hour after premedication, general anesthesia was induced with propofol (5 mg/kg IV) and maintained with isoflurane (1.2%-1.3% expired concentration delivered in 100% oxygen using a nonrebreathing circuit). Intravenous fluids (3 mL/kg/hr) were also administered. A firm mass (1.2 × 2 cm) was identified on the right rostral mandible. Oral radiographs revealed marked osteolysis and periosteal proliferation. An inferior alveolar (mandibular) nerve block was performed using bupivacaine 0.5% (see ***Local Anesthetic Technique for Nerve Blocks***). An incisional biopsy was performed at the junction of normal and abnormal tissues and submitted for histopathology. No attempts were made to surgically remove the mass, as the owners did not want to perform any invasive procedures and wished to only confirm diagnosis. Histopathology results were consistent with squamous cell carcinoma.

DIAGNOSIS:
SQUAMOUS CELL CARCINOMA

Treatment & Long-Term Management

Anesthesia & Acute Perioperative Analgesia

Opioids are safe at clinically acceptable dosages and are excellent analgesics.[4] The combination of opioids and acepromazine reduces inhalant anesthetic requirements. Locoregional anesthesia with bupivacaine provides pain relief by blocking sodium channels and the consequent production and transmission of nociceptive stimuli (ie, pain transduction and transmission). Analgesia lasts approximately 6 hours with locoregional bupivacaine.

Luna was hospitalized for 36 hours and maintained on fluid therapy. Pain was assessed every hour for the first 8 hours and every 6 hours thereafter using the Glasgow Composite Measure Pain Scale, which includes evaluation of the cat's behavior and facial expressions while undisturbed.[5] A pain scale score equal to or higher than 5 (out of 20) is the recommended cut-off score for intervention (eg, with buprenorphine [0.02 mg/kg IV q6h]). During pain assessment 4 hours after recovery from anesthesia, Luna was tense and crouched, with facial expressions indicative of pain, based on ear position and muzzle shape; pain score was 7/20. Thus, buprenorphine (0.02 mg/kg IV q6h) was administered. In addition, Luna exhibited a normal appetite when offered soft food, suggesting that the previously reported decreased appetite had been due to oral pain, which was attenuated by analgesic management.

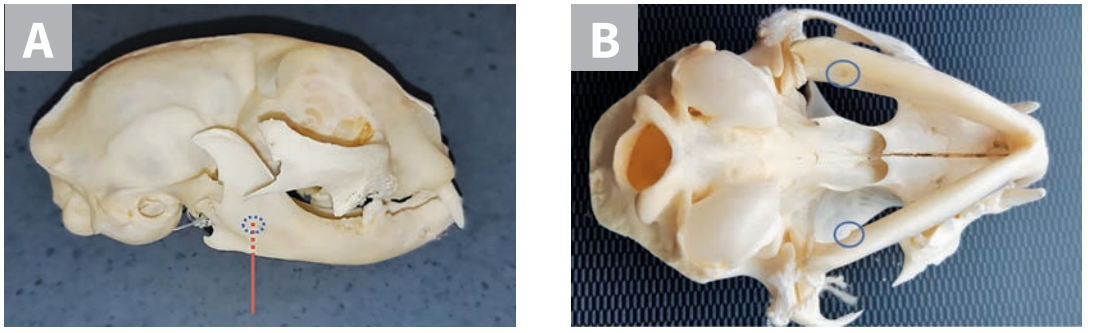
The owners opted for palliative analgesic treatment (see ***Treatment at a Glance***, next page), with the aim of improving quality of life. Treatment of cancer was declined after a thorough discussion.

Pain Management & Palliative Care

Luna's potential sources of pain included cancer pain affecting the oral cavity and bone, as well as pain associated with OA, resulting in mixed inflammatory and neuropathic pain. Therapy was planned

LOCAL ANESTHETIC TECHNIQUE FOR NERVE BLOCKS

For local anesthetic techniques of the oral cavity, generally, a maximum bupivacaine dose of 2 mg/kg is calculated, and the total volume is divided among all the local blocks to be performed; in Luna's case, because only the inferior alveolar (mandibular) nerve block was performed, 0.3 mL of bupivacaine 0.5% was used. The inferior alveolar foramen can be located on the medial side of the mandible approximately halfway between the angular process of the mandible and the last molar tooth. Although the foramen can be difficult to palpate in cats, the block can often still be performed successfully using 2 imaginary lines to locate the mandibular foramen (ie, a line perpendicular to the lateral canthus of the eye can be crossed with another line that divides the dorsal and ventral teeth arcade). The ventral teeth arcade is parallel to the ventral portion of the mandible. The injection point should be located at the intersection of these 2 lines, and the needle should be inserted perpendicular to the ventral margin of the mandible using an extraoral approach (***Figure 2***). The inferior alveolar (mandibular) nerve block produces anesthesia of the mandible, including the teeth, lower lip, part of the tongue, and hard and soft tissues.[10]



▲ **FIGURE 2** Right lateral (***A***) and ventrodorsal (***B***) views of a feline skull to demonstrate the inferior alveolar (mandibular) nerve block technique. The technique should be performed using 27- to 30-gauge, 12- to 16-mm long needles, and a 1-mL syringe. The area of injection of the local anesthetic is indicated by the ***dotted blue circle***. For the extraoral approach, the needle (represented by the ***red line***) should be inserted perpendicular to the ventral margin of the mandible, with the bevel of the needle directed toward the medial aspect of the mandible. The local anesthetic should be injected close to the inferior alveolar foramen on the medial aspect of the mandible (***solid blue circles***). Prior to injection, aspiration should be performed to confirm that no intravascular injections are being performed. The local anesthetic should be injected slowly, and no resistance should be felt.

RELATED ARTICLE

See related article, **Peripheral Nerve Block Techniques: Dental Blocks**, at **cliniciansbrief.com/article/peripheral-nerve-block-techniques-dental-blocks**

using a mechanism-based approach (ie, analgesics to counteract inflammatory and neuropathic pain mechanisms). Luna was discharged on long-term medication, including robenacoxib (1 mg/kg PO q24h [see ***Extra-Label Drug Use***]) and gabapentin (10 mg/kg PO q12h). NSAIDs are excellent analgesics for inflammatory pain but are normally contraindicated in cats with CKD; however, recent research has suggested that NSAIDs may be safely administered long-term in cats with stable CKD.[6,7] The decision to initiate NSAID therapy in cats with CKD, however, should be made on a case-by-case basis, and the risks and benefits should be carefully assessed.[8] In Luna's case, the benefits of NSAID therapy were determined to outweigh the risks, particularly because proper nutrition and hydration were being maintained. Gabapentin blocks Ca^{+2} channels and reduces neuronal excitability, and this drug has been shown to provide analgesia in cats with OA and is indicated in conditions that cause neuropathic pain.[9]

Nonpharmacologic therapy in the form of environmental enrichment was also initiated and included play sessions (15-20 minutes of access to the backyard under supervision twice daily), brushing (10-minute sessions twice daily according to Luna's preference), and providing scratching posts, homemade toys and condos, and steps to give Luna access to windows. Other nonpharmacologic treatment modalities could include acupuncture and/or nutraceuticals (eg, fish oil or green-lipped mussel extract, glucosamine/chondroitin sulfate, polysulfated glycosaminoglycan [extra-label]). Long-term chronic pain management should include treatment of breakthrough pain (eg, administering buprenorphine when oral medications and other treatments are not controlling pain).[2]

Luna's needs were approached from a welfare perspective to provide optimal pain management using pharmacologic and nonpharmacologic options.[2,3]

TREATMENT AT A GLANCE

- Chronic pain can be managed on an outpatient basis through both pharmacologic and nonpharmacologic means.
  - Pharmacologic therapy
    - For Luna, this included robenacoxib (1 mg/kg PO q24h) and gabapentin (10 mg/kg PO q12h). Tramadol (3 mg/kg PO q12h[11]) or amitriptyline (10 mg PO q24h) could also have been added to this patient's analgesic protocol.
  - Nonpharmacologic management
    - Environmental enrichment tailored to the patient's needs. In Luna's case, this included the addition of scratch posts, toys, and condos; steps so she could have access to windows; play sessions (15-20 minutes of access to the backyard under supervision twice daily); brushing (10-minute sessions twice daily as tolerated); and administration of soft food.
    - Nonpharmacologic therapies might also include acupuncture and/or nutraceuticals (eg, fish oil or green-lipped mussel extract, glucosamine/chondroitin sulfate, polysulfated glycosaminoglycan [extra-label]).
- Long-term chronic pain management should include treatment of breakthrough pain (eg, administering buprenorphine when oral medications and other treatments are not controlling the pain).[2]

EXTRA-LABEL DRUG USE

Clinicians are advised to check local regulations of NSAID administration in their country of practice. For example, in Canada, robenacoxib can be administered once daily for the treatment of musculoskeletal disorders, and the duration of treatment can be decided on an individual basis[12]; however, in the United States, this drug is only labeled for administration for up to 3 days.[13] If extra-label administration is performed, owners should be made aware and perhaps sign a written consent form.

CKD = chronic kidney disease
OA = osteoarthritis

Prognosis & Outcome

Luna's prognosis was guarded to poor. Recheck visits were performed monthly. Despite pain management, disease was progressive and resulted in pathologic mandibular fractures. Luna's quality of life could no longer be maintained as an outpatient, and she was euthanized 8 weeks after presentation (see ***Take-Home Messages***).

POLL

Do you use NSAIDs as part of long-term pain management in cats, including those with stable chronic kidney disease?

A. Yes
B. No

Scan the QR code to submit your answer and see the other responses! The poll is located at the bottom of the article.

Using QR codes from your mobile device is easy and quick!

Simply focus your phone's camera on the QR code as if taking a picture (but don't click!). A notification banner will pop up at the top of your screen; tap the banner to view the linked content.

TAKE-HOME MESSAGES

- Oral and bone tumors cause severe pain, which can be controlled using a multimodal pharmacologic and nonpharmacologic approach.
- Pain in cancer patients is multifactorial and can originate from the tumor itself, diagnostic procedures, therapies, metastatic disease, and/or concomitant painful conditions.
- Owners should be involved in the treatment plan and management of chronic pain by administering analgesics and providing nonpharmacologic therapies.
- Cancer pain may become refractory to treatment as disease progresses, and pain management may no longer be achievable on an outpatient basis, requiring hospitalization.
- Euthanasia should be considered for cats with severe chronic pain and/or poor quality of life. Decisions should be made on a case-by-case basis.

References

1. Lascelles BDX, Hansen BD, Roe S, et al. Evaluation of client-specific outcome measures and activity monitoring to measure pain relief in cats with osteoarthritis. *J Vet Intern Med*. 2007;21(3):410-416.
2. Monteiro B, Troncy E. Treatment of chronic (maladaptive) pain. In: Steagall P, Robertson SA, Taylor P, eds. *Feline Anesthesia and Pain Management*. Hoboken, NJ: Wiley-Blackwell; 2018:257-280.
3. Mathews K, Kronen PW, Lascelles D, et al. Guidelines for recognition, assessment and treatment of pain: WSAVA Global Pain Council members and co-authors of this document. *J Small Anim Pract*. 2014;55(6):E10-E68.
4. Simon BT, Steagall PV. The present and future of opioid analgesics in small animal practice. *J Vet Pharmacol Ther*. 2017;40(4):315-326.
5. Reid J, Scott EM, Calvo G, Nolan AM. Definitive Glasgow acute pain scale for cats: validation and intervention level. *Vet Rec*. 2017;180(18):449.
6. Gowan RA, Lingard AE, Johnston L, Stansen W, Brown SA, Malik R. Retrospective case-control study of the effects of long-term dosing with meloxicam on renal function in aged cats with degenerative joint disease. *J Feline Med Surg*. 2011;13(10):752-761.
7. King JN, King S, Budsberg SC, et al. Clinical safety of robenacoxib in feline osteoarthritis: results of a randomized, blinded, placebo-controlled clinical trial. *J Feline Med Surg*. 2016;18(8):632-642.
8. Sparkes AH, Caney S, Chalhoub S, et al. ISFM consensus guidelines on the diagnosis and management of feline chronic kidney disease. *J Feline Med Surg*. 2016;18(3):219-239.
9. Guedes AGP, Meadows JM, Pypendop BH, Johnson EG, Zaffarano B. Assessment of the effects of gabapentin on activity levels and owner-perceived mobility impairment and quality of life in osteoarthritic geriatric cats. *J Am Vet Med Assoc*. 2018;253(5):579-585.
10. Staffieri F, Steagall P. Local anesthetics and loco-regional techniques. In: Steagall P, Robertson SA, Taylor P, eds. *Feline Anesthesia and Pain Management*. Hoboken, NJ: Wiley-Blackwell; 2018:67-87.
11. Monteiro BP, Klinck MP, Moreau M, et al. Analgesic efficacy of tramadol in cats with naturally occurring osteoarthritis. *PLoS One*. 2017;12(4):e0175565.
12. Elanco. Compendium of Veterinary Products - Canada edition: Onsior. Elanco Compendium of Veterinary Products website. https://elanco.cvpservice.com/product/basic/view/1231105?key=label. Accessed November 14, 2018.
13. Onsior [package insert]. Greenfield, IN: Elanco; 2016. https://assets.ctfassets.net/kvimhx6nhg7h/3lqYXVToVqWsgEiikumWs8/b641f1f0c40e3fe26a2c35fdc5170e69/Onsior_Tablets_for_Cats_PI_Oct_2016.pdf. Accessed November 14, 2018.

Suggested Reading

North Carolina State University. Comparative pain research – clinical metrology instruments. North Carolina State University College of Veterinary Medicine website. https://cvm.ncsu.edu/research/labs/clinical-sciences/comparative-pain-research/clinical-metrology-instruments. Accessed October 10, 2018.

Bifidobacterium longum BL999 Supplementation: A New Approach to Managing Dogs with Anxiety

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Q It is conservatively estimated that 29 percent of dogs suffer from anxiety.[1] What is known about the causes and physical manifestations of this condition?

A The causes of anxiety in dogs are complex. Genetics can be a factor, and some dogs are anxious from a very early age while others are calm and happy-go-lucky. Anxiety can also be acquired through triggering events or stressors in the environment. Whether the origins are intrinsic, external or both, the severity of the anxiety may be more important than the cause. An anxious dog lives in a chronic vigilant state of anticipating negative outcomes and negative emotional arousal, even when there's no clear sign that something bad or frightening is about to occur.

While we think of anxiety as a psychological condition, its effect on a dog's physiological state is real. Dogs with generalized anxiety live in a state of chronic stress and thus may have elevated cortisol levels[2] and low heart rate variability, meaning the time between heartbeats fluctuates very little. If a dog is happy and excited to see his owner walk in the door, his or her heart rate and heart rate variability increase. If a dog's heart rate is elevated but the variability decreases, however, it is likely he or she is in a very stressed state.

Q It is believed there is a connection between an imbalance of bacteria in the gut microbiota and anxiety. Can you explain?

A The gut is sometimes referred to as a "second brain" because of the bi-directional communication between the gut and brain via the vagus nerve. In a study at McMaster University, bacteria from laboratory mice exhibiting anxious behaviors (e.g., circling, bar biting, spitting in the enclosure) were transferred to germ-free, non-anxious mice via fecal transplantation. As a result, the behavior of the anxious mice was transferred with those microbes.[3] Understanding this connection may be key to finding solutions. There is scientific evidence that manipulating the gut bacteria can also have a positive influence on anxious behavior, with specific probiotics having anxiolytic properties when fed to both animals and humans.[4]

Q Nestlé Purina recently conducted a trial with dogs supplemented with the probiotic *Bifidobacterium longum* BL999,* a strain shown to help dogs maintain calm behavior. What were the findings?

A A group of 24 anxious Labrador Retrievers was enrolled in the trial and all dogs were fed the same complete and balanced diet. For the first six weeks, 12 dogs were supplemented with *B. longum* BL999 while the other 12 were given a placebo. Following a three-week washout period, the supplemented and placebo groups were reversed for an additional six weeks, so that each dog served as his or her own control.

During each phase, the dogs' behaviors in response to a variety of stimuli were recorded and heart rate and heart rate variability, as well as salivary cortisol concentrations, were assessed. Day-to-day behaviors (e.g., spinning, pacing, jumping, barking) were also noted.

The findings showed that *B. longum* BL999 administration resulted in statistically significant improvement in dogs displaying day-to-day anxious behavior, as well as reduced salivary cortisol concentrations, decreases in heart rates and increases in heart rate variability.[5] By feeding a probiotic that positively affects dogs, veterinarians can offer owners a new strategy to help manage dogs with anxiety.

> "While we think of anxiety as a psychological condition, its effect on a dog's physiological state is real."

**The probiotic* B. longum *BL999 is the active ingredient in Purina® Pro Plan® Veterinary Supplements Calming Care canine supplement.*

1. *Denenberg S, Landsberg GM, Blizzard T. Prevalence of Fearful and Anxious Behaviors in Dogs in the United States. Proc of the ACVM/AVSAB Veterinary Behavior Symposium. Chicago. 2013;50-51.*
2. *Beerda B, Schilder MBH, Van Hooff JARAM, DeVries HW, Mol JA. Chronic stress in dogs subjected to social and spatial restriction. I. Behavioral responses. Physiol Behav 1999; 66(2):233-42.*
3. *Collins SM, Kassam Z, Bercik P. The adoptive transfer of behavioral phenotype via the intestinal microbiota: experimental evidence and clinical implications. Curr Opin Microbiol. 2013 Jun;16(3):240-5.*
4. *Messaoudi M, Lalonde R, Violle N, et al. Assessment of Psychotropic-Like Properties of a Probiotic Formulation (*Lactobacillus helveticus *R0052 and* Bifidobacterium longum *R0175) in Rats and Human Subjects. Brit J Nutr. 2011;105:755-764.*
5. *Trudelle-Schwarz McGowan, R. Tapping into those 'Gut Feelings': Impact of BL999 (Bifidobacterium longum) on anxiety in dogs. ACVB Symposium 2018.*

Managing Dogs with Anxiety: Make Behavioral Assessment Part of the Routine

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Anxiety in dogs is like any other medical condition: The longer it goes untreated, the harder it can be to manage. Uncovering the clinical signs of anxiety isn't always simple, because owners don't necessarily associate their dogs' behaviors with a condition that can be managed. Screening patients and educating owners are key to prompt diagnosis and management of dogs with anxiety. Training several staff members to talk with patients about behavior can also help. Everyone on your staff should be noticing if a pet is exhibiting signs of anxiety in the clinic and reporting behavioral concerns to those with additional behavioral education.

Incorporate behavior screening into routine exams

It's important to ask questions about specific behaviors because clients often don't associate subtle signs such as lip licking, yawning, darting eyes or low body posture with anxiety.
I ask about those behaviors as well as more overt signs, like pacing, panting, excessive salivation, excessive cleaning, destruction and nighttime vocalization.

If a patient appears anxious during a clinic visit, you might start the exam with, "Casey seems pretty anxious today — does he ever act like this at home?" If the client says yes, I recommend probing a little deeper and asking for specifics about in-home behaviors as well as the owner's perception of the types of triggers that elicit them. Also ask the client how long it takes the dog to return to normal behavior after becoming anxious.

I recommend adding several questions about behavior to the patient history you gather at every wellness exam. If you are dealing with puppies, you're probably already asking about behaviors that could become problematic over time, such as house and/or crate training and mouthing. However, it's important to proactively inquire about behavior issues in pets of any age.

Correct misconceptions about anxiety causes

Some owners feel guilty about their dogs' behavior issues, believing they may result from a lack of training or training mistakes. However, many misbehaviors can be linked to unrecognized anxiety issues, and both genetics and experiences can contribute to anxiety disorders. Many of my clients acquire their dogs after the four- to 14-week socialization period that is critical in a dog's early development. Lack of positive exposure to various environmental stimuli can predispose an animal to fears later in life. Likewise, most owners of rescued dogs weren't able to control factors such as genetics, neglect or mistreatment prior to acquisition.

I emphasize to clients that while reward-based dog training can help an owner communicate with his or her pet better, this type of formal training has less to do with managing anxious behaviors than the owner may think. Often, simple steps can be taken by a family to improve the emotional health of their pet. Because many behavioral issues are emotional in nature, aversive punishment should not be used to modify them. For example, putting a shock collar on a dog to stop him from barking when the owner is gone will only make the dog with separation distress equate being alone with something even more terrible happening.

Offer options to owners of anxious dogs

A referral to a behaviorist and prescribing anti-anxiety medications are two potential ways to help manage anxious patients. Purina® Pro Plan® Veterinary Supplements Calming Care, a new probiotic supplement, can also be used as part of a multimodal approach. Even if you refer a patient, be sure to stay apprised of the care the patient is receiving and remain involved with the care program. It's important to reassure clients that they are not alone in their quest to manage these challenging behaviors.

5 Screening Questions for Canine Anxiety

1. Is there anything that makes your dog afraid or anxious?
2. If so, what triggers this fear or anxiety (e.g., being alone, loud noises, going to the veterinarian, thunderstorms)?
3. How does your dog's fear or anxiety manifest itself (e.g., inappropriate defecation/urination, salivation, dilated pupils, trembling, tucking tail, hiding, vocalizing)?
4. Did your dog's fearful or anxious behavior result from a traumatic event or did it develop gradually? At what age did the behavior develop?
5. Is there anything you can do to calm your dog? If so, what? How long does it take for your dog to return to behaving normally?

Easing Anxiety at the Veterinary Office: Keep Calm and Practice On

Marty Becker, DVM
Founder and CEO
Fear Free

After nearly five decades of working in veterinary hospitals, attending a veterinary behaviorist seminar several years ago triggered an awakening about how I was living out the veterinary oath that compels me to prevent and relieve animal suffering. While I had always dutifully cared for the physical well-being of my patients, I hadn't been focused on their emotional well-being. Since then, I have dedicated myself to reducing fear, anxiety and stress in pets through the Fear Free educational services.

Many of our patients come through our office doors because of medical problems, from torn nails and GI disorders to joint inflammation and cancer. Unlike other medical professionals, we cannot tell patients why they hurt or explain the medical procedures they must undergo. The unfortunate result is that our patients often associate our care with pain. Just pulling into the veterinary hospital parking lot can engage a pet's fight or flight response. And that can keep owners from seeking veterinary care when their pets need it.

The good news is that our patients don't need to suffer in this way. There are many ways to make the veterinary environment a calmer, more enjoyable experience, including:

- Reducing or removing anxiety triggers – Avoid what the patient hates. If the examination table causes anxiety, provide a more comfortable surface, such as a yoga mat or pheromone-infused towel.
- Changing the environment – Rather than have an anxious patient sit in the waiting area, it may be helpful to have the clients check in and then wait outside in a calm environment until their appointment begins.
- Incorporating play – Tap into the innate behaviors and needs of pets by giving cats a place to climb, hide and scratch, or dogs interesting smells to sniff.

By taking steps to minimize pet anxiety we can provide a better level of veterinary care and help our patients lead healthy and happy lives.

Dog Anxiety Perceptions by the Numbers

To better understand the impact of behaviors potentially associated with anxiety, Purina recently conducted a **survey of 826 US dog owners** whose pets visited the veterinarian in the last 12 months.

Anxious behaviors are common and often associated with anxiety.

62% of dog owners surveyed have regularly seen behaviors that could be signs of anxiety in their dogs.

Of these owners, **49%** attribute their dogs' behavior to anxiety.

These owners are concerned about their dogs' behaviors.

40% of owners surveyed whose dogs have experienced behaviors possibly linked to anxiety say it **has impacted their lifestyle or changed their routine**.

These owners want solutions.

If a veterinarian diagnosed their dog with anxiety...

68% of these owners would be extremely or very likely to consider behavior modification.

64% would be similarly open to nutritional supplements.

39% would be extremely or very likely to consider medications.

Data was collected by Relevation via on online survey utilizing the Prodege panel facility. Qualified participants were adult men and women age 18 or older, owned one or more adult dogs age 13 months or older, were the person in the household most responsible for taking the dog(s) to a veterinarian (12% were not qualified) and took the dog(s) to a veterinarian in the past 12 months (11% were not qualified). 826 nationally-representative dog owners qualified and completed the survey, 77% of the dog owners qualified. Online data collection was conducted from August 15-19, 2018. The online survey averaged 4 minutes in length.

Key Takeaways

- A Nestlé Purina study showed that administration of the probiotic *Bifidobacterium longum* BL999 to anxious dogs resulted in statistically significant improvement in dogs displaying day-to-day anxious behavior, reduced salivary cortisol concentrations, decreased heart rates and increased heart rate variability.
- The longer behavior problems go untreated, the harder it can be to manage and alleviate them, making proactive client conversations critical.
- A calmer, more enjoyable veterinary environment is critical to fear-free experiences and more regular patient visits.

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WHAT IF...

A PROBIOTIC COULD HELP ANXIOUS DOGS FEEL CALMER?

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Helps dogs cope with external stressors like separation, unfamiliar visitors, novel sounds, or changes in routine and location

Helps dogs maintain positive cardiac activity during stressful events, promoting a positive emotional state

Helps blunt cortisol response to anxious events and supports a healthy immune system

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*McGowan, R. T. S. (2016). "Oiling the brain" or "Cultivating the gut": Impact of diet on anxious behavior in dogs. Proceedings of the Nestlé Purina Companion Animal Nutrition Summit, March 31-April 2, Florida, 91-97.

PURINA® Your Pet, Our Passion.®

Ear Surgery: Picking the Right Technique

In small animal medicine, there are several indications for ear surgery, including otitis externa, otitis media, and traumatic and neoplastic conditions of the bulla, ear canal, and pinna. Ear surgery is associated with significant morbidity.

For patients with otitis externa that fails to respond to medical management or with stenotic or obstructed canals, surgical correction is indicated. Lateral and vertical wall resection are associated with less damage to neurovascular structures but do not remove all diseased tissue. Total ear canal ablation with bulla osteotomy (TECA-BO) and subtotal ear canal ablation with bulla osteotomy (STECA-BO) allow total dissection of the vertical and horizontal canals. However, TECA-BO poses risks for facial nerve paralysis, which occurs in 13% to 40% of dogs and 56% of cats, as well as Horner's syndrome, which occurs in 42% of cats. In both conditions, damage can be permanent in a subset of cases. Vestibular signs may result secondary to TECA-BO in 3% to 8% of dogs, and recovery can take months and may be incomplete. Fistula formation can occur if infected tissue is not removed. Recent data are limited but suggest STECA-BO may be a less invasive option than TECA-BO.

Ear canal tumors are typically malignant, particularly in cats, although metastasis is uncommon. Treatment of choice is total ear canal ablation. Median survival time is good in cases of ceruminous gland adenocarcinoma (49 months in cats, 58 months in dogs) but poor in cats with squamous cell carcinoma (3.8 months). Squamous cell carcinoma, the most common neoplasia of the pinna, is generally treated with complete pinnectomy to achieve adequate margins. In cats, prognosis with surgery is good (median survival time, 799 days).—*Mayhew PD*

Building the Practice's Online Reputation

A veterinary practice's online reputation is the cornerstone of its success and can dictate future success. It is important for the veterinary team to be involved with managing the practice's online reputation and pay close attention to online reviews of sites such as Google, Bing, and Yahoo!. As means of streamlining an online user's initial search, practices with 4- and 5-star ratings often overwhelmingly appear first, which can greatly increase online traffic for those businesses. It is currently estimated that one-third of new business stems from internet referrals, which emphasizes the importance of securing new, positive online reviews. For a practice to get involved with online reputation management, it should first claim its business with Google and list the practice hours, phone number, and location and provide up-to-date photos. Responding to positive reviews and expressing appreciation for reviewer support is also important.

Soliciting new reviews, especially from pet owners who have expressed happiness with their visit, may also help. Services that can assist pet owners in leaving positive reviews and give step-by-step guidance to ensure a smooth process are available.—*Garcia ED*

2018 Wild West Veterinary Conference

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2019 Wild West Veterinary Conference

October 23-27, 2019
Reno, Nevada

Proteinuria & Protein-Losing Nephropathy

Proteinuria can be preglomerular, glomerular, or postglomerular in origin. Nonglomerular kidney diseases (eg, pyelonephritis, severe chronic kidney disease, acute tubular necrosis) can cause proteinuria. Protein-losing nephropathies include glomerulonephritis, glomerulopathy, and amyloidosis. Glomerulonephritis has infectious, inflammatory, neoplastic, and endocrine causes, although many cases are classified as idiopathic. Amyloidosis can be familial in Abyssinian cats and shar-peis. Soft-coated Wheaten terriers and English cocker spaniels have a high incidence of glomerulonephropathy.

Proteinuria should be assessed in all animals with chronic kidney disease, and urine dipstick testing is recommended for every canine wellness examination.

Presence of proteinuria must be evaluated in light of urinary sediment results and clinical signs. Positive urine dipstick results should be confirmed using a more specific test, such as sulfosalicylic acid turbidimetry testing or urine protein: creatinine ratio. Multiple (eg, 3-4) samples collected on different days are ideal for urine protein:creatinine measurement due to daily variability. Urine dipstick testing may have false negative results in cats; thus, a more sensitive test is warranted. For persistent renal proteinuria, further testing should include CBC, serum chemistry profile, and urinalysis. Additional testing may include urine culture, tick titers, heartworm testing (in dogs), FeLV testing, thoracic radiography, abdominal imaging, and, possibly, renal biopsy.

Standard treatment of protein-losing nephropathies includes a protein-restricted diet, ACE inhibitors and/or angiotensin-receptor blockers, and antiplatelet drugs. Additional antihypertensive agents may be necessary, as 50% to 85% of dogs with protein-losing nephropathies have hypertension. Immunosuppressive therapy may be warranted based on kidney biopsy results. Resolution of proteinuria is the goal of treatment; a ≥50% reduction is considered a partial response.—*Langston C*

Resolution of proteinuria is the goal of treatment.

Osteosarcoma Survival Guide

Osteosarcoma (OSA) is the most common primary bone cancer in dogs, particularly in large and giant breeds. It is locally aggressive and highly metastatic. When treated with amputation alone, 90% of patients die within a year due to metastasis. Patient size appears to be the most predictive factor for OSA development. A hereditary factor has also been suspected, and sex hormones may play a protective role. OSA occurs primarily in the long bones as compared with the axial skeleton. Patients are often progressively lame and appear painful; radiography should promptly be performed in any large- or giant-breed dog presented with lameness and metaphyseal swelling, as OSA should be suspected.

Classic radiographic signs include cortical lysis, soft tissue swelling, new bone extension in a sunburst pattern, and Codman's triangle. Cytology, although not definitive, can be supportive and has 70% to 85% accuracy in distinguishing malignant from nonmalignant lesions. Preoperative biopsy may be reserved for nonclassic cases, when the owner desires confirmation, or when cytology is nondiagnostic. Staging includes local lymph node aspiration, orthopedic examination for bone metastasis, and 3-view thoracic radiography or CT. Treatment should ideally be both local and systemic. Amputation is the standard treatment for appendicular OSA and is well tolerated. Limb-sparing techniques have much higher complication rates. Palliative radiation is an excellent local treatment option when amputation is declined. Stereotactic radiosurgery delivers precise high-dose radiation with fewer side effects. Chemotherapy significantly increases median survival time and is therefore considered part of the standard of care. Bisphosphonates, immunotherapy, and cyclooxygenase-2 inhibitors are other potential treatment options.—*Ettinger S*

Top 5 Steps to Practice Evidence-Based Veterinary Medicine

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Veterinarians in all disciplines[1] should use optimal diagnostics, interventions, and medications to examine and treat veterinary patients. However, many veterinarians may not be using the newest information to aid clinical decision-making.

The principles of evidence-based veterinary medicine (EBVM) provide structured methods for processing the large amount and different types of clinical trials, studies, and other information available and applying that information to clinical case management.[2] In the context of a specific case, following the 5 steps of EBVM[3] can help veterinarians avoid mistakes, be more circumspect in practice, and provide the best patient care.

1 Ask

Formulate a relevant and answerable clinical question.

It is important for veterinarians to recognize knowledge gaps and limitations when facing a specific case. Using treatment protocols simply because they have "always been used" is often not appropriate in the rapidly developing veterinary field. Accepting that more valid information is needed to make an appropriate clinical decision is the first step in using the concepts of EBVM.

After identifying a gap in knowledge, situations or concepts that are often complex should be broken down into a precise clinical question. For example, a veterinarian treating pyometra in a dog should not simply ask, *How should I treat a pyometra case?* Instead, the veterinarian should formulate a question that addresses all aspects of the case. The PICO approach is a practical way to formulate a question:

- P: Patient, population, and problem
- I: Intervention
- C: Comparison or control
- O: Outcome

In the pyometra example, the *patient* and *problem* element is a female dog with pyometra. *Interven-*

TOP 5 STEPS TO PRACTICE EVIDENCE-BASED VETERINARY MEDICINE

1. Ask
2. Acquire
3. Appraise
4. Apply
5. Assess

tion would involve hysterectomy, whereas choosing to do nothing would serve as a *control*. A hysterectomy as intervention can also be *compared* with the choice to treat with progesterone blockers or antibiotics. Finally, the *outcome* is considered: Will the patient survive or maintain fertility?

Considering each of the steps in the PICO approach leads to the precise clinical question, *In a 6-year-old female dog with open pyometra and only moderate clinical signs and slight WBC elevation, does hysterectomy have a better survival rate as compared with treatment with progesterone antagonists and antibiotics?* The clinician can then research surgical versus medical treatment for pyometra.

A PICO question can be adjusted to different situations, including treatment considerations (eg, *What medication is best? Is there risk for negative reaction?*) or diagnostic questions (eg, *Which diagnostic test provides the most reliable results?*).

2 Acquire

Access the best available information to answer your question.

With so much information available, it may not be practical to read all veterinary journals. Thus, veterinarians should develop skills to efficiently find relevant articles via literature databases (eg, PubMed, CAB Abstracts). After developing a PICO-based question, the terms determined in the PICO process can be used as search terms. In the pyometra case example, "pyometra in a dog," "hysterectomy," "surgical intervention," "medical management," "fertility," and "antibiotics" could all be used to search for relevant data.

It can be difficult to determine whether an article or study will contain the expected information based on an abstract or title alone. Many journals charge considerable fees to access articles, making it difficult for veterinarians to decide whether an article is relevant and worth purchasing. To overcome these obstacles, some projects aim to provide knowledge synthesis, systematic reviews, and meta-analysis of journal content (see ***Suggested***

CHECKLIST 1

CHECKLIST TO ASSESS THE QUALITY OF RESEARCH ON DIAGNOSTIC TESTS

Evaluation of diagnostic tests should include examination of the usefulness of new diagnostic tests. Results of a new diagnostic test are typically compared with current gold standard outcomes to establish the sensitivity, specificity, and likelihood ratios for the new diagnostic test.

Study Design	
The disease/condition to be tested is clearly defined.	1 point
Clear thresholds for physiologic/nonphysiologic conditions are defined.	2 points
Clear inclusion/exclusion criteria for patients/samples are reported.	1 point
An appropriate number of patients/samples was included in the study.	1 point
The test procedures are described in detail.	1 point
The study was blinded.	2 points
Test Characteristics	
The test was compared to an acknowledged gold standard.	1 point
Sensitivity and specificity of the test are given.	2 points
Repeatability of the test is good (same results when test is repeated).	1 point
Possible bias or other problems of the test (preanalytical/analytical) are discussed.	1 point
Practical Relevance	
Quality of the test results is discussed in context to other diagnostic tools for the given disease/condition.	1 point
Applicability and reliability of the test in practice is discussed objectively.	1 point
Add the given rating points to obtain the overall rating score.	____ points

15-13 = very good, 12-10 = good, 9-7 = satisfactory, 6-4 = adequate, 3-2 = inadequate, 1 = fail

EBVM = evidence-based veterinary medicine

Reading, page 66).[4] Meta-analyses summarize information and statistically analyze the results of different clinical trials relating to a specific topic to formulate concise and advanced conclusions. Systematic reviews aim to collect and interpret all available information on a specific topic without a statistical approach but with a defined and rigorous search method. Knowledge syntheses (also referred to as critically appraised topics) are standardized summaries of research evidence around a specific clinical question, usually generated from a specific case or problem. Inclusion of case reports in knowledge syntheses is uncommon, as they are prone to bias. No quantitative assignments exist for meta-analyses, systematic reviews, or knowledge syntheses.

CHECKLIST 2

CHECKLIST TO ASSESS THE QUALITY OF REVIEWS

Literature reviews in journals aim to objectively summarize recent knowledge on a specific topic. In general, these knowledge compilations can be helpful. However, sometimes it is unclear how cited publications were selected and what the authors based their conclusions on. This checklist aims to provide an objective assessment of bias in literature reviews.

Literature Search & Inclusion	
Literature search was conducted systematically via databases and is well documented.	4 points
The used search terms are documented.	2 points
More literature was searched in reference lists of acquired articles.	1 point
Inclusion and exclusion criteria for papers are well documented.	2 points
Assessment	
The quality of each paper was assessed systematically.	4 points
The findings and conclusions are discussed objectively.	2 points
Add the given rating points to obtain the overall rating score.	____ points

15-13 = very good, 12-10 = good, 9-7 = satisfactory, 6-4 = adequate, 3-2 = inadequate, 1 = fail

A knowledge synthesis may be helpful if the specific clinical question is very similar to the posed PICO question. In other cases, reviews might provide a broader overview about different options and give helpful background information. Large-scale reviews of evidence, common in human medicine, would be helpful in veterinary medicine but are not generally available.

3 Appraise

Assess the quality of the relevant evidence found.

After reading a study, trial, or article, the clinician must assess the information's quality. Evidence can be ranked from weak to strong based on methodology.[5] The following questions may be helpful in assessing information[5]:

- Is the information relevant to my clinical question or my patient(s)?
- Is the study design appropriate to answer my clinical question?
- Is the level of evidence and the quality of the paper good enough to rely on the results?

Checklists are available to guide veterinarians through determining whether the level of evidence and quality of the paper are good enough to rely on the results (***Checklists 1***, previous page, ***2***, and ***3***). However, checklists are not comprehensive and do not cover all possible scientific research approaches.[6] The literature evaluation form (***Checklist 3***) can be helpful in assessing the quality of treatment information in a study but is not the only method available for determining quality. When using it to assess the quality of information, clinicians should first determine the evidence level (eg, meta-analysis, clinical trial, case report, expert's opinion or experience). Quality criteria such as study design, information content, and objectivity should then be assessed.

By assigning a subjective score for each area in the checklist and totaling these ratings to obtain an overall score (***Checklists 1***, previous page, and ***2***), an impression of the quality and practical

CHECKLIST 3

CHECKLIST TO ASSESS THE QUALITY OF RESEARCH ON INTERVENTIONS

Step 1: Evidence Level		
Meta-analysis (statistical combination of the results of several studies)	☐	5 points
Clinical trial	☐	3 points
Case report	☐	2 points
Expert's opinion or experience	☐	1 point
Step 2: Additional Quality Criteria (Regarding the Corresponding Evidence Level)		
Meta-Analysis	**Agree**	
The literature search was exhaustive and reproducible.	☐	2 points
The included trials were comparable from a clinical point of view.	☐	4 points
Trials of a high quality (eg, randomized, controlled, blinded) were included.	☐	2 points
Results are discussed objectively and critically, including questions regarding comparability and publication bias.	☐	2 points
Clinical Trial	**Agree**	
The trial comprised a sufficient number of animals or samples.	☐	2 points
Essential information regarding the animals are given (eg, number, breed, age, sex, inclusion criteria, housing).	☐	1 point
The trial comprised an adequate control group.	☐	3 points
The trial is randomized.	☐	1 point
The trial is blinded.	☐	1 point
Examinations and interventions are described in detail. Results are presented completely.	☐	1 point
Adequate statistic procedures were used. Data is complete, or missing data is documented sufficiently.	☐	1 point
Results are discussed critically.	☐	1 point
The bibliography is adequate (extent and up to date).	☐	1 point
Case Report	**Agree**	
Essential information regarding the animals are given (eg, number, breed, age, sex, inclusion criteria, housing).	☐	2 points
Examinations and interventions are described in detail.	☐	2 points
Results are discussed critically.	☐	2 points
The bibliography is adequate (extent and up to date).	☐	1 point
Expert's Opinion or Experience	**Agree**	
Results are discussed critically.	☐	1 point
The bibliography is adequate (extent and up to date).	☐	1 point
Step 3: Summate Rating Points to Obtain the Overall Rating Score.		___ points

15-13 = very good, 12-10 = good, 9-7 = satisfactory, 6-4 = adequate, 3-2 = inadequate, 1 = fail

From Arlt SP, Heuwieser W. Training students to appraise the quality of scientific literature. *J Vet Med Educ*. 2011;38(2):137. doi: 10.3138/jvme.38.2.135.

applicability of the information in a given study or paper can be formed.

The methods section should be reviewed to determine the study type and whether possible bias was addressed appropriately. Common sources of bias in veterinary literature include a small number of animals, lack of or incomparable control groups, missing specifications of diagnostic procedures, or missing definitions of diseases. Earlier studies have shown that common flaws in many papers include poor reporting of essential information (eg, age and medical history of the animals in the study), small sample size, missing enrollment criteria, and missing information on allocation and blinding.[1,7] These are all factors that determine the quality of information and should be considered when deciding whether a study or paper is reliable.[3]

It is not possible or necessary for the reader to recalculate all the statistics given in a paper. However, by assessing other factors, the clinician can make some determination of quality.

4 Apply

Implement the evidence into clinical practice.

After new information is proven to be of good quality, the information should be assessed to determine if it is appropriate for a patient's condition. The availability of the suggested therapies, availability of equipment, the veterinary team's skills, whether the circumstances of the study are similar to the patient's circumstances, the owner's wishes, and legal and ethical aspects should all be considered. In the pyometra case example, step 4 involves discussing intended treatment extensively with the owners, including potential complications and recurrence.

Any new clinical applications or approaches should be communicated to the veterinary team and the pet owner. Even small changes concerning specific cases, practice protocols, or other routines in the practice may have a large impact on clinical outcomes, the practice, and the clinician's professionalism.

5 Assess

Evaluate the impact of the changes.

Because improving clinical practice is a never-ending task,[8] clinicians should assess whether changes implemented as a result of EBVM really led to better outcomes. Although it is easy to reflect on cases in which something went wrong or that had an unexpected outcome, it is also important to reflect on what went well in cases with positive outcomes. Assessment can be as simple as a personal reflection on individual cases at the end of a busy day. A more thorough assessment could include a reflection on the PICO-based clinical question, answers found through research, and a comparison to the actual outcome of the case. Finally, a formal practice-wide audit based on these 5 steps could be conducted.

EBVM = evidence-based veterinary medicine

See page 66 for references.

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The safe use with other anti-hypertensive medications has not been evaluated.
For additional information, see the full prescribing information on page 30.

References: 1. Semintra® (telmisartan oral solution) Prescribing Information. Boehringer Ingelheim Vetmedica, Inc. 2018.
2. Zimmering T. Ease of use of Semintra® and its effects on quality of life—update on cat owner feedback ("EASY Programme") [abstract]. In: Proceedings from the 21st Federation of European Companion Animal Veterinary Associations (FECAVA); October 15–17, 2015; Barcelona, Spain. Poster.

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Which Drugs Are Used to Treat Cognitive Dysfunction Syndrome?

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Cognitive dysfunction syndrome is a chronic, progressive disease with a range of clinical signs, including disorientation, changes in social interactions, alterations in sleep–wake cycles, house soiling (in a previously housetrained pet), and changes in activity and learning.[1] Cognitive dysfunction syndrome is characterized by neuronal loss and neuroaxonal degeneration.[2] The neuroanatomic pathology in dogs and cats shares some characteristics with human Alzheimer's disease,[3,4] specifically β-amyloid accumulation, tau phosphorylation, and neuronal loss in the frontal cortex, cerebellum, and hippocampus.[2,5-7] The most common signs of cognitive dysfunction syndrome in dogs include house soiling and an increase or decrease in social interactions[8]; the most common signs in cats include vocalization and house soiling.[9] Both dogs and cats may show signs of anxiety or fear (eg, agitation), which may be a result of disorientation. These clinical signs, particularly being awake at night, can be detrimental to the human–animal bond. Older dogs and cats should be screened for cognitive dysfunction syndrome at annual visits and pet owners educated about the common signs.

Environmental enrichment, mental stimulation, and diet promote cognitive health as pets age. Therapeutics used to treat cognitive dysfunction syndrome are typically chosen to address clinical signs once they have been detected. There are no approved drugs for prevention of cognitive dysfunction syndrome, and only one drug has been approved for dogs.[10] Use of drugs to provide supportive and complementary care can mitigate signs associated with cognitive dysfunction syndrome. Clinician understanding of the rationale and utility of available drugs is crucial, as is balancing medications, owner expectations, and potential drug interactions.

Drug decisions should be based on clinical presentation, and patients should be monitored for treatment efficacy. It can be useful to prioritize the presenting signs to address those most pressing; for example, anxiety and changes to the sleep–wake cycle are often addressed first.

Selegiline

Selegiline is the only FDA-approved drug for treatment of cognitive dysfunction syndrome. It is only approved for use in dogs, although use in cats has been described.[11] Selegiline is a monoamine oxidase-B inhibitor (MAOI). Its effects in the CNS include

MAOI = monoamine oxidase-B inhibitor

increasing phenylethylamine and slowing metabolism of dopamine (and other monoamine neurotransmitters). Selegiline may also decrease free-radical production and enhance free-radical scavenging.[12] In clinical trials, selegiline was shown to improve sleeping, housetraining, and activity in dogs.[13] It has also been shown to improve spatial memory in older laboratory-housed dogs[14] and have positive effects on learning and attention.[15]

Formulation → Oral

Dose (dogs) → 0.5-1.0 mg/kg q24h (administered in the morning)
Dose (cats; extra-label) → 0.25-1.00 mg/kg q24h (administered in the morning)

Key Points

- Improvement or stabilization of clinical signs may take 6 to 8 weeks.
- If there are no adverse effects, owners should be encouraged to continue administering the medication for 2 months then reassess the dog's status. Adverse effects reported in clinical trials included vomiting, diarrhea, hyperactivity/restlessness, ataxia, and disorientation.[16]
- Concurrent use of selegiline with other MAOIs (eg, amitraz) or serotonergic drugs (eg, selective serotonin reuptake inhibitors, tramadol, trazodone) is contraindicated due to increased risk for serotonin syndrome.

Benzodiazepines

In older humans, benzodiazepines may be associated with postoperative cognitive decline and an increased risk for Alzheimer's disease.[17] However, the disease risk in humans increases with both length of treatment and half-life of the medication,[18] and relevance in animals is unknown. Benzodiazepines may be useful in treating anxiety and agitation associated with cognitive decline in humans and may be helpful in treating this condition in dogs. Although a variety of benzodiazepines are widely available, those with a shorter half-life and no active metabolites are preferred.

Lorazepam

Lorazepam is a generally well tolerated benzodiazepine with no active metabolites. Its elimination half-life in dogs is approximately an hour. Side effects can include lethargy or idiosyncratic increases in activity or vocalization. Lorazepam may be beneficial at night for patients that exhibit night waking.

Formulation → Oral

Dose (dogs) → 0.025-0.200 mg/kg up to q8h
Dose (cats) → 0.025-0.050 mg/kg q8-12h

MAOI = monoamine oxidase-B inhibitor

Nutraceuticals

Various nutraceuticals have been used to treat cognitive dysfunction syndrome. The following discussion is limited to those that have been studied in dogs or cats.

α-Casozepine

α-casozepine is a decapeptide derived from α S1-casein in milk. Though the mechanism of action is not completely understood, α-casozepine appears to be structurally similar to γ-aminobutyric acid. It has been studied primarily for efficacy in anxiety paradigms in cats and dogs[19,20]; in dogs, however, it was evaluated for equivalence against selegiline.[20] α-casozepine may be useful in alleviating signs of anxiety that accompany cognitive dysfunction syndrome.

Formulation → Oral

Dose (dogs, cats) → 15 mg/kg PO q24h

Key Point

- α-casozepine has not been evaluated for use in treating cognitive dysfunction syndrome, but it may be useful for treating comorbid anxiety.

Antioxidants & Phospholipids

Oxidative stress appears to have a role in cognitive disorders by causing damage to proteins and lipids in the brain. Vitamins E and B and resveratrol have antioxidant properties and have been incorporated into supplement combinations and diets. Phospholipids (eg, phosphatidylserine) have also been included for their role in cell signaling. Products that contain a mixture of antioxidants and phospholipids (eg, phosphatidylserine) are available. One such product has been evaluated in an open-label trial with a small number ($n = 8$) of dogs with cognitive dysfunction syndrome.[21] Although positive effects were shown on signs of cognitive dysfunction syndrome,[21] results should be followed with a larger, controlled trial. This

product was also shown to improve performance in a memory task in a placebo-controlled study of laboratory beagles.[22] Other supplement combinations are available outside the United States, one of which includes antioxidants, phosphatidylserine, and omega-3 fatty acids and has been shown to improve scores for house soiling, owner recognition, and number of hours awake during the day.[23]

Dose (dogs) → See package insert.

S-Adenosyl-L-Methionine Tosylate

S-adenosyl-L-methionine tosylate may help maintain cell membranes and regulate cellular functions. It has been evaluated for use in treating depression, osteoarthritis, and liver disease.[24] It has also been shown to selectively improve performance on tasks of executive function in laboratory-housed dogs and cats with cognitive dysfunction syndrome.[25] In cats, treatment was most successful in earlier stages of cognitive decline as compared with later stages.[25]

Dose (dogs, cats) → Dose divided by weight class (≤22 lb; 22-44 lb; >44lb)

Apoaequorin

Apoaequorin* is a calcium-binding protein derived from jellyfish. It is believed to have calcium-buffering effects that protect against cell death. When assessed for effects on attention and memory in laboratory-housed dogs, apoaequorin showed favorable results against both placebo and selegiline for select cognitive tasks, particularly selective attention.[26]

Dose (dogs, cats) → See package insert.

Key Points

Apoaequorin has not been evaluated for beneficial effects in cats but is available in a sprinkles formulation.

Drugs Available Outside the United States

Propentofylline

Propentofylline is a xanthine derivative licensed in parts of Europe for the treatment of signs associated with cognitive dysfunction syndrome in dogs. It acts as a phosphodiesterase inhibitor, inhibits the reuptake of adenosine, and decreases the production of free radicals. In a comparison trial, propentofylline did not increase locomotor activity in older dogs.[27]

Formulation → Oral

Dose (dogs, cats) → 3-5 mg/kg PO q12h

Nicergoline

Nicergoline is an ergot alkaloid derivative that acts as an α_1-adrenergic antagonist and enhancer of cholinergic function via acetylcholine release. It is believed to have some neuroprotective and antioxidant activity. In a comparison trial, propentofylline did not increase locomotor activity in older dogs.[27]

Formulation → Oral

Dose (dogs, cats) → 0.25-0.50 mg/kg PO q24h (administered in the morning)

Diets

Two prescription diets have been labeled to support cognitive health in dogs, including:

- Hills Canine b/d (hillsvet.com)
- Purina Pro Plan Veterinary Diets NeuroCare (purina.com)

Hill's Canine b/d contains supplements of antioxidants, mitochondrial cofactors, and omega-3 fatty acids. Aged dogs fed this diet for 6 months showed improved performance (ie, fewer errors) on an oddity discrimination task as compared with aged dogs fed a control diet.[28] Purina Pro Plan Veterinary Diets NeuroCare is supplemented with antioxidants, omega-3 fatty acids, and medium chain triglyceride vegetable oil. This diet was studied in a randomized controlled trial and was shown to improve signs of cognitive dysfunction syndrome in dogs following a 90-day feeding period, relative to baseline.[29] In another study, dogs fed a diet supplemented with arginine, B vitamins, fish oil, and antioxidants performed better in tests of memory and discrimination.[30] These specific diets are available for dogs, whereas supplementation has been incorporated into the diets of senior and geriatric cats. No veterinary diet has been specifically labeled to support cognitive function in cats. However, there is evidence that middle-aged cats fed a diet supplemented with antioxidants, arginine, B vitamins, and fish oil performed better in a series of cognitive tests as compared with cats fed a nonsupplemented control diet.[31]

See next page for references.

*Of note, the commercial product has been placed on indefinite backorder.

References

1. Landsberg G, Hunthausen W, Ackerman L. The effects of aging on behavior in senior pets. In: Landsberg G, Hunthausen W, Ackerman L. *Behavior Problems of the Dog and Cat*. 3rd ed. Philadelphia, PA: Elsevier Saunders; 2013:211-236.
2. Head E. Neurobiology of the aging dog. *Age (Dordr)*. 2011;33(3):485-496.
3. Cummings BJ, Head E, Afagh AJ, Milgram NW, Cotman CW. Beta-amyloid accumulation correlates with cognitive dysfunction in the aged canine. *Neurobiol Learn Mem*. 1996;66(1):11-23.
4. Bosch MN, Pugliese M, Gimeno-Bayón J, Rodríguez MJ, Mahy N. Dogs with cognitive dysfunction syndrome: a natural model of Alzheimer's disease. *Cur Alzheimer Res*. 2012;9(3):298-314.
5. Zhang C, Hua T, Zhu Z, Luo X. Age-related changes of structures in cerebellar cortex of cat. *J Biosci*. 2006;31(1):55-60.
6. Zhang C, Zhu Q, Hua T. Effects of ageing on dendritic arborizations, dendritic spines and somatic configurations of cerebellar Purkinje cells of old cat. *Pak J Zool*. 2011;43(6):1191-1196.
7. Chambers JK, Tokuda T, Uchida K, et al. The domestic cat as a natural animal model of Alzheimer's disease. *Acta Neuropathol Com*. 2015;3:78.
8. Azkona G, García-Belenguer S, Chacón G, Rosado B, León M, Palacio J. Prevalence and risk factors of behavioural changes associated with age-related cognitive impairment in geriatric dogs. *J Small Anim Pract*. 2009;50(2):87-91.
9. Landsberg GM, Deporter T, Araujo J. Clinical signs and management of anxiety, sleeplessness, and cognitive dysfunction in the senior pet. *Vet Clin North Am Small Anim Pract*. 2011;41(3):565-590.
10. U.S. Food & Drug Administration. Application number 141-080 (Anipryl). US FDA website. https://animaldrugsatfda.fda.gov/adafda/views/#/home/previewsearch/141-080. Accessed November 6, 2018.
11. Landsberg G. Therapeutic options for cognitive decline in senior pets. *J Am Anim Hosp Assoc*. 2006;42(6):407-413.
12. Knoll J. (L-)Deprenyl (selegiline), a catecholaminergic activity enhancer (CAE) substance acting in the brain. *Pharmacol Toxicol*. 1998;82(2):57-66.
13. Ruehl WW, Bruyette DS, DePaoli A, et al. Canine cognitive dysfunction as a model for human age-related cognitive decline, dementia and Alzheimer's disease: clinical presentation, cognitive testing, pathology and response to 1-deprenyl therapy. *Prog Brain Res*. 1995;106:217-225.
14. Head E, Hartley J, Kameka AM, et al. The effects of L-deprenyl on spatial short term memory in young and aged dogs. *Prog Neuropsychopharmacol Biol Psychiatry*. 1996;20(3):515-530.
15. Mills D, Ledger R. The effects of oral selegiline hydrochloride on learning and training in the dog: a psychobiological interpretation. *Prog Neuropsychopharmacol Biol Psychiatry*. 2001;25(8):1597-1613.
16. Anipryl [package insert]. Kalamazoo, MI: Zoetis; 2013.
17. Defrancesco M, Marksteiner J, Fleischhacker WW, Blasko I. Use of benzodiazepines in Alzheimer's disease: a systematic review of literature. *Int J Neuropsychopharmacol*. 2015;18(10):pyv055.
18. Bégaud B, de Gage SB. Benzodiazepine use and risk of Alzheimer's disease: case-control study. *BMJ*. 2014;349:g5025.
19. Beata C, Beaumont-Graff E, Coll V, et al. Effect of alpha-casozepine (Zylkene) on anxiety in cats. *J Vet Behav Clin Appl Res*. 2007;2(2):40-46.
20. Beata C, Beaumont-Graff E, Diaz C, et al. Effects of alpha-casozepine (Zylkene) versus selegiline hydrochloride (Selgian, Anipryl) on anxiety disorders in dogs. *J Vet Behav Clin Appl Res*. 2007;2(5):175-183.
21. Osella MC, Re G, Odore R, et al. Canine cognitive dysfunction syndrome: prevalence, clinical signs and treatment with a neuroprotective nutraceutical. *Appl Anim Behav Sci*. 2007;105(4):297-310.
22. Araujo JA, Landsberg GM, Milgram NW, Miolo A. Improvement of short-term memory performance in aged beagles by a nutraceutical supplement containing phosphatidylserine, Ginkgo biloba, vitamin E, and pyridoxine. *Can Vet J*. 2008;49(4):379-385.
23. Heath SE, Barabas S, Craze PG. Nutritional supplementation in cases of canine cognitive dysfunction—a clinical trial. *Appl Anim Behav Sci*. 2007;105(4):284-296.
24. Sharma A, Gerbarg P, Bottiglieri T, et al. S-adenosylmethionine (SAMe) for neuropsychiatric disorders: a clinician-oriented review of research. *J Clin Psychiatry*. 2017;78(6):e656-e667.
25. Araujo JA, Faubert ML, Brooks ML, Landsberg GM, Lobprise H. NOVIFIT (NoviSAMe) tablets improve executive function in aged dogs and cats: implications for treatment of cognitive dysfunction syndrome. *Intern J Appl Res Vet Med*. 2012;10(1):90-98.
26. Milgram NW, Landsberg G, Merrick D, Underwood MY. A novel mechanism for cognitive enhancement in aged dogs with the use of a calcium-buffering protein. *J Vet Behav Clin Appl Res*. 2015;10(3):217-222.
27. Siwak CT, Gruet P, Woehrlé F, Muggenburg BA, Murphey HL, Milgram NW. Comparison of the effects of adrafinil, propentofylline, and nicergoline on behavior in aged dogs. *Am J Vet Res*. 2000;61(11):1410-1414.
28. Milgram NW, Zicker SC, Head E, et al. Dietary enrichment counteracts age-associated cognitive dysfunction in canines. *Neurobiol Aging*. 2002;23(5):737-745.
29. Landsberg G, Pan Y, Mougeot I, et al. Efficacy of a therapeutic diet on dogs with signs of cognitive dysfunction syndrome. In: *Proceedings of the 11th International Veterinary Behaviour Meeting*. 2017;114.
30. Pan Y, Kennedy AD, Jönsson TJ, Milgram NW. Cognitive enhancement in old dogs from dietary supplementation with a nutrient blend containing arginine, antioxidants, B vitamins, and fish oil. *Br J Nutr*. 2018;119(3):349-358.
31. Pan Y, Araujo JA, Burrows J, et al. Cognitive enhancement in middle-aged and old cats with dietary supplementation with a nutrient blend containing fish oil, B vitamins, antioxidants, and arginine. *Br J Nutr*. 2013;110(1):40-49.

Clinician understanding of the rationale and utility of available drugs is crucial, as is balancing medications, owner expectations, and potential drug interactions.

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Saccharomyces boulardii: A New Probiotic Approach in Veterinary Medicine

The use of *Saccharomyces boulardii* has been established for multiple indications in human patients. With a better understanding of the impact of antibiotics on the intestinal microbiota, as well as increasing concerns surrounding antimicrobial resistance, a closer look at the yeast's potential impact on veterinary medicine is warranted.

KEY POINTS

- Indiscriminate use of antibiotics promotes development of antibiotic resistance, which poses a critical problem in public healthcare.
- Antibiotics cause alterations in intestinal microbiota, resulting in loss of microbiota function.[1] Antimicrobial-associated dysbiosis may predispose patients for atopic, inflammatory, and autoimmune diseases.[2,3]
- Antibiotic-associated diarrhea (AAD) is a common presenting sign in veterinary and human medicine and occurs in up to 25% of human patients.[4] In veterinary studies, 56% of healthy dogs receiving metronidazole[5] and up to 85.7% of cats receiving amoxicillin-clavulanate[6] developed worsening fecal scores. Administration of the probiotic yeast *Saccharomyces boulardii* helps in protection against and management of AAD in dogs.[7]
- In dogs with inflammatory bowel disease (IBD) managed with standard therapy (ie, diet, antibiotics, and steroids) and concurrent administration of *S boulardii*, clinical signs improved faster and more significantly than dogs managed with standard therapy alone.[8]

Antibiotics

Judicious Use

The indiscriminate overuse of antibiotics promotes antimicrobial resistance and transfer of resistance genes to pathogenic bacteria.[1,9] In 2014, the World Health Organization published a global report[10] with alarming data on the increase of antimicrobial resistance by specific pathogens. Resulting limited treatment options for bacterial infections and the subsequent potential for worse clinical outcomes and death pose a major problem in both human and veterinary medicine.

A study in healthy dogs evaluated the effect of a 7-day treatment with amoxicillin, an antibiotic commonly used in small animal veterinary practice. After 4 to 7 days of treatment, most dogs shed *Escherichia coli* resistant to several antibiotics.[11] Therefore, due to the alarming emergence of antimicrobial resistance, a more judicious use of antibiotics is recommended.

Effects on Intestinal Microbiota

Antimicrobial agents also have pervasive effects on resident intestinal bacteria, which can result in dysbiosis,[12] an alteration in microbiota diversity and composition.

Several studies have shown negative effects on the intestinal microbiome after antibiotic treatment in humans and animals. In one such study, cats receiving amoxicillin-clavulanate for 7 days were observed to have a decreased number of intestinal bacterial species, and the overall distribution of specific taxa had not recovered 7 days after antibiotic cessation.[6] Another study revealed dogs treated with tylosin—an antibiotic commonly used for canine chronic enteropathy—for 14 days also had significantly decreased microbiota diversity and alterations in

microbiota composition, particularly an increase in *E coli*-like sequences. Several bacterial taxa did not recover 14 days after antibiotic cessation, when the last fecal sample was collected in this study.[13] Similar bacterial alterations with increased *E coli* have also been seen in dogs receiving metronidazole. Major disruptions in intestinal metabolism—including levels of bile acids and tryptophan—were observed and persisted until 4 weeks after cessation of metronidazole.[5]

Health Effects of Dysbiosis & Duration of Effects

The intestinal microbiome works as a metabolic organ and fulfills a variety of functions; a balanced microbiome is essential for host health. The microbiota modulates the host immune system, protects the host from invading pathogens, and provides nutrients to the host by metabolizing and fermenting various dietary components.[14,15] Intestinal dysbiosis causes alterations in composition or diversity of bacteria as well as loss of microbiota function.[1] Negative effects from loss of microbiota function include overproduction and translocation of bacterial toxins, pro-inflammatory stimulation of the immune system, reductions in beneficial bacterial metabolites (eg, short-chain fatty acids [SCFAs], secondary bile acids), and increased intestinal permeability.

Clinical signs vary between individuals and can range from mild GI signs to an increased risk for systemic diseases (eg, diabetes mellitus, obesity).[2,16] Although clinical signs caused by antibiotic exposure usually resolve within days to weeks, alterations in diversity and composition can persist for longer periods. Studies in human medicine showed that alterations in intestinal microbiota and increased presence of bacterial resistance following antibiotic treatment can persist up to 4 years.[17] Antimicrobial-associated dysbiosis is suspected to predispose patients for development of atopic, inflammatory, and autoimmune diseases, as well as IBD, asthma, or obesity in humans.[2,3]

▲ MYCEQUIN™ chewable tablets for dogs from Nutramax Laboratories Veterinary Sciences, Inc. contain NMXAAD™ Proprietary blend of 10 billion CFUs (colony-forming units) of *Saccharomyces boulardii* plus beta-glucan. Beta-glucan is an immune-modulating compound that enhances innate defenses and stimulates both cell-mediated and humoral immunity. Beta-glucan has been shown beneficial in dogs with IBD.

General recommendation for MYCEQUIN use is 1 daily with antibiotics to help protect against antibiotic-associated gastrointestinal signs and 2 daily for chronic gastrointestinal conditions.

Saccharomyces boulardii as a Probiotic

Differences from Bacteria

S boulardii is a yeast strain first isolated in 1920 from the outer skin of tropical fruits in Indochina[18] and, in recent decades, has garnered much interest as a probiotic agent. Probiotics are live microorganisms that, when consumed in adequate amounts, confer a health benefit to the host.[19] *S boulardii* has favorable probiotic properties that differentiate it from bacterial probiotics.[20] While bacteria are prokaryotes, yeasts are eukaryotic cells, which are up to 10 times larger than bacterial cells. Because of their differing cell wall structure, yeast cells are recognized by different host receptors than bacterial cell wall components, thus causing different antigenic responses. Yeast cells are resistant to low pH, bile salts, and GI enzymes, and *S boulardii* also has an optimal growth temperature similar to body temperature. These features allow for transit through the acidic stomach and are favorable to optimal colonization of the colon.[21] An important property of yeast is its natural resistance to antibiot-

S boulardii has favorable probiotic properties that differentiate it from bacterial probiotics.

ics, which allows it to be administered concurrently with antibiotics. In addition, administration of yeast does not promote development of antimicrobial resistant bacteria.

Mechanisms of Action of *S boulardii*

Several studies investigated the properties of *S boulardii* and found an extensive spectrum of mechanisms of action. *S boulardii* directly inhibits the growth of several pathogens (eg, *Salmonella typhimurium*, *Yersinia enterocolitica*) and has toxin-inhibiting properties through production of proteases able to degrade *Clostridium difficile* toxins and *E coli* endotoxin.[18]

In mice, treatment with *S boulardii* promoted faster restoration of the intestinal microbiota after disruption due to antibiotic treatment.[22] Administration of *S boulardii* in humans was associated with increased intestinal SCFAs,[23] which have anti-inflammatory properties, regulate intestinal motility, and are known to be an important source of energy.[15] By increasing IgA levels and reducing pro-inflammatory responses, *S boulardii* is also able to modulate immune responses.[18]

In human medicine, major indications for the use of *S boulardii* are AAD and IBD (see **Human Global Guidelines for Probiotics and Prebiotics**). Clinical efficacy of *S boulardii* has also been observed in unclassified acute diarrhea, enteral-nutrition–related diarrhea, traveler's diarrhea, irritable bowel syndrome, *C difficile* infection, and reduction of side effects of *Helicobacter pylori* therapy.[18]

In a study of healthy dogs receiving lincomycin, AAD was prevented in all dogs concurrently receiving *S boulardii*.

Research in Veterinary Medicine

Antibiotic-Associated Diarrhea

AAD is defined as otherwise unexplained diarrhea that occurs in association with the administration of antibiotics. An estimated 25% of human patients treated with antibiotics develop diarrhea.[4] While the exact incidence is currently unknown in veterinary medicine, antibiotic-associated GI side effects, including diarrhea, vomiting, and hyporexia, are believed to occur frequently and can result in owners discontinuing the course of antibiotics prematurely with implications for development of antimicrobial resistance.[6,24]

In numerous studies in human medicine, *S boulardii* significantly reduced the development of AAD.[18] In a veterinary study of healthy dogs receiving lincomycin at 150 mg/kg IM (approximately 7 times the recommended dose in dogs), AAD was prevented in all dogs concurrently receiving *S boulardii* at 20 billion CFUs/day. In the control group that only received lincomycin without *S boulardii*, 75% of the dogs developed diarrhea with a mean duration of 6.5 days. In dogs that received *S boulardii* as soon as diarrhea occurred, a significantly shorter duration of diarrhea was observed with a mean duration of 2.9 days.[7]

Inflammatory Bowel Disease

IBD is characterized by a histologically confirmed inflammation of the GI tract with chronic recurrent GI signs.[25] Animals with IBD require multimodal therapeutic approaches, and achieving relief of clinical signs can be challenging. Although the pathophysiology of IBD differs in humans and small animals, treatment with *S boulardii* in humans with IBD was associated with significantly reduced colonic permeability and relapse rate as well as significantly improved stool scores.[18]

One veterinary study investigated the effects of *S boulardii* in 20 dogs with chronic enteropathy confirmed as IBD. The dogs received *S boulardii* versus placebo concurrent to regular IBD therapy consisting of diet, antibiotics, and steroids ± other immunosuppressants. Clinical signs, evaluated with the canine chronic enteropathy clinical activity index (CCECAI), improved significantly in dogs administered *S boulardii* compared with dogs given placebo. The body condition scores increased significantly only in the *S boulardii* group.[8]

AAD = antibiotic-associated diarrhea
IBD = inflammatory bowel disease
SCFAs = short-chain fatty acids

HUMAN GLOBAL GUIDELINES FOR PROBIOTICS AND PREBIOTICS

AAD and IBD are listed as evidence-based indications for adults and/or children in the *Guidelines on Probiotics and Prebiotics* published by the World Gastroenterology Organisation. Specific indications in children are acute gastroenteritis, prevention of AAD, and reduction of side effects from treatment for *Helicobacter pylori*. Recommended dose of *S boulardii* in children for the prevention of AAD is 5-10 billion CFUs/day.[26]

Implications

These results indicate that *S boulardii* is a promising probiotic agent that can be used for protection against and management of AAD and in addition to standard therapy in dogs with IBD. Further studies are warranted to evaluate the efficacy of *S boulardii* against other GI diseases in small animals.

Future Directions in Probiotic Research

Research on the intestinal microbiome has grown tremendously in recent years. The intestinal microbiome is a highly complex organ that affects the host's metabolism and immune system; therefore, a balanced microbiome is crucial for host health.

Therapies for the modulation of the intestinal microbiome are currently limited, mostly because of technical difficulties in evaluating the complex multiple immune and metabolic interactions between the microbiome and the host. It has become clear that individual probiotics have strain-specific effects on the host. For the best clinical outcome, probiotic products should be chosen based on scientifically proven effects for the particular clinical disorder.

These results indicate that *S boulardii* is a promising probiotic agent that can be used for protection against and management of AAD and in addition to standard therapy in dogs with IBD.

References

1. Francino MP. Antibiotics and the human gut microbiome: dysbioses and accumulation of resistances. *Front Microbiol*. 2016;6:1543.
2. Saari A, Virta LJ, Sankilampi U, Dunkel L, Saxen H. Antibiotic exposure in infancy and risk of being overweight in the first 24 months of life. *Pediatrics*. 2015;135(4):617-626.
3. Metsälä J, Lundqvist A, Virta LJ, Kaila M, Gissler M, Virtanen SM. Prenatal and post-natal exposure to antibiotics and risk of asthma in childhood. *Clin Exp Allergy*. 2015;45(1):137-145.
4. Bartlett JG. Clinical practice. Antibiotic-associated diarrhea. *N Engl J Med*. 2002;346(5):334-339.
5. Suchodolski JS, Olson E, Honneffer J, et al. Effects of a hydrolyzed protein diet and metronidazole on the fecal microbiome and metabolome in healthy dogs. *J Vet Intern Med*. 2016;30:1455.
6. Torres-Henderson C, Summers S, Suchodolski J, Lappin MR. Effect of Enterococcus faecium strain SF68 on gastrointestinal signs and fecal microbiome in cats administered amoxicillin clavulanate. *Top Companion Anim Med*. 2017; 32(3):104-108.
7. Aktas MS, Borku MK, Ozkanlar Y. Efficacy of *Saccharomyces boulardii* as a probiotic in dogs with lincomycin induced diarrhoea. *Bull Vet Inst Pulawy*. 2007;51(3):365-369.
8. D'Angelo S, Fracassi F, Bresciani F, et al. Effect of *Saccharomyces boulardii* in dogs with chronic enteropathies: double-blinded, placebo-controlled study. *Vet Rec*. 2018;182(9):258.
9. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. *BMJ*. 2010;340:c2096.
10. Ravi P. Antimicrobial resistance: global report on surveillance. *Australas Med J.* 2014;7:237.
11. Grønvold AM, L'abée-Lund TM, Sørum H, Skancke E, Yannarell AC, Mackie RI. Changes in fecal microbiota of healthy dogs administered amoxicillin. *FEMS Microbiol Eco*. 2010;71(2):313-326.
12. Dethlefsen L, Huse S, Sogin ML, Relman DA. The pervasive effects of an antibiotic on the human gut microbiota, as revealed by deep 16S rRNA sequencing. *PLoS Biol*. 2008;6(11):e280.
13. Suchodolski JS, Dowd SE, Westermarck E, et al. The effect of the macrolide antibiotic tylosin on microbial diversity in the canine small intestine as demonstrated by massive parallel 16S rRNA gene sequencing. *BMC Microbiol*. 2009;9:210.
14. Bansal T, Alaniz RC, Wood TK, Jayaraman A. The bacterial signal indole increases epithelial-cell tight-junction resistance and attenuates indicators of inflammation. *Proc Natl Acad Sci U S A*. 2010;107(1):228-233.
15. Arpaia N, Campbell C, Fan X, et al. Metabolites produced by commensal bacteria promote peripheral regulatory T-cell generation. *Nature*. 2013;504(7480):451-455.
16. Vrieze A, Out C, Fuentes S, et al. Impact of oral vancomycin on gut microbiota, bile acid metabolism, and insulin sensitivity. *J Hepatol*. 2014;60(4):824-831.
17. Jakobsson HE, Jernberg C, Andersson AF, Sjolund-Karlsson M, Jansson JK, Engstrand L. Short-term antibiotic treatment has differing long-term impacts on the human throat and gut microbiome. *PLoS One*. 2010;5(3):e9836.
18. McFarland LV. Systematic review and meta-analysis of *Saccharomyces boulardii* in adult patients. *World J Gastroenterol*. 2010;16(18):2202-2222.
19. Food and Agriculture Organization of the United Nations and World Health Organization. Guidelines for the Evaluation of Probiotics in Food. http://www.who.int/foodsafety/fs_management/en/probiotic_guidelines.pdf. Accessed October 5, 2018.
20. Czerucka D, Piche T, Rampal P. Review article: yeast as probiotics—*Saccharomyces boulardii*. *Aliment Pharmacol Ther*. 2007;26(6):767-778.
21. Graff S, Chaumeil JC, Boy P, Lai-Kuen R, Charrueau C. Influence of pH conditions on the viability of *Saccharomyces boulardii* yeast. *J Gen Appl Microbiol*. 2008;54(4):221-227.
22. Barc MC, Charrin-Sarnel C, Rochet V, et al. Molecular analysis of the digestive microbiota in a gnotobiotic mouse model during antibiotic treatment: Influence of *Saccharomyces boulardii*. *Anaerobe*. 2008;14(4):229-233.
23. Girard-Pipau F, Pompei A, Schneider S, et al. Intestinal microflora, short chain and cellular fatty acids, influence of a probiotic *S. boulardii*. *Microb Ecology Health Dis.* 2002;14:220-227.
24. Stokes JE, Price JM, Whittemore JC. Randomized, controlled, crossover trial of prevention of clindamycin-induced gastrointestinal signs using a synbiotic in healthy research cats. *J Vet Intern Med.* 2017;31(5):1406-1413.
25. Simpson KW, Jergens AE. Pitfalls and progress in the diagnosis and management of canine inflammatory bowel disease. *Vet Clin North Am Small Anim Pract.* 2011;41(2):381-398.
26. World Gastroenterology Organisation. *World Gastroenterology Organisation Global Guidelines: Probiotics and Prebiotics*. World Gastroenterology Organisation website. http://www.worldgastroenterology.org/UserFiles/file/guidelines/probiotics-and-prebiotics-english-2017.pdf. Published February 2017. Accessed October 17, 2018.

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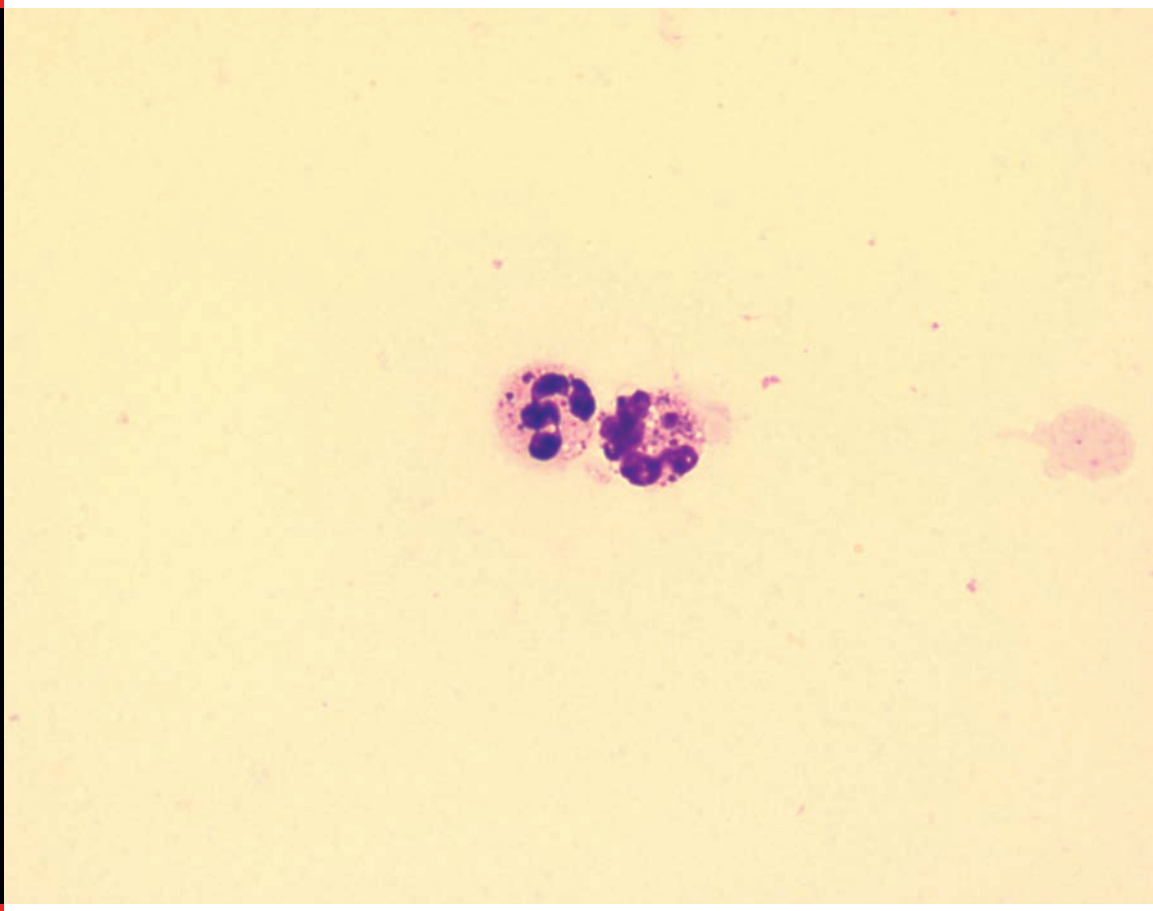
FROM PAGE TO PATIENT

Designed to bridge the gap between research pages and daily practice protocol, the following pearls offer tips and techniques to grow the general practitioner's clinical excellence.



Calcineurin Inhibitors as Steroid-Sparing Agents

William Oldenhoff, DVM, DACVD
Leader Animal Specialty Hospital
Cooper City, Florida

In the Literature

Banovic F, Robson D, Linek M, Olivry T. Therapeutic effectiveness of calcineurin inhibitors in canine vesicular cutaneous lupus erythematosus. *Vet Dermatol.* 2017;28(5):493-e115.

FROM THE PAGE ...

Vesicular cutaneous lupus erythematosus (VCLE) is a form of cutaneous lupus erythematosus that is seen mainly in collies and Shetland sheepdogs. VCLE has a distinctive clinical appearance, with lesions consisting of annular to serpiginous ulcerations primarily on the ventral abdomen, groin, and axillae, although mucocutaneous junctions and the concave aspect of the pinnae are commonly affected as well. As with many other autoimmune skin diseases, the treatment of choice has historically involved immunosuppressive doses of oral glucocorticoids. Although glucocorticoids are usually effective at inducing remission, side effects are common, and the long-term prognosis is guarded. As such, there is a need for safer long-term treatment options for VCLE. Calcineurin inhibitors (eg, cyclosporine, tacrolimus) are frequently used

as steroid-sparing agents in dogs with autoimmune skin diseases, but there is a lack of published data examining the outcomes of these treatments.

In this study, the authors analyzed the outcomes of 11 dogs with VCLE that were treated with oral modified cyclosporine (5-10 mg/kg q24h). Initial therapies included systemic and topical antimicrobials (6 and 2 dogs, respectively) and oral corticosteroids (9 dogs); these treatments resulted in clinical improvement for several dogs, but none achieved clinical remission. After initiation of treatment with oral modified cyclosporine, complete remission was noted in 8 of the 11 dogs within 35 to 70 days. Complete remission was achieved in 2 additional dogs when the cyclosporine dosage was increased and topical tacrolimus was added. Relapse was often seen when cyclosporine doses were tapered. Three dogs were euthanized, but clinical remission was maintained in the remaining 8 dogs with oral cyclosporine and, occasionally, topical tacrolimus or pimecrolimus.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Cyclosporine appears to be a safer long-term treatment option for VCLE than glucocorticoids alone.

2. Once clinical remission has been achieved, clinicians should attempt to gradually taper medications to the lowest effective dose. Topical calcineurin inhibitors (eg, tacrolimus, pimecrolimus) can be used to further reduce the need for oral cyclosporine. Although these topical products are initially expensive, one tube usually lasts several months, as only a small amount is used for each dose.

3. In dogs with immune-mediated skin disease, avoiding excess sun exposure is recommended. UV light has been known to exacerbate skin lesions in humans with CLE,[1] and anecdotal information supports this effect in dogs.

Reference

1. Kim A, Chong BF. Photosensitivity in cutaneous lupus erythematosus. *Photodermatol Photoimmunol Photomed*. 2013;29(1):4-11.

See page 44 for product information summary.

Ticks on Cats

Katie M. Clow, DVM, PhD
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In the Literature

Little SE, Barrett AW, Nagamori Y, et al. Ticks from cats in the United States: patterns of infestation and infection with pathogens. *Vet Parasitol.* 2018;257:15-20.

FROM THE PAGE ...

The assumption that cats are careful groomers that can readily remove ticks has been studied in recent research. A handful of studies have suggested that ticks may pose a greater risk to cats in the United States than previously believed.[1-3]

In this study,* 796 ticks removed from 332 cats were submitted by 41 veterinary practices in 18 states, covering all 4 US geographic regions. Most ticks were identified as *Ixodes scapularis* (53.1%), *Amblyomma americanum* (28.4%), and *Dermacentor variabilis* (16.5%). Submissions occurred in all months, with peak submissions coinciding with peak activity of the tick species identified. Greater numbers of adult *D variabilis* and *A americanum* and nymphal *I scapularis* were submitted in May and June, whereas submissions of adult *I scapularis* peaked in October and November. The spatial distribution of submissions aligned with the known range of each tick species. *I scapularis* submissions were predominately from the northeast, *A americanum* submissions were mostly from the south, and *D variabilis* were from all regions. Tick-borne pathogens were detected in 17.1% of ticks; the most common pathogen was *Borrelia burgdorferi* found in *I scapularis*.

Patient age, sex, weight, spay/neuter status, site of tick attachment, and time spent outdoors were noted for each submission. Patients covered a wide age and weight range. Most were male and altered and spent >30% of time outdoors. Cats reported to be completely indoor also had ticks. Site of tick attachment varied by tick species, with *I scapularis* noted being predominately attached to the dorsal head and neck, *D variabilis* to the back and ears, and *A americanum* to the legs and feet, perianal area, and the abdominal, axillary, and inguinal regions.

Greater attention should be paid to tick burden in cats. Cats are susceptible to several tick-borne pathogens, including *Cytauxzoon felis* and *Anaplasma phagocytophilum*.[4] Cats also live in close association with humans and other pets and may introduce ticks into shared environments.[5] Year-round tick control should be considered for all cats, regardless of level of outdoor exposure.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Clinicians should be aware of the ticks prominent in their geographic region of practice; *I scapularis*, *A americanum*, and *D variabilis* pose the greatest risk to cats in the United States. Risk is greater during peak tick activity (ie, May to June, October to November) and in geographic regions with known tick populations.
2. The possibility of ticks being present should not be ruled out in any feline patient, as ticks can be found on any cat, including those that do not frequent the outdoors. Location of tick bite varies greatly and is influenced by tick species.
3. Tick control should be considered for all cats, even those that have limited to no outdoor exposure.

*Funding to support this research was provided by a grant from Merck Animal Health, Madison, New Jersey, US, to Oklahoma State University.

References

1. Akucewich LH, Philman K, Clark A, et al. Prevalence of ectoparasites in a population of feral cats from north central Florida during the summer. *Vet Parasitol*. 2002;109(1-2):129-139.
2. Thomas JE, Staubus L, Goolsby JL, Reichard MV. Ectoparasites of free-roaming domestic cats in the central United States. *Vet Parasitol*. 2016;228:17-22.
3. Shannon AB, Rucinsky R, Gaff HD, Brinkerhoff RJ. *Borrelia miyamotoi*, other vector-borne agents in cat blood and ticks in eastern Maryland. *Ecohealth*. 2017;14(4):816-820.
4. Nagamori Y, Reichard MV. Parasitology experts from the NCVP: feline tick-borne diseases. *Today's Veterinary Practice*. 2015;5(3):69-74.
5. Davies S, Abdullah S, Helps C, Tasker S, Newbury H, Wall R. Prevalence of ticks and tick-borne pathogens: *Babesia* and *Borrelia* species in ticks infesting cats of Great Britain. *Vet Parasitol*. 2017;244:129-135.

Research Note:
B-Tubes for Esophageal Strictures

The current standard of care for esophageal strictures is repeated mechanical dilatation, which requires multiple anesthetic events. An alternative single-stage solution (ie, esophageal stenting) has been explored but has been associated with major complications. In this prospective study, an indwelling balloon dilatation esophagostomy tube (B-tube) was designed and investigated as a way to provide more frequent stricture dilatations while avoiding the persistent dilatation of stenting. B-tubes were placed in 9 dogs and 3 cats with benign esophageal strictures. The owners performed at-home inflations twice daily for approximately 6 weeks. The tubes were relatively well tolerated and maintained dilatation while in place. Modified dysphagia scores were significantly improved at final follow-up. These findings suggest that B-tubes offer an effective economical alternative, with decreased anesthetic time as compared with traditional balloon dilatation procedures.

Source

Tan DK, Weisse C, Berent A, Lamb KE. Prospective evaluation of an indwelling esophageal balloon dilatation feeding tube for treatment of benign esophageal strictures in dogs and cats. *J Vet Intern Med*. 2018;32(2):693-700.

Research Note:
Hepadnavirus in Immunocompromised Cats

A novel hepadnavirus was discovered in lymphoma samples from an Australian domestic cat with concurrent high-grade, B-cell lymphoma and FIV. Genome sequencing and phylogenetic analysis identified the virus as belonging to the *Hepadnaviridae* family, the same family as that of the human hepatitis B virus. Presence of this virus was detected via PCR testing in whole blood samples from 6 of 60 (10%) FIV-infected cats and 2 of 63 (3.2%) cats not infected with FIV. Because this is the first report of a hepadnavirus infection in a carnivore or companion animal, further study is warranted.

Source

Aghazadeh M, Shi M, Barrs VR, et al. A novel hepadnavirus identified in an immunocompromised domestic cat in Australia. *Viruses*. 2018;10(5):269.

Helping Owners Avoid Behavior Problems in Pets

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In the Literature

Todd Z. Barriers to the adoption of humane dog training methods. *J Vet Behav*. 2018;25:28-34.

FROM THE PAGE ...

This article discusses the issues that may keep pet owners from adopting humane dog training methods. Humane dog training embraces the concept that only positive reinforcement and negative punishment techniques (ie, reward-based training) should be used. Other techniques such as positive punishment (ie, punishing an animal after a behavior has occurred in an attempt to discourage that particular behavior), use of aversive equipment (eg, choke or electric shock collars), and physical reprimands can be detrimental to efficient learning and have welfare implications on the dogs receiving them.[1] The training method used has been significantly associated with the degree of attention-seeking behavior, fear-related behavior, and aggression; these behaviors have been shown to be highest in dogs trained with positive punishment.[2]

The information available to pet owners and owner unfamiliarity with terminology often leads them to inappropriate resources. Some owners are influenced by television celebrity trainers that highlight use of aversive methods. Lack of regulation in dog training adds to this problem; trainers may advertise their use of positive reinforcement and humane methods when, in reality, the techniques being used do not fit with the standard definitions of these methods. In addition, there can be disparity among training term definitions (eg, positive punishment).

Some professional organizations, including the UK Association of Pet Dog Trainers and the Pet Professional Guild, forbid their members from using certain aversive techniques. The International Association of Animal Behavior Consultants and Association of Pet Dog Trainers have adopted the least intrusive, minimally aversive approach. The American Veterinary Society for Animal Behavior has several position statements for the public, including use of punishment and dominance theory in behavior modification of animals.

Although veterinarians are in a position to counsel owners on these issues, not all veterinary colleges offer courses in veterinary behavior. Thus, veterinarians should educate themselves and research the credentials of trainers in their area.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Veterinarians can help owners understand the benefits and risks of certain training techniques and that positive reinforcement is the most efficient and humane way to train.
2. Owners should be informed of differences between trainers and the lack of reputable information on training and education of many individuals.
3. For cases in which behavior problems are affecting the human–animal bond or putting humans or other animals at risk, clinicians should consider referring to a board-certified veterinary behaviorist or certified applied animal behaviorist.

References

1. Dreschel NA. The effects of fear and anxiety on health and lifespan in pet dogs. *Appl Anim Behav Sci*. 2010;125(3-4):157-162.
2. Blackwell EJ, Twells C, Seawright A, Casey RA. The relationship between training methods and the occurrence of behavior problems, as reported by owners, in a population of domestic dogs. *J Vet Behav*. 2008;3(5):207-217.

MAINTAINING YEAR-ROUND PATIENT & PRACTICE HEALTH

Sponsored by Merck Animal Health

In general, as the weather cools, business slows; in the last quarter of the year, practices are less likely to work at full capacity, and they typically make a significantly smaller portion of practice revenue.[1,2] Simultaneously, although patients are at year-round risk for parasitic infestations, compliance declines during cool or cold seasons, as pet owners are less likely to see the need for preventives when they perceive parasites to be scarce.[3] This so-called "off-season" can be an opportunity to reinvest the team's time into the health of patients *and* the practice to improve patient welfare and practice financial success.

The Patient Benefits of Improved Compliance

Veterinary practices develop flea and tick prevention protocols with the health of patients and their human families in mind. Fleas and ticks can act as vectors for many diseases—including bartonellosis, Rocky Mountain spotted fever, ehrlichiosis, anaplasmosis, and Lyme disease—that not only can cause significant morbidity and mortality among veterinary patients but also may be zoonotic. Although most veterinarians recommend year-round flea and tick control, purchasing data indicates that actual flea and tick prevention coverage is only 4 to 6 months out of the year.[4]

Improving owner compliance is crucial for pet health as well as the health of other family members. Selecting treatment options that are convenient to administer—and remember—can enhance compliance, improve treatment success, and decrease long-term client expenses.[5]

How to Improve Compliance with Convenience

Compliance improves when people must give or take medications less frequently; as the number of daily doses increases, compliance worsens.[6] Traditional flea and tick preventives require monthly administration. In one study, although 62% of owners recalled receiving a recommendation for year-round prevention from their veterinarian, only 13% purchased enough medication to adhere to the recommendation.[4]

Fluralaner's 12-week dosing interval‡ allows for decreased dosing frequency when compared with older generations of flea and tick preventives. Recent surveys suggest that owners find this more convenient (89%), prefer it over monthly preventives (89%), and are more likely to give the medication on time (65%), which results in fewer gaps in coverage (see **Table**).[7]

The Practice's Benefits of Improved Compliance

Optimizing preventive care compliance not only improves overall patient health but also supports the practice financially. With the right tools, any practice (large or small, in any location, in any economy) can grow.[8] Examples from an AAHA compliance report show how even a 10% improvement in compliance can contribute to this practice growth.[9] For example, a product like fluralaner, with evidence supporting that it helps drive client satisfaction as well as adherence for consistent flea and tick protection, may help healthcare teams significantly improve practice health year-round.[7]

When the practice performs well financially, there are resources available to invest in supporting team members and helping patients. An increased investment in team support can enhance team member buy-in, thus further promoting client education, patient welfare, and the economic health of the practice.

TABLE

PET OWNER FAVORABILITY: FLURALANER VS MONTHLY FLEA/TICK[7]

Characteristic	% Respondents
Overall preference to current product	89%
Convenience	89%
Timely dosing	65%

Conclusion

Optimizing compliance is not only financially favorable to the practice but also is beneficial to patient health and client loyalty. As higher compliance has been directly linked to decreased dosing frequency and ease of administration, recommending a more convenient medication has high potential for ensuring successful parasite prevention. In this season of decreased parasite control compliance, now is the perfect time to be proactive about preventive care.

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

REFERENCES

1. Barker S, Knippenberg R. When veterinary clients spend the most—and the least. *DVM360 Magazine*. http://veterinarynews.dvm360.com/when-veterinary-clients-spend-most-and-least?pageID=1. Published July 18, 2016. Accessed August 16, 2018.
2. Larkin M. Practices busier than ever, except for one time of year. *JAVMANews*. https://www.avma.org/News/JAVMANews/Pages/170315c.aspx. Published March 15, 2017. Accessed August 16, 2018.
3. Gates MC, Nolan TJ. Factors influencing heartworm, flea, and tick preventative use in patients presenting to a veterinary teaching hospital. *Prev Vet Med*. 2010;93(2-3):193-200.
4. Lavan RP, Tunceli K, Zhang D, Normile D, Armstrong R. Assessment of dog owner adherence to veterinarians' flea and tick prevention recommendations in the United States using a cross-sectional survey. *Parasit Vectors*. 2017;10:284.
5. Van Vlaenderen I, Nautrup BP, Gasper SM. Estimation of the clinical and economic consequences of non-compliance with antimicrobial treatment of canine skin infections. *Prev Vet Med*. 2011;99(2-4):201-210.
6. Claxton AJ, Cramer J, Pierce C. A systematic review of the associations between dose regimens and medication compliance. *Clin Ther*. 2001;23(8):1296-1310.
7. Lavan RP, Armstrong R, Normile D, Zhang D, Tunceli K. Results from a U.S. dog owner survey on the treatment satisfaction and preference for fluralaner against flea and tick infestations. *J Vet Sci Technol*. 2017;8:439.
8. Cavanaugh M. AAHA state of the veterinary profession. American Animal Hospital Association. https://www.aaha.org/public_documents/professional/resources/aaha_state_of_the_industry_2013_white_paper.pdf. Published October 2013. Accessed August 16, 2018.
9. *The Path to High Quality Care: Practical Tips for Improving Compliance*. Lakewood, CO: American Animal Hospital Association; 2003.

Emerging Pathogens in Canine Infectious Respiratory Disease Complex

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In the Literature

Mitchell JA, Cardwell JM, Leach H, et al. European surveillance of emerging pathogens associated with canine infectious respiratory disease. *Vet Microbiol*. 2017;212:31-38.

FROM THE PAGE ...

Canine infectious respiratory disease complex (CIRDC), a common cause of illness in dogs, is associated with a number of pathogens. Canine distemper virus, canine parainfluenza virus, canine adenovirus type 2, and *Bordetella bronchiseptica* have traditionally been associated with clinical disease related to CIRDC, but the importance of emerging pathogens is unknown.

This study* of European dogs investigated the prevalence of 4 emerging CIRDC pathogens (ie, canine respiratory coronavirus [CRCoV], canine pneumovirus [CnPnV], *Mycoplasma cynos*, influenza A [H3N8]) and their risk factors for exposure, infection, and clinical disease. Signalment data and samples from nasal swabs, oropharyngeal swabs, and serum were collected from 572 dogs from various sources (eg, shelters, households) and clinical groups (ie, clinically unaffected but exposed to acute CIRDC-affected dogs, acute and convalescent CIRDC-affected dogs).

Most study dogs (66.6%), including both pet and shelter dogs, had clinical CIRDC. Although CIRDC was noted in dogs vaccinated against CIRDC agents (ie, canine distemper virus, canine adenovirus type 2, canine parainfluenza virus), disease occurrence and severity were significantly reduced in these dogs. Overall estimated seroprevalence for CRCoV, CnPnV, and *M cynos* was high (47%, 41.7%, and 45%, respectively). Overall prevalence of CRCoV and CnPnV detected through PCR testing was 7.7% and 23.4%, respectively; presence of these pathogens was positively associated with clinical CIRDC disease and severity. *M cynos* and influenza A were infrequently detected by PCR (0.9% and 0%, respectively).

Pathogen seroprevalence and detection varied by source and country of origin. Shelter dogs were more likely to be seropositive for *M cynos* and CnPnV than were pet dogs, but prevalence was high for both shelter and pet dogs. Dogs that were seropositive for CnPnV were significantly more likely to be seropositive for CRCoV (and vice versa) and *M cynos*; this suggests frequent coinfection or cocirculation of these pathogens in dogs.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. CIRDC and associated infection from pathogens should be considered in dogs with consistent clinical signs.
2. Vaccination against CIRDC agents is important to reduce disease occurrence and severity, although owners should be warned that dogs may still develop (most commonly) mild disease.
3. The emerging pathogens CnPnV and CRCoV appear to play important roles in CIRDC in both shelter and pet dogs and should be considered when diagnosing and managing CIRDC. Pathogen testing is offered by some commercial laboratories. Clinicians should be aware of current trends in local CIRDC pathogen prevalence (eg, outbreaks, emergence), as these vary by region and should influence clinical suspicion and response.

*Sample collection and analysis for CRCoV, *M cynos*, and influenza A virus was funded by Zoetis Animal Health.

Blood Glucose Concentrations in Senior Cats

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Cats with a screening blood glucose concentration >189 mg/dL should be reassessed within 4 hours to rule out stress hyperglycemia.

In the Literature

Reeve-Johnson MK, Rand JS, Vankan D, et al. Cutpoints for screening blood glucose concentrations in healthy senior cats. *J Feline Med Surg.* 2017;19(12):1181-1191.

FROM THE PAGE ...

Similar to humans, many cats experience a period of carbohydrate intolerance before onset of fulminant diabetes mellitus (DM), termed prediabetes.[1,2] Early recognition of this stage could enable clinicians to implement preventive measures (eg, weight loss), thereby preventing development of a diabetic state. An objective of this study* was to define a screening blood glucose (BG) concentration cutoff using healthy cats of ideal BCS (BCS, 4-5/9) that could be applied to a population of overweight and obese cats to help facilitate detection of a prediabetic state.

A population of cats of ideal BCS (n = 49) was used to establish a normal screening BG concentration range with an upper reference limit of 189 mg/dL. Screening BG was defined as the patient's glucose concentration at the time of presentation and any time after eating. Samples were collected via marginal ear vein or pisiform pad stick, and BG concentration was measured using a glucometer calibrated for feline blood. When this screening BG concentration cutoff was applied to the obese cat group (BCS, 8-9/9; n = 26), no value was found to be above the reference limit, suggesting glucose intolerance was not present in this population.

The study also evaluated the impact of several factors on the screening BG concentrations obtained, including various patient characteristics (eg, age, BCS), stress exhibited during sampling, carbohydrate intake, and fasting BG concentrations (upper limit

*This study was partially funded by Abbott Animal Health, Illinois, US.

for cats with ideal BCS was found to be 116 mg/dL). None were statistically shown to alter screening BG concentration variability significantly.

In addition, the study investigated how different methods of blood collection or BG concentration analysis impacted variability of BG concentration readings. Glucometer readings differed when samples were immediately tested following an ear/pad prick as compared with jugular venipuncture. In addition, ear/pad prick glucometer readings differed from results obtained using jugular blood stored in preservative-containing collection tubes and from those of samples analyzed by an external laboratory.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. BG concentrations should be screened in senior cats presented for routine health assessment; a BG concentration >189 mg/dL is indicative of possible glucose intolerance.
2. Cats with a screening BG concentration >189 mg/dL should be reassessed within 4 hours to rule out stress hyperglycemia.
3. Persistent hyperglycemia in otherwise healthy cats may warrant determination of an 18- to 24-hour fasted BG concentration (upper reference limit, 116 mg/dL) and/or a glucose tolerance test to fully elucidate whether prediabetes is present.
4. Clinicians should adhere to a consistent BG concentration assessment methodology to minimize variability in results obtained.

References

1. Appleton DJ, Rand JS, Sunvold GD. Insulin sensitivity decreases with obesity, and lean cats with low insulin sensitivity are at greatest risk of glucose intolerance with weight gain. *J Feline Med Surg*. 2001;3(4):211-228.
2. Hoenig M. Comparative aspects of diabetes mellitus in dogs and cats. *Mol Cell Endocrinol*. 2002;197(1-2):221-229.

Positive Antinuclear Antibody & Coombs Test Results in Healthy Cats

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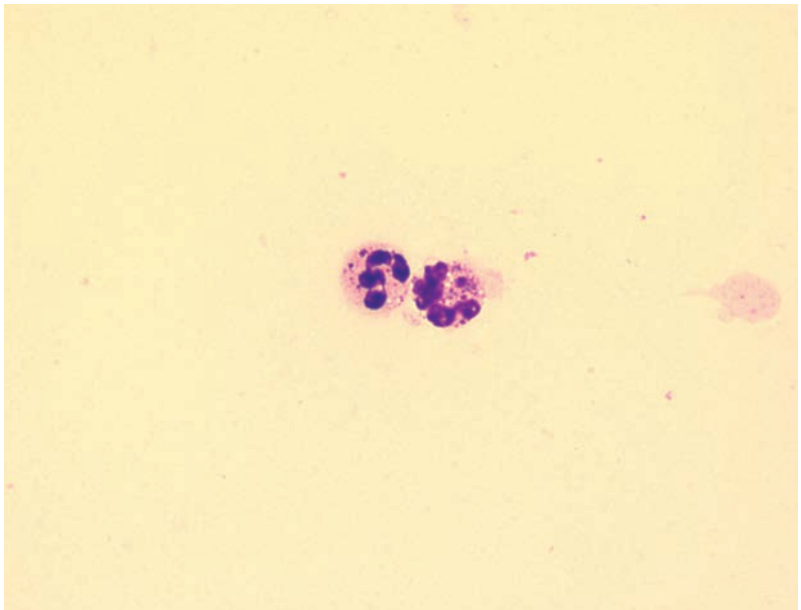
In the Literature

Abrams-Ogg ACG, Lim S, Kocmarek H, et al. Prevalence of antinuclear and anti-erythrocyte antibodies in healthy cats. *Vet Clin Pathol*. 2018;47(1):51-55.



▲ **FIGURE** Synovial fluid from a dog with systemic lupus erythematosus. The neutrophils contain many cytoplasmic inclusions. The cell is described as a ragocyte and can be identified in patients with systemic lupus erythematosus. *Wright-Giemsa stain; 100× total magnification*

FROM THE PAGE ...

Diagnosing immune-mediated diseases can be difficult in all species but can be particularly challenging in cats. Patients with systemic lupus erythematosus produce antibodies directed against molecular structures from the nucleus, cytoplasm, and cell membranes. These autoantibodies form immune complexes that can damage cells and interfere with cellular physiology. Clinical findings can include a broad range of signs (eg, fever, nonerosive arthritis, renal disease [primarily glomerular], skin lesions, CNS disorders). Fever and skin lesions are the most commonly identified clinical abnormalities in cats.

Antinuclear antibody (ANA) testing has shown that 16% to 20% of healthy dogs or dogs with other inflammatory diseases will have a positive test result.[1] The prevalence of positive results in healthy cats, however, has not been clearly established. This study sought to determine the prevalence of positive ANA test and direct antiglobulin test (DAT) results in healthy cats. Sixty-one client-owned and 28 facility-owned cats were included. Of the 61 client-owned cats, 20% had strong ANA titers

and 10% had weak ANA titers. Of the 28 facility-owned cats, only 4% had weak titers; no cats in this group had a strong titer.

The DAT, or Coombs test, is commonly used in the diagnosis of immune-mediated hemolytic anemia (IMHA). This species-specific test detects immunoglobulins and complement bound to patient RBCs. In cats, a negative DAT result has infrequently been identified in patients with IMHA, but a positive DAT result has been identified in cats with other inflammatory diseases such as pyothorax, pancreatitis, and FeLV.[2,3] The present study showed that a low percentage of all the healthy cats were DAT-positive at a low dilution (1:2). These findings illustrate that healthy cats may have positive ANA or DAT results, but the prevalence of strong reactions is low.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Although ANA testing is a good diagnostic procedure, it is not a stand-alone test. It must be incorporated with the clinical presentation of the patient, as well as with other laboratory abnormalities (eg, suppurative arthritis, thrombocytopenia, hemolytic anemia, skin lesions).[1]
2. Similar to ANA testing, the DAT is not a stand-alone test and should be interpreted as part of a panel of tests, which should include CBC, and clinical suspicion of hemolytic anemia.
3. A positive DAT result may be seen in cats with inflammatory diseases other than IMHA (eg, pyothorax, pancreatitis, FeLV).

References

1. Gershwin LJ. Antinuclear antibodies in domestic animals. *Ann N Y Acad Sci*. 2005;1050:364-370.
2. Ottenjann M, Weingart C, Arndt G, Kohn B. Characterization of the anemia of inflammatory disease in cats with abscesses, pyothorax, or fat necrosis. *J Vet Intern Med*. 2006;20(5):1143-1150.
3. Wardrop KJ. Coombs' testing and its diagnostic significance in dogs and cats. *Vet Clin North Am Small Anim Pract*. 2012;42(1):43-51.

Rabbit Neuter Techniques

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In the Literature

Duhamelle A, Tessier E, Larrat S. Comparative study of scrotal and prescrotal castration in pet rabbits (*Oryctolagus cuniculus*). *J Exotic Pet Med.* 2018;27(3):15-21.

FROM THE PAGE ...

Rabbits, one of the more commonly owned exotic pets, are routinely presented for neutering. Three surgical techniques exist (ie, scrotal, prescrotal, abdominal), but no formal comparison of these techniques has been reported.

In this prospective, randomized clinical trial, 13 rabbits were neutered by either a scrotal or prescrotal technique. The inguinal rings were not closed in either technique. Surgery and anesthesia times, postoperative scrotal edema, licking, dehiscence, and infection were all assessed. Postoperative evaluations were performed at 8, 24, 32, and 168 hours postoperation.

The prescrotal technique was associated with a shorter anesthesia time, likely due to an insignificant decrease in preparation and surgery times.

A significant increase was found in the duration of anesthesia time in the scrotal group (median, 20.6 minutes) as compared with the prescrotal group (median, 17.9 minutes), and a significantly higher degree of edema at 8, 24, and 32 hours postoperation was identified in the scrotal group. The remaining variables were not significantly different. No infections or inguinal hernias were noted. Licking with incisional dehiscence was observed in 2 rabbits in the scrotal group. The prescrotal technique was associated with a shorter anesthesia time, likely due to an insignificant decrease in preparation and surgery times, and the prescrotal group also experienced less postoperative swelling. Both groups recovered well from the procedure.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Neutering should be considered in pet rabbits, as it has been known to be well tolerated in this species.
2. The prescrotal technique for neutering rabbits is superior to the scrotal technique for decreasing both anesthetic time and postoperative swelling.
3. Although the inguinal rings were not closed in either surgical group, no hernias were noted, suggesting this complication may be rare.

Extended Use of Alfaxalone After Vial Puncture

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In the Literature

Whitehead MC, Vanetten CL, Jacob ME, Harrison TM. Microbial integrity of preservative-free alfaxalone in a multiple-use system for two storage conditions and three handling techniques. *Am J Vet Res*. 2018;79(7):704-710.

FROM THE PAGE ...

The United States Food and Drug Administration (FDA) mandates that preservative-free alfaxalone be discarded within 6 hours of vial puncture. Preservatives are commonly added to drugs to prevent bacterial contamination, which can occur when a needle punctures the vial stopper. Microbial contamination of drug vials has been identified in human cases of nosocomial morbidity and mortality.[1] The FDA mandate is designed to preserve drug integrity and support patient safety, as the greatest risk for contamination occurs in multidose vials without preservatives, but failure to use the entire vial within the allotted time can result in drug wastage and increased costs.

Because alfaxalone is approved for use until 7 days after vial puncture in Australia,[2] this study* evaluated the integrity of preservative-free alfaxalone in a multiuse system. Vials were refrigerated (at 39.2°F [4°C]) or stored at room temperature (71.6°F [22°C]). Samples were drawn by daily needle puncture through the rubber stopper of the vial or by 1 of 2 drug withdrawal systems that allowed a single puncture of the rubber stopper. Samples were incubated in soy broth ± subcultured on blood agar.

Although incidence of bacterial contamination was low, 6 of the 22 samples had bacterial growth. One isolate was identified on day 3 in a vial stored at room temperature from the repeated puncture group. The other 5 bacterial isolates were identified on day 7 or later in both refrigerated and room temperature samples. Four of the 6 isolates were from the repeated puncture group.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. It is possible to use preservative-free alfaxalone for up to 7 days, with the precaution of using specialized withdrawal equipment that allows only one puncture of the vial's rubber stopper.
2. Use of an open vial for more than 7 days is not recommended, especially if the vial has multiple punctures. Although the study authors recommended drug refrigeration, the results do not support refrigeration as a means to decrease contamination.
3. Use of preservative-free alfaxalone more than 6 hours after vial puncture should be weighed against patient safety and standard of care. Appropriate patient care could be questioned if nosocomial infection is suspected following alfaxalone administration and the FDA's 6-hour discard requirement has not been followed. Thus, the safest and most defensible option for clinicians is to use alfaxalone with a preservative, which was approved by the FDA in June 2018 and can be used up to 28 days after vial puncture.[3]

*This study was supported by Jurox Pty Ltd.

References

1. Vonberg RP, Gastmeier P. Hospital-acquired infections related to contaminated substances. *J Hosp Infect*. 2007;65(1):15-23.
2. Jurox Pty Ltd. Jurox technical notes: Alfaxan anaesthetic injection. https://www.jurox.com/sites/default/files/resources/Alfaxan-Technical-Notes.pdf. Accessed October 10, 2018.
3. The US Food and Drug Administration. Freedom of information summary NADA 141-342. https://animaldrugsatfda.fda.gov/adafda/app/search/public/document/downloadFoi/3739. Accessed October 10, 2018.

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Feline Malignant Nerve Sheath Neoplasm

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▲ **FIGURE 1** The patient demonstrating a plantigrade stance in the left pelvic limb

Socks, a 12-year-old, 14.8-lb (6.7-kg), indoor, neutered male domestic shorthair cat, was evaluated for a plantigrade stance in the left pelvic limb (***Figure 1***) of several days' duration. Socks had no other known health issues, was current on vaccinations, and had no known trauma.

Physical Examination

There was a poor withdrawal reflex of the left pelvic limb characterized by an inability to flex the stifle/tarsus, with normal flexion of the coxofemoral joint. Withdrawal reflexes in the thoracic and right pelvic limbs were normal. Patellar reflexes were normal bilaterally. Mentation, cranial nerves, and postural reactions were normal, and hyperpathia was not observed on vertebral column palpation. Abnormal gait was limited to the plantigrade stance in the left pelvic limb.

Diagnosis

CBC, serum chemistry profile, and 3-view thoracic radiographs were normal. Serology results for FeLV, FIV, coronavirus, *Toxoplasma gondii*, and *Cryptococcus neoformans* were negative. MRI of the vertebral column from L5 through the caudal vertebrae and extending through the pelvic limbs revealed enlargement and abnormal homogeneous contrast enhancement of the left sciatic nerve between the biceps femoris and semimembranosus muscles from the level of the greater trochanter distally to the level of the mid-diaphysis of the femur. There was no mass effect. Initial fascicular biopsy and histopathology of the sciatic nerve revealed degenerative changes consisting of axonal loss, adipose infiltration, and fibrosis. There was no evidence of neoplasia or inflammation. After the initial biopsy, Socks was treated palliatively with analgesics and corticosteroids. No change in neurologic function was noted. Despite the initial biopsy results, neoplasia involving the sciatic nerve was considered likely. The owner was instructed to monitor for progression of weakness or development of other neurologic deficits.

TREATMENT AT A GLANCE

Following initial biopsy

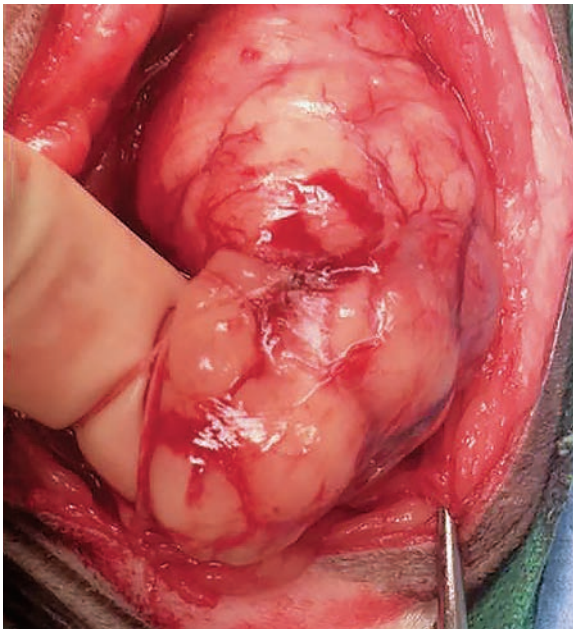
- Palliative treatment with analgesics and corticosteroids
- At-home monitoring for progression of weakness or development of neurologic deficits

28 months after initial presentation

- Palliative excisional biopsy (elected by owner)
- Postoperative analgesics, including tramadol (12.5 mg PO q12h) and transdermal fentanyl patch (12 µg/hr), antibiotics (ie, amoxicillin–clavulanic acid [62.5 mg PO q12h]), and corticosteroids (ie, prednisone [5 mg PO q12h])

46 months after initial presentation

- Palliative excisional biopsy (elected by owner)
- Adjunct corticosteroids (ie, prednisone [5 mg PO q12h]), analgesics (ie, tramadol [12.5 mg PO q12h], transdermal fentanyl patch [12 µg/hr]), and antibiotics (ie, amoxicillin–clavulanic acid [62.5 mg PO q12h])



▲ **FIGURE 2** Intraoperative photograph of the patient's left sciatic nerve mass 28 months after initial presentation. Histopathology was consistent with MNSN. Proximal is toward the top and cranial to the left of the photograph.

MNSN = malignant nerve sheath neoplasm

Twenty-eight months after initial presentation, the neurologic examination was unchanged. However, a palpable mass was present in the left caudal thigh, and there was atrophy of the muscles distal to the stifle. CBC and serum chemistry profile remained unremarkable, but thoracic radiographs revealed a left cranial lung nodule. MRI of the pelvis and left pelvic limb revealed a 3.8 × 4.6 × 7.3 cm, multilobulated, ovoid mass located in the mid-thigh between the biceps femoris and semimembranosus muscles (***Figure 2***). As compared with the adjacent muscles, the mass was hyperintense on T2-weighted images, was hyperintense on T1-weighted images, and displayed strong, homogenous contrast enhancement. The owner declined definitive therapy (ie, pelvic limb amputation, hemipelvectomy, radiation therapy, chemotherapy) for the mass and elected palliative excisional biopsy of the mass. Histopathology following excisional biopsy was consistent with a malignant nerve sheath neoplasm (MNSN; ***Figure 3***). No special stains were performed, as the pathologist was comfortable with the diagnosis of MNSN based on histopathology. Socks was treated postoperatively with analgesics (ie, tramadol [12.5 mg PO q12h], transdermal fentanyl patch [12 µg/hr]), antibiotics (ie, amoxicillin–clavulanic acid [62.5 mg PO q12h]), and corticosteroids (ie, prednisone [5 mg PO q12h]). The lung mass was not addressed further because the owner did not wish to pursue further diagnostics or treatment and the nodule was suspected to be a primary pulmonary neoplasm. Excision of the neoplasm provided analgesia, but neurologic status remained unchanged.

Forty-six months after initial presentation, examination revealed a firm, painful mass, measuring approximately 2 to 3 cm, dorsomedial to the left greater trochanter. The left plantigrade stance persisted. Socks had excessive flexion of the left coxofemoral joint during protraction and persistent poor withdrawal reflex. There was progressive atrophy and secondary contracture of the superficial and deep digital flexor and gastrocnemius muscles, resulting in hyperextension of the tarsus and flexion of digits. Left tarsal laxity and crepitus

were palpable. Thoracic radiographs revealed enlargement of the left cranial lung nodule. Radiographs of the tarsus revealed osteopenia and proximal intertarsal joint subluxation. MRI of the left pelvic limb revealed regrowth of the mass (1.7 × 2.4 × 3.1 cm) at the level of the coxofemoral joint (***Figure 4***). Histopathology following excisional biopsy confirmed MNSN.

DIAGNOSIS:

MALIGNANT NERVE SHEATH NEOPLASM

Treatment & Outcome

After diagnosis of MNSN, the owner again elected palliative excision of the recurrent painful neoplasm with adjunct corticosteroids (ie, prednisone [5 mg PO q12h]), analgesics (ie, tramadol [12.5 mg PO q12h], transdermal fentanyl patch [12 µg/hr]), and antibiotics (ie, amoxicillin–clavulanic acid

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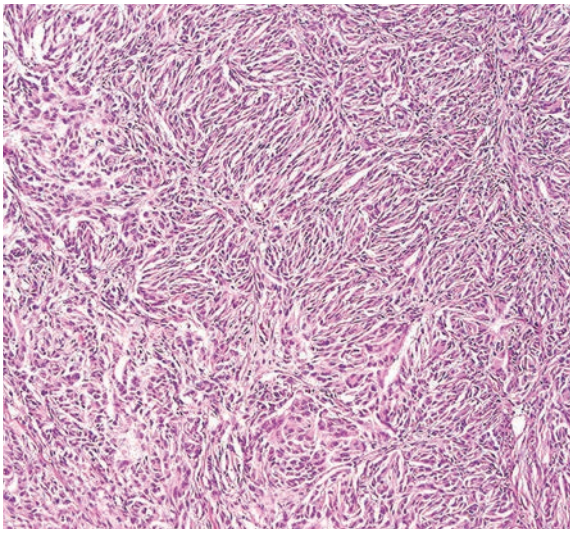
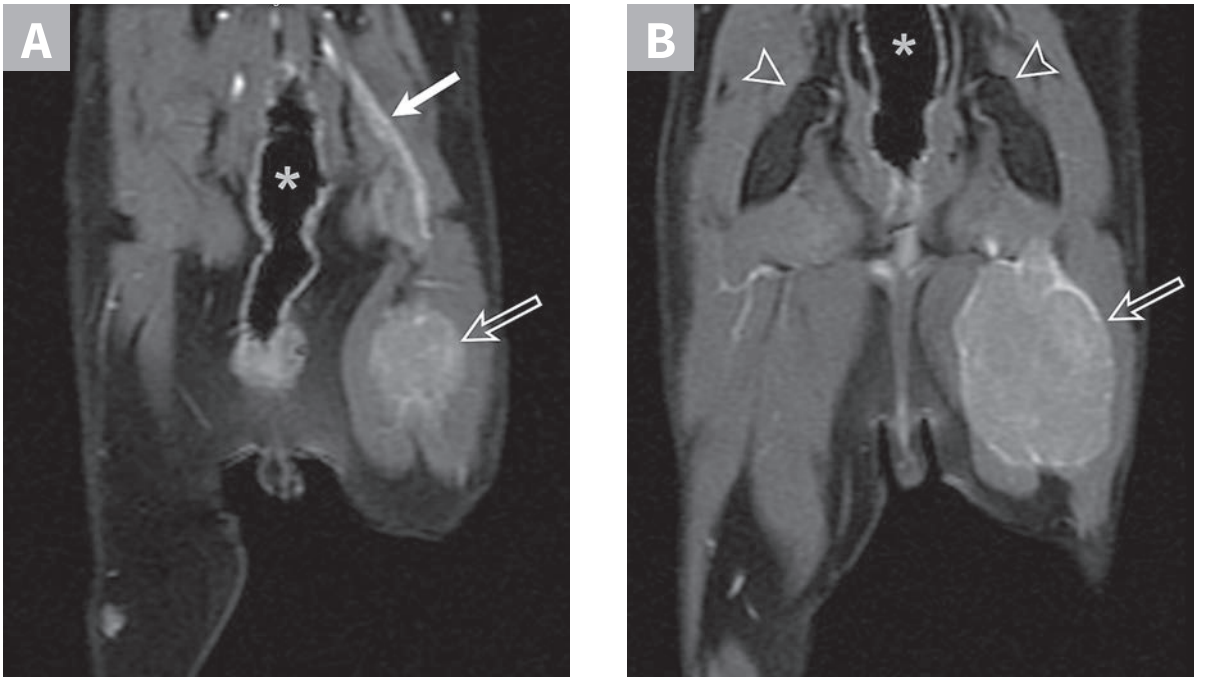


▲ **FIGURE 3** Histopathology of the mass was consistent with MNSN. A characteristic Antoni type A pattern consisting of bipolar spindle cells forming intersecting bundles, streams, and whorls can be seen. Not shown are the necrosis, atypia, and high mitotic rate that were noted in the patient and led to diagnosis of MNSN.



▲ **FIGURE 4** Repeat MRI 46 months after initial presentation revealed regrowth of the left sciatic nerve mass. Dorsal plane MRI T1-weighted images (inversion prepared following fast spoiled gradient echo) obtained after intravenous contrast medium administration. ***Figure 4A*** is dorsal to the pelvis. The contrast-enhancing enlarged sciatic nerve (***solid arrow***) that courses to a large mass (***open arrow***), in addition to the visible colon on the midline (***asterisk***), can be noted. ***Figure 4B*** is at the level of the coxofemoral joints (***open arrowheads***). A large, uniformly contrast-enhancing mass can be observed in the mid-thigh (***open arrow***). The colon is visible (***asterisk***).

[62.5 mg PO q12h]). Six months postoperatively, Socks appeared comfortable with static neurologic examination.

Discussion

Plantigrade posture is associated with multiple neurologic and musculoskeletal causes,[1] including:

- Tibial nerve dysfunction with denervation of the tarsal extensor muscles (ie, gastrocnemius, superficial digital flexor). Endocrine-related neuropathies can affect the tibial nerve. In cats, diabetes mellitus can cause bilateral tibial nerve paresis/paralysis. In dogs, hypothyroidism may affect the tibial nerves. Resolution of tibial nerve paresis/paralysis may occur with treatment of the underlying endocrinopathy.
- Partial or complete disruption of the common calcanean tendon. With disruption of the origin of the gastrocnemius muscle, the gastrocnemius muscle itself, or its tendon of insertion, the tarsus overflexes (ie, plantigrade stance) with weightbearing, and there is flexion of the digits. With tarsal flexion, the digits flex due to tension placed on the intact superficial digital flexor tendon as it courses along the caudal surface of the tarsus. In cases involving complete rupture of the calcanean tendon, plantigrade stance will be more complete and the digits normal.
- Fracture of the calcaneus bone or tarsal luxation
- Disruption of the long plantar ligament, originating at the plantar surface of the calcaneus, passing distally across the 4th tarsal bone, and attaching to the base of the 4th and 5th metatarsals

Differentials for a sciatic nerve tumor include primary neoplasms of nerves, which occur relatively infrequently in dogs and are rare in cats.[2] Lymphoma is the most common secondary tumor involving nerves.[2] Nerve tumors may arise from Schwann cells, perineurial cells, and intraneural fibroblasts and include schwannomas or nerve sheath tumors, neurofibromas, and MNSNs.[2,3]

Histologic features vary widely. Immunohistochemical stains may help in the diagnosis of schwannomas but were not used in this case.[3] Diffuse, strong immunoreactivity against S-100 protein is seen in schwannomas, whereas neurofibromas demonstrate inconsistent immunoreactivity against S-100.[3] MNSNs tend to have mitotic indices of at least 4, and necrosis is often present.[3]

Nerve sheath neoplasms typically progress slowly over weeks to months.[2] MNSNs are often treated with surgical excision via limb amputation when the neoplasm involves a named nerve of the limb. Despite gross cytoreductive surgery, there is a high risk of recurrence.[3] Although rare, pulmonary and regional lymph node metastasis have been reported in a cat.[4] Median survival times for cats with integumentary nerve sheath tumors with surgery alone has been noted at 645 days.[5] The role of postoperative radiation therapy or chemotherapy has not been defined, but they are likely to provide beneficial effects.

MNSN = malignant nerve sheath neoplasm

References

1. de Lahunta A, Glass EN, Kent M. Lower motor neuron: spinal nerve, general somatic efferent system. In: de Lahunta A, Glass EN, Kent M. *Veterinary Neuroanatomy and Clinical Neurology*. 4th ed. St. Louis, MO: Elsevier Saunders; 2015:102-161.
2. Withrow SJ, Vail DM, Page RL. Tumors of the nervous system. In: Withrow SJ, Vail DM, Page RL. *Withrow & MacEwen's Small Animal Clinical Oncology*. 5th ed. St. Louis, MO: Elsevier Saunders; 2013: 583-596.
3. Schulman FY, Johnson TO, Facemire PR, Fanburg-Smith JC. Feline peripheral nerve sheath tumors: histologic, immunohistochemical, and clinicopathologic correlation (59 tumors in 53 cats). *Vet Pathol*. 2009;46(6):1166-1180.
4. Buza EL, Menzies RA, Goldschmidt MH, Durham AC. Malignant peripheral nerve sheath tumor in a cat with nodal and pulmonary metastases. *J Vet Diagn Invest*. 2012;24(4):781-784.
5. Dillon CJ, Mauldin GN, Baer KE. Outcome following surgical removal of nonvisceral soft tissue sarcomas in cats: 42 cases (1992-2000). *J Am Vet Med Assoc*. 2005;227(12):1955-1957.

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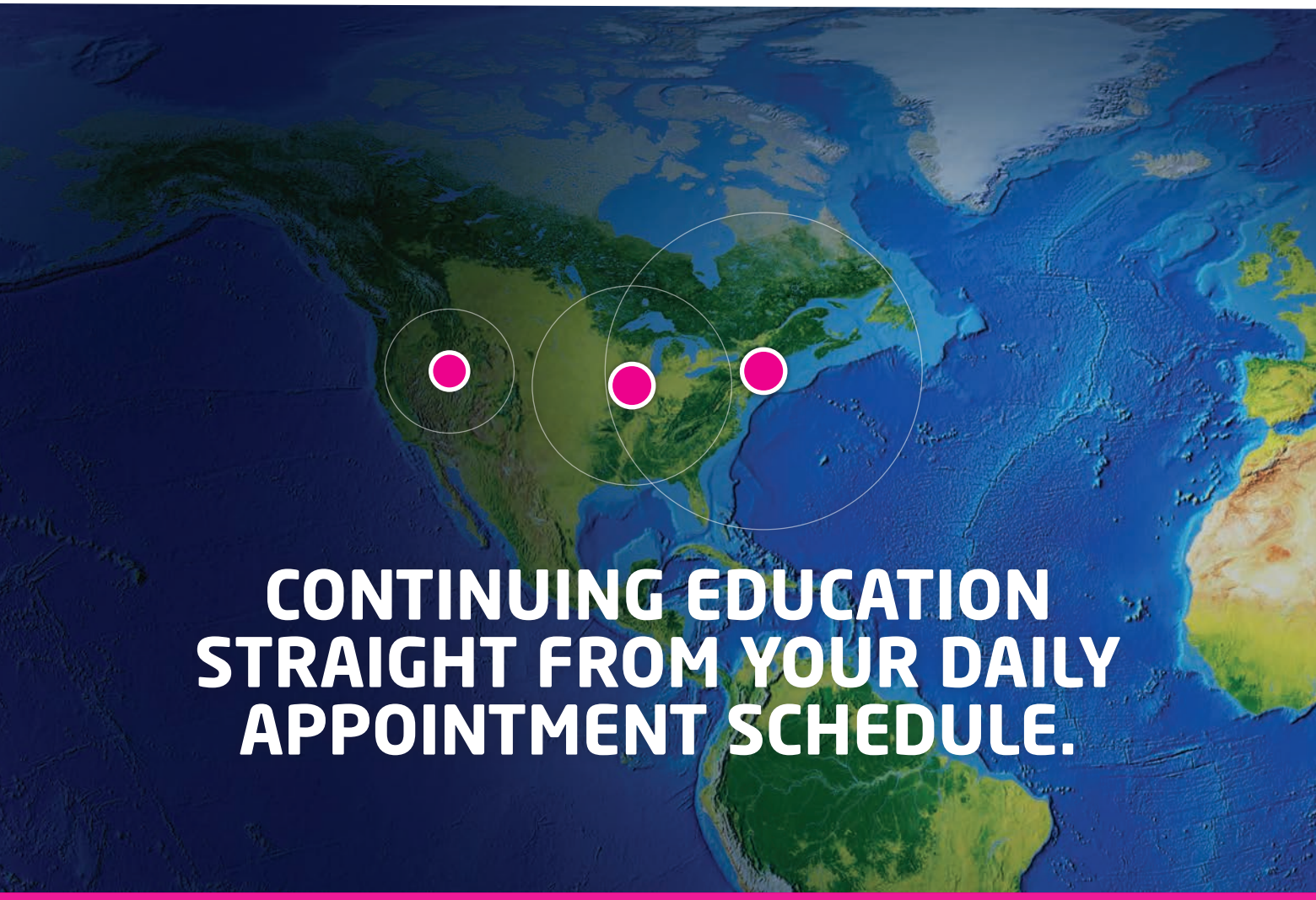

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Acute Urethral Obstruction in a Cat

Marcella D. Ridgway, VMD, MS, DACVIM (SAIM)
University of Illinois

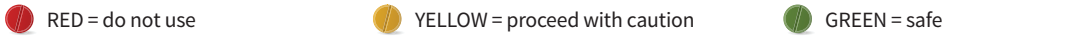
A 3-year-old neutered male domestic shorthair cat was presented after 2 days of pollakiuria and hematuria; 2 hours of vocalization, stranguria, and dribbling urine; and a single episode of vomiting. Examination revealed 7% dehydration, tachycardia, and a firm, distended bladder; the remainder of the physical examination was within normal limits. CBC, serum chemistry profile, and urinalysis were unremarkable other than 4+ blood and presence of RBCs (TNTC) in the urine. Findings on abdominal ultrasonography likewise were unremarkable, with no evidence of calculi in the urinary tract.

The cat was treated with IV fluids, decompressive cystocentesis, and removal of an obstructive distal urethral mucus plug. An indwelling urinary catheter was maintained for 24 hours, then removed.

TNTC = too numerous to count

Which of the following drugs would be appropriate for this patient?

Based on the information provided, how would you grade the following drugs and why?



Buprenorphine	RED	YELLOW	GREEN
Meloxicam	RED	YELLOW	GREEN
Prednisolone, dexamethasone	RED	YELLOW	GREEN
Amoxicillin–clavulanate	RED	YELLOW	GREEN
Prazosin	RED	YELLOW	GREEN
Phenoxybenzamine	RED	YELLOW	GREEN
Acepromazine	RED	YELLOW	GREEN
Phenylpropanolamine	RED	YELLOW	GREEN
Maropitant	RED	YELLOW	GREEN
Amitriptyline	RED	YELLOW	GREEN

TURN THE PAGE TO COMPARE YOUR RESULTS

Did you answer?

The following represents the best responses based on drug metabolism, pharmacokinetics, species, diagnostic differentials, clinical and laboratory data, and other pertinent findings.

Buprenorphine

CORRECT RESPONSE 

Feline lower urinary tract signs are painful and most commonly associated with feline idiopathic cystitis (FIC). They are considered best managed by opioids in the acute phases of disease. Of the opioids, buprenorphine has the benefit of multiple routes of administration, including sublingual and subcutaneous, and is suitable for at-home use. Alternative analgesics have some disadvantages; for example, the sedative butorphanol has limited analgesic activity, and fentanyl is linked to respiratory depression, bradycardia, and urinary retention and requires more intensive patient monitoring than does buprenorphine.

Meloxicam

CORRECT RESPONSE 

Multiple studies have failed to show a benefit of meloxicam treatment for the clinical course of FIC (eg, pain, duration) or for recurrence of urethral obstruction.[1,2] Although renal injury is not apparent in this patient, NSAID use is contraindicated in patients with potential renal injury secondary to urinary outflow obstruction.

Prednisolone, dexamethasone

CORRECT RESPONSE 

Anti-inflammatory doses of prednisolone or dexamethasone have been shown to have no positive effect on the clinical course of idiopathic feline lower urinary tract disease (FLUTD) or FIC.

Amoxicillin–clavulanate

CORRECT RESPONSE 

Empiric use of antibiotics is not warranted in cats with urinary obstruction. Bacterial UTI is uncommon in cats presented with FLUTD, FIC, or urethral obstruction, especially those between 1 and 10 years of age,[3-5] and antibiotic administration does not prevent catheter-related UTI. Antibiotics should not be administered to these cats unless bacterial infection is documented by urine culture. If lower urinary tract signs recur post-catheterization, obtaining a urine sample for culture at a return visit 3 to 4 days later is recommended to determine whether bacterial infection was introduced as a consequence of catheterization.

Prazosin

CORRECT RESPONSE 

α_1-adrenergic blockers (ie, α_1 antagonists), which can cause urethral muscle relaxation, are often used in cats with urethral obstruction because of the potential contribution of urethral spasm (ie, functional obstruction) to initial or recurrent urethral blockage. Prazosin is the antispasmodic of choice because of its rapid onset of action and demonstrated superiority to phenoxybenzamine in impacting patient outcomes[2] and less sedative effect as compared with acepromazine. Although urethral relaxants may appear to benefit individual patients, controlled studies have not shown a positive impact for their use in cats with FLUTD or FIC, possibly because only the preprostatic and prostatic urethra are affected by smooth muscle relaxants. Hypotension is a potential adverse effect of all α_1-adrenergic blockers used as urethral relaxants; these drugs should not be used in cats with hypovolemia or other conditions associated with pre-existing hypotension.

Phenoxybenzamine

CORRECT RESPONSE 

Although phenoxybenzamine is commonly administered as a urethral relaxant in cats with urethral obstruction, this drug is less effective in reducing proximal urethral pressure than is prazosin or acepromazine and may require up to a week to show pharmacologic effect. In addition, cats with urethral obstruction treated with phenoxybenzamine were shown to have a significantly higher rate of recurrence of urethral obstruction as compared with cats treated with prazosin.[2] As with prazosin, hypotension is a potential adverse effect, and thus phenoxybenzamine should not be used in cats with hypovolemia or other conditions associated with pre-existing hypotension.

Acepromazine

CORRECT RESPONSE 

Acepromazine is effective in lowering proximal urethral pressures, but sedation is a common side effect. Because of its α_1-adrenergic blocking effects, acepromazine can cause significant hypotension and thus should be avoided in hypovolemic patients.

Phenylpropanolamine

CORRECT RESPONSE 

Phenylpropanolamine is a sympathomimetic drug used to treat urethral sphincter mechanism incompetence secondary to urethral sphincter hypotonia in dogs and cats. However, use of an agent that increases urethral sphincter tone is contraindicated in patients with urethral obstruction. The urine dribbling in this cat is likely related to small amounts of urine escaping past the urethral obstruction rather than from urethral sphincter hypotonus.

Maropitant

CORRECT RESPONSE 

Antiemetic therapy is not indicated in this patient, as vomiting was most likely the result of urinary bladder distension and pain triggering peripheral afferent pathways to the emetic center. This triggering condition can be resolved by bladder decompression and pain management. In addition, a single episode of vomiting often does not warrant pharmacologic intervention. In a minority of cats with obstructive FLUTD or FIC, antiemetic therapy may be needed if they suffer severe metabolic consequences (eg, acute renal injury, acid-base and electrolyte derangements) of urinary obstruction and subsequent ongoing emesis. In addition to its antiemetic effect, maropitant may provide a visceral analgesic effect[6-8]; however, its use as an analgesic in cats with lower urinary tract disease or urinary obstruction has not been evaluated.

FIC = feline idiopathic cystitis
FLUTD = feline lower urinary tract disease

Amitriptyline

CORRECT RESPONSE 

Stress is thought to contribute to the development of FIC.[9-11] Amitriptyline, a tricyclic antidepressant that has both anxiolytic and analgesic action, may be beneficial in managing patients with severe or recurrent disease. Side effects include sedation, salivation, urine retention, thrombocytopenia, and neutropenia. Although there is insufficient evidence to support use of amitriptyline as a short-term medication, long-term use of this drug may be considered if or when other evidence-based methods of control—which include moist diet, veterinary therapeutic urinary diet, and multimodal environmental modification or environmental enrichment[11]—have not delivered a desired response.

References

1. Dorsch R, Zellner F, Schulz B, Sauter-Louis C, Hartmann K. Evaluation of meloxicam for the treatment of obstructive feline idiopathic cystitis. *J Feline Med Surg*. 2016;18(11):925-933.
2. Hetrick PF, Davidow EB. Initial treatment factors associated with feline urethral obstruction recurrence rate: 192 cases (2004-2010). *J Am Vet Med Assoc*. 2013;243(4):512-519.
3. Cooper ES. Controversies in the management of feline urethral obstruction. *J Vet Emerg Crit Care (San Antonio)*. 2015;25(1):130-137.
4. Cooper ES, Lasley E, Daniels J, et al. Incidence of urinary tract infection at presentation and after urinary catheterization in feline urethral obstruction. *J Vet Emerg Crit Care (San Antonio)*. 2013;23(S1):S13.
5. Lund HS, Skogtun G, Sørum H, Eggertsdóttir AV. Absence of bacterial DNA in culture-negative urine from cats with and without lower urinary tract disease. *J Feline Med Surg*. 2015;17(10):909-914.
6. Ruggieri MR, Filer-Maerten S, Hieble JP, Hay DW. Role of neurokinin receptors in the behavioral effect of intravesicular antigen infusion in guinea pig bladder. *J Urol*. 2000;164(1):197-202.
7. Niyom S, Boscan P, Twedt DC, Monnet E, Eickhoff JC. Effect of maropitant, a neurokinin-1 receptor antagonist, on the minimum alveolar concentration of sevoflurane during stimulation of the ovarian ligament in cats. *Vet Anaesth Analg*. 2013;40(4):425-431.
8. Marquez M, Boscan P, Weir H, Vogel P, Twedt DC. Comparison of NK-1 receptor antagonist (maropitant) to morphine as a pre-anaesthetic agent for canine ovariohysterectomy. *PLoS One*. 2015;10(10):e0140734.
9. Westropp JL, Kass PH, Buffington CA. Evaluation of the effects of stress in cats with idiopathic cystitis. *Am J Vet Res*. 2006;67(4):731-736.
10. Buffington CA. Idiopathic cystitis in domestic cats—beyond the lower urinary tract. *J Vet Intern Med*. 2011;25(4):784-796.
11. Forrester SD, Towell TL. Feline idiopathic cystitis. *Vet Clin North Am Small Anim Pract*. 2015;45(4):783-806.

FIC = feline idiopathic cystitis

TOP 5 ▸ CONTINUED FROM PAGE 30

References

1. Arlt SP, Heuwieser W. Evidence-based medicine in animal reproduction. *Reprod Domest Anim*. 2014;49:11-15.
2. Cockroft PD. Clinical reasoning and decision analysis. *Vet Clin North Am Small Anim Pract*. 2007;37(3):499-520.
3. EBVM Network. EBVM learning. http://www.ebvmlearning.org. Accessed October 8, 2018.
4. Kasch C, Haimerl P, Heuwieser W, Arlt S. Evaluation of a CAT database and expert appraisal of CATs developed by students. *J Vet Med Educ*. 2017;44(4):676-685.
5. Arlt SP, Heuwieser W. The staircase of evidence – a new metaphor displaying the core principles of evidence-based veterinary medicine. *Vet Evidence*. 2016;1(1): doi: 10.18849/ve.v1i1.18.g28
6. Dean R. How to read a paper and appraise the evidence. *In Pract*. 2013;35(5):282-285.
7. Arlt SP, Heuwieser W. Training students to appraise the quality of scientific literature. *J Vet Med Educ*. 2011;38(2):135-140.
8. Holmes MA. Evidence for best veterinary practice: clinical veterinary research. *J Vet Intern Med*. 2007;21(4):671-672.

Suggested Reading

Cockcroft PD, Holmes MA. *Handbook of Evidence-Based Veterinary Medicine*. Oxford, UK: Blackwell Publishing; 2008.

Evidence-Based Veterinary Medicine Association. EBVMA website. http://ebvma.org. Accessed October 11, 2018.

RCVS Knowledge. Veterinary evidence website. https://veterinaryevidence.org. Accessed October 8, 2018.

University of Nottingham. BestBETs for Vets website. https://bestbetsforvets.org. Accessed October 8, 2018.

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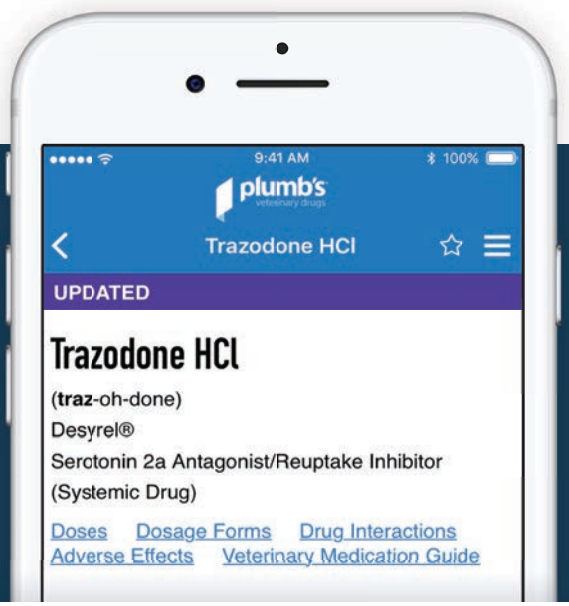

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Removal of Canine Benign Cutaneous Growths with a Flexible Hollow Waveguide CO_2 Laser

By David D. Duclos
DVM, Dipl. ACVD
Animall Skin and Allergy Clinic - Lynnwood, WA

CO_2 laser surgery

This article describes two cases of removal of benign cutaneous growths — nodular sebaceous gland hyperplasia and histiocytoma — with a CO_2 laser.

In my clinic, I use the flexible hollow waveguide fiber CO_2 laser to surgically remove soft tissue growths. This technology allows ablating tumors quickly, providing control over intraoperative bleeding. Another benefit of laser surgery is that there is no need to close the surgical site in case of superficial cutaneous lesions. Moreover, the laser allows treating multiple lesions during a single visit.

Laser Equipment: VetScalpel®, a 45-watt continuous wave (CW)/30-watt SuperPulse (SP) flexible hollow waveguide CO_2 laser with a tipless adjustable spot size handpiece set to 0.8 mm focal spot size (by Aesculight®, Bothell, Wash.)

Initial laser settings (higher power) for both nodular sebaceous gland hyperplasia removal and histiocytoma removal: 12 W, SP, repeat mode, 29 Hz; the laser pulse ontime is 25 msec and 8.7 W of average power is delivered to the target tissue.

Procedure 1: Nodular sebaceous gland hyperplasia removal

Patient: Bella, a 4-year-old female, spayed pit bull terrier dog mix, was brought in with a small round scaly bump on the left hind leg (Figure 1A). The bump was diagnosed as a focal nodular sebaceous gland hyperplasia. The owners requested its removal. **Anesthesia:** The surgery was performed under local anesthesia.

Technique

More power is typically required to ablate sebaceous gland hyperplasia at first. The mass was ablated in quick overlapping strokes with the laser beam directed perpendicular to the target tissue (Figure 1B). Between laser passes, the surgical site was wiped with a salinesoaked gauze pad and examined. Insignificant bleeding encountered after the first laser pass was stopped by defocusing the laser beam (this was achieved by increasing the distance between the nozzle and the target tissue). The pulse duration was decreased to 20 msec and average laser power was reduced to 4 W; several more laser passes were performed to clean up the deep part of the lesion. The laser pulse duration was now shortened to 15 msec and the average power was decreased to 3 W. Another laser pass was made and the site was blotted with a saline gauze pad to ensure the complete removal of sebaceous tissue. With the final pass, a protective layer of coagulated tissue was created. The resulting tissue defect was left to heal by secondary intention (Figure 1C). No postoperative care was prescribed.

Procedure 2: Removal of histiocytoma

Patient: Tucker, a 5-year-old male, neutered boxer dog,was brought in with a solitary, 0.5 cm in diameter, buttonshaped, elevated lump located close to the edge of the left pinna (Figure 2A). The tumor was alopecic and pink. The owners brought the dog to the clinic alarmed by the tumor's rapid growth. Diagnosis of histiocytoma was made and it was decided to remove the tumor with the CO_2 laser. **Anesthesia:** The procedure was performed under general anesthesia.

Technique

After the tumor surface was initially ablated at the highest power setting, the surgical site was gently blotted with saline soaked gauze. The average power was then decreased to 1.6 W and another laser pass was made (Figure 2B). The site was blotted and the power was then reduced again to 0.8 W. The rest of the tumor was ablated in overlapping sweeping strokes. After each laser pass the surgical site was wiped with saline soaked gauze; but after the final pass, the surgical wound was not wiped (Figure 2C shows immediately postoperative appearance of the surgical site). No sutures were needed.

Conclusion

Soft tissue growths were easily ablated with the VetScalpel CO_2 laser. The procedures were quick, and the surgical defects were left to heal by secondary intention. Due to its ability to coagulate small blood vessels (less than 0.5 mm in diameter), the laser provided efficient hemostasis throughout the procedures, which ensured good visibility and precise tissue removal with excellent cosmetic outcome. Moreover, the laser allowed for fine adjustments in power and pulsing settings during the surgeries with a simple push of a button on the touch screen. The great control afforded by the VetScalpel CO_2 laser enables the surgeon to remove target tissue, while avoiding unnecessary damage to healthy adjacent structures.

FIGURE 1A. Nodular sebaceous gland hyperplasia — preoperative view

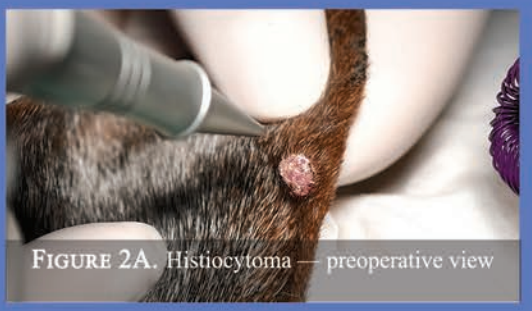

FIGURE 2A. Histiocytoma — preoperative view

FIGURE 1B. Initial ablation of the lesion with the CO_2 laser

FIGURE 2B. Intraoperative view of histiocytoma tumor ablation

FIGURE 1C. Immediately postoperative view

FIGURE 2C. Immediately postoperative appearance

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About Dr. Duclos:

Dr. Duclos is a small-animal practitioner in Lynnwood,WA. He completed his residency in veterinary dermatology at the University of Pennsylvania. He is an associate clinical instructor for the Western University College of Veterinary Medicine in Pomona, CA, and teaches senior veterinary students as externs at his clinic. Dr. Duclos is well known in the veterinary dermatology specialty for his expertise in CO_2 laser surgery and for his interest in clinical photography.

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PRACTICE MARKETPLACE

QUIZ CORNER

QUIZ YOURSELF

on this issue's features

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1 **CASE IN POINT** PAGE 18

Using the Glasgow Composite Measure Pain Scale, a score equal to or higher than ___ out of 20 is the recommended cutoff score for analgesic intervention.

A. 5
B. 7
C. 10
D. 12

2 **TOP 5** PAGE 26

The PICO approach is a practical way to formulate a question that addresses all aspects of a clinical case. What does the "O" stand for in PICO?

A. Objective
B. Outcome
C. Onus
D. Overall design

3 **Rx SOLUTIONS** PAGE 33

The only FDA-approved drug for the treatment of canine cognitive dysfunction syndrome is _____.

A. Lorazepam
B. Selegiline
C. γ-aminobutyric acid
D. S-adenosyl-L-methionine tosylate

4 **CASE IN POINT** PAGE 57

How quickly do nerve sheath neoplasms typically progress?

A. Rapidly (over 2-4 weeks)
B. Moderately quickly (over 6-8 weeks)
C. Slowly (over weeks to months)
D. Nerve sheath neoplasms do not tend to progress.

5 **RED LIGHT, GREEN LIGHT** PAGE 62

Which of the following would be the preferred drug to use for urethral muscle relaxation in a cat presented with lower urinary tract obstruction?

A. Acepromazine
B. Phenoxybenzamine
C. Phenylpropanolamine
D. Prazosin

Answer Key:
1: A 2: B 3: B 4: C 5: D

POLLING PLACE

WE ASKED ...

What management techniques do you recommend to owners of pets with cognitive dysfunction? (Check all that apply)

YOU ANSWERED ...

A. Environmental enrichment 23%
B. Regular exercise 20%
C. Medication 16%
D. Dietary change 18%
E. Nutritional supplements 23%

THIS MONTH'S QUESTION ...

What do you recommend when a dog is presented with a fractured tooth or teeth?

A. If the patient exhibits no clinical signs, I advise the owner to watch for signs of pain and/or infection.
B. Radiography of the affected tooth or teeth
C. Restoration of the affected tooth or teeth
D. Extraction of the affected tooth or teeth

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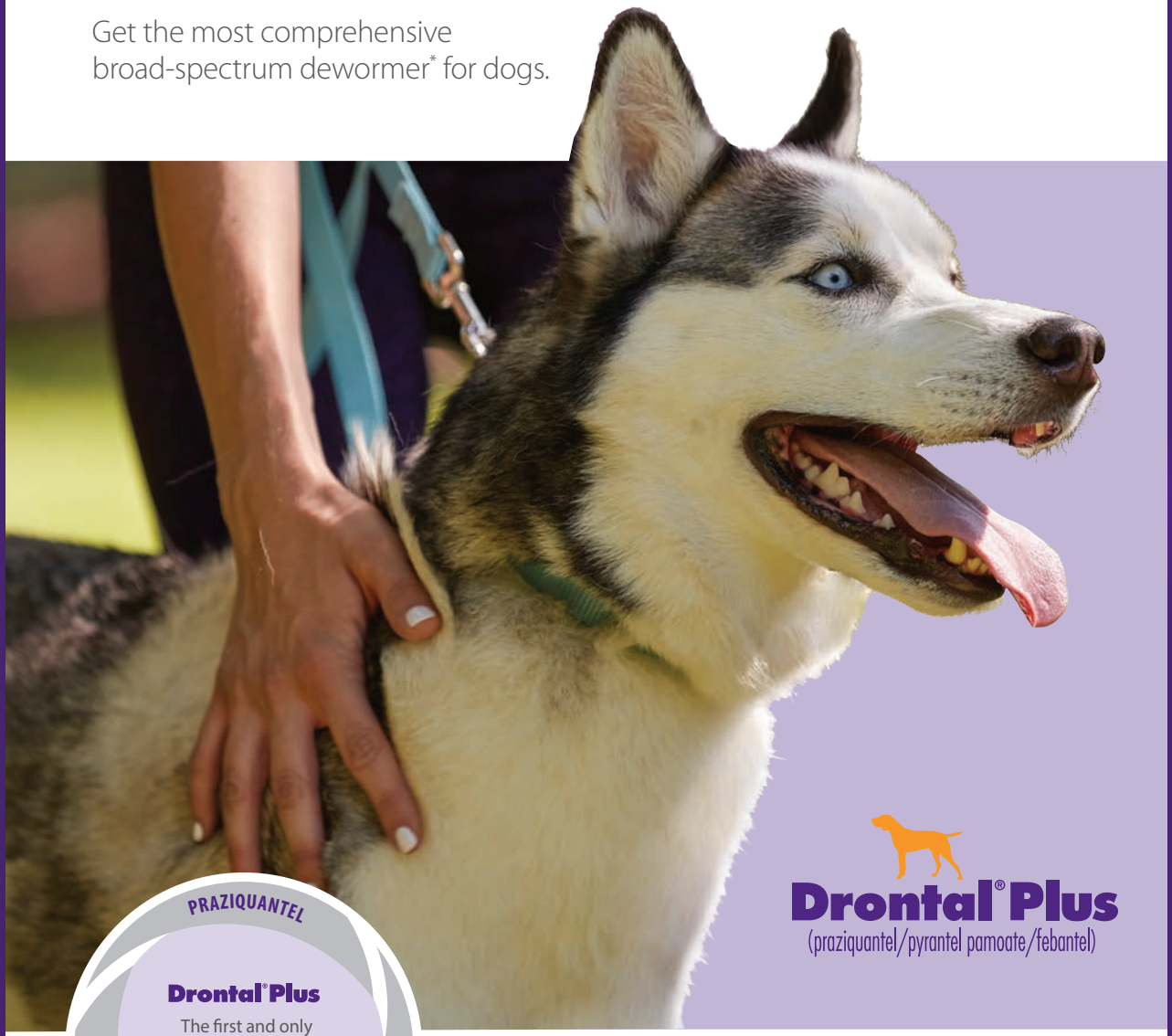

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