August 2019

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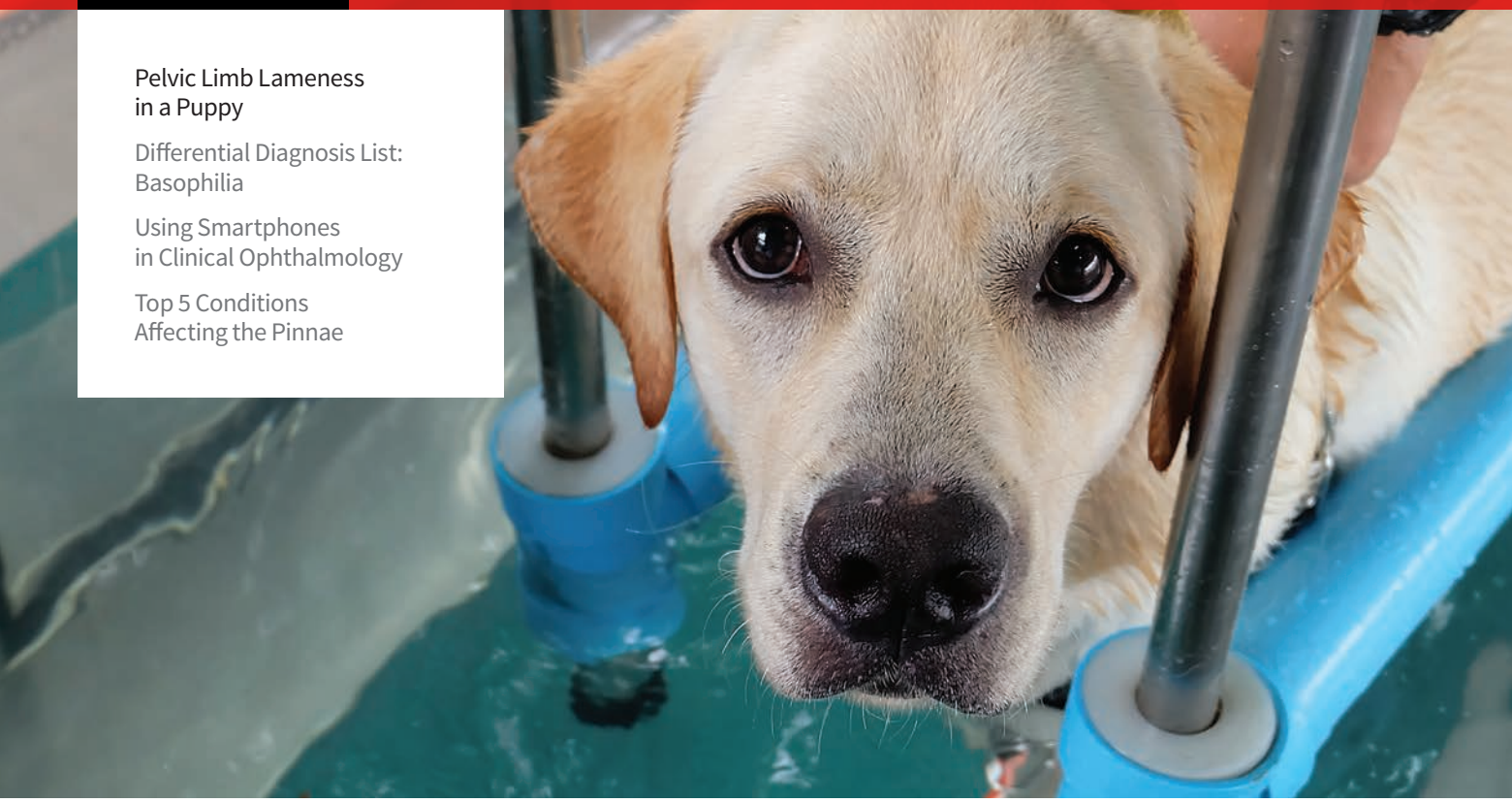
TOP 5 POSTOPERATIVE ORTHOPEDIC REHABILITATION CONSIDERATIONS

IN THIS ISSUE



Volume 17 Number 8

WSAVA Global Veterinary Community

clinician's brief

THE OFFICIAL CLINICAL PRACTICE JOURNAL OF THE WSAVA

CANADIAN VETERINARY MEDICAL ASSOCIATION

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Fleas | Ticks

Credelio® (lotilaner)

ENDOPARASITES

Tapeworms | Heartworm | Intestinal Parasites

INTERCEPTOR® PLUS (milbemycin oxime/praziquantel)

Clients can save big when they purchase both Credelio and Interceptor Plus, and we support your clinic with the useful tools you need. See back cover to learn more.

Indications

Credelio kills adult fleas and is indicated for the treatment of flea infestations (*Ctenocephalides felis*) and the treatment and control of tick infestations [*Amblyomma americanum* (lone star tick), *Dermacentor variabilis* (American dog tick), *Ixodes scapularis* (black-legged tick) and *Rhipicephalus sanguineus* (brown dog tick)] for one month in dogs and puppies 8 weeks of age and older, and weighing 4.4 pounds or greater.

Important Safety Information

The safe use of Credelio in breeding, pregnant or lactating dogs has not been evaluated. Use with caution in dogs with a history of seizures. The most frequently reported adverse reactions are weight loss, elevated blood urea nitrogen, excessive urination, and diarrhea. Please see brief summary on side back cover for full prescribing information.

Indications

Interceptor Plus is indicated for the prevention of heartworm disease caused by *Dirofilaria immitis*, and for the treatment and control of adult roundworm (*Toxocara canis, Toxascaris leonina*), adult hookworm (*Ancylostoma caninum*), adult whipworm (*Trichuris vulpis*), and adult tapeworm (*Taenia pisiformis, Echinococcus multilocularis, Echinococcus granulosus,* and *Dipylidium caninum*) infections in dogs and puppies two pounds of body weight or greater and six weeks of age and older.

Important Safety Information

Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention. Prior to administration of Interceptor Plus, dogs should be tested for existing heartworm infections. The safety of Interceptor Plus has not been evaluated in dogs used for breeding or in lactating females. The following adverse reactions have been reported in dogs after administration of milbemycin oxime or praziquantel: vomiting, diarrhea, depression/lethargy, ataxia, anorexia, convulsions, weakness, and salivation. Please see brief summary on side back cover for full prescribing information.

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

Before using Credelio, please consult the product insert, a summary of which follows:

Indications:
CREDELIO kills adult fleas and is indicated for the treatment of flea infestations (*Ctenocephalides felis*) and the treatment and control of tick infestations [*Amblyomma americanum* (lone star tick), *Dermacentor variabilis* (American dog tick), *Ixodes scapularis* (black-legged tick) and *Rhipicephalus sanguineus* (brown dog tick)] for one month in dogs and puppies 8 weeks of age and older, and weighing 4.4 pounds or greater.

Dosage and Administration:
CREDELIO is given orally once a month, at the minimum dosage of 9 mg/lb (20 mg/kg). See product insert for complete dosing and administration information.

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

Warnings:
Not for human use. Keep this and all drugs out of the reach of children.

Precautions:
The safe use of CREDELIO in breeding, pregnant or lactating dogs has not been evaluated. Use with caution in dogs with a history of seizures (see **Adverse Reactions**).

Adverse Reactions:
In a well-controlled U.S. field study, which included 284 dogs (198 dogs treated with CREDELIO and 86 dogs treated with an oral active control), there were no serious adverse reactions.

Over the 90-day study period, all observations of potential adverse reactions were recorded. Reactions that occurred at an incidence of 1% or greater are presented in the following table.

Dogs with Adverse Reactions in the Field Study

Adverse Reaction (AR)	CREDELIO Group: Number (and Percent) of Dogs with the AR (n=198)	Active Control Group: Number (and Percent) of Dogs with the AR (n=86)
Weight Loss	3 (1.5%)	2 (2.3%)
Elevated Blood Urea Nitrogen (BUN)	2 (1.0%)*	0 (0.0%)
Polyuria	2 (1.0%)*	0 (0.0%)
Diarrhea	2 (1.0%)	2 (2.3%)

*Two geriatric dogs developed mildly elevated BUN (34 to 54 mg/dL; reference range: 6 to 31 mg/dL) during the study. One of these dogs also developed polyuria and a mildly elevated potassium (6.5 mEq/L; reference range: 3.6 to 5.5 mEq/L) and phosphorous (6.4 mg/dL; reference range: 2.5 to 6.0 mg/dL). The other dog also developed a mildly elevated creatinine (1.7 to 2.0 mg/dL; reference range: 0.5 to 1.6 mg/dL) and weight loss.

In addition, one dog experienced intermittent head tremors within 1.5 hours of administration of vaccines, an ear cleaning performed by the owner, and its first dose of CREDELIO. The head tremors resolved within 24 hours without treatment. The owner elected to withdraw the dog from the study.

In an Australian field study, one dog with a history of seizures experienced seizure activity (tremors and glazed eyes) six days after receiving CREDELIO. The dog recovered without treatment and completed the study. In the U.S. field study, two dogs with a history of seizures received CREDELIO and experienced no seizures throughout the study.

In three well-controlled European field studies and one U.S. laboratory study, seven dogs experienced episodes of vomiting and four dogs experienced episodes of diarrhea between 6 hours and 3 days after receiving CREDELIO.

To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Elanco US, Inc. at 1-888-545-5973. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or http://www.fda.gov/AnimalVeterinary/SafetyHealth.

Effectiveness:
In well-controlled European laboratory studies, CREDELIO began to kill fleas four hours after administration or infestation, with greater than 99% of fleas killed within eight hours after administration or infestation for 35 days. In a well-controlled U.S. laboratory study, CREDELIO demonstrated 100% effectiveness against adult fleas 12 hours after administration or infestation for 35 days.

In a 90-day well-controlled U.S. field study conducted in households with existing flea infestations of varying severity, the effectiveness of CREDELIO against fleas on Days 30, 60 and 90 compared to baseline was 99.5%,100% and 100%, respectively. Dogs with signs of flea allergy dermatitis showed improvement in erythema, papules, scaling, alopecia, dermatitis/pyodermatitis and pruritus as a direct result of eliminating fleas.

In well-controlled laboratory studies, CREDELIO demonstrated > 97% effectiveness against *Amblyomma americanum*, *Dermacentor variabilis*, *Ixodes scapularis* and *Rhipicephalus sanguineus* ticks 48 hours after administration or infestation for 30 days. In a well-controlled European laboratory study, CREDELIO started killing *Ixodes ricinus* ticks within four hours after administration.

Storage Information:
Store at 15-25°C (59 -77°F), excursions permitted between 5 to 40°C (41 to 104°F).

How Supplied:
CREDELIO is available in five chewable tablet sizes for use in dogs: 56.25, 112.5, 225, 450, and 900 mg lotilaner. Each chewable tablet size is available in color-coded packages of 1 or 6 chewable tablets.

NADA #141-494, Approved by the FDA

Manufactured for:
Elanco US Inc
Greenfield, IN 46140 USA

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PA209456X_BrS1 P2a

Interceptor™ Plus

(milbemycin oxime/praziquantel)

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

Before using INTERCEPTOR PLUS, please consult the product insert, a summary of which follows:

Indications
INTERCEPTOR PLUS is indicated for the prevention of heartworm disease caused by *Dirofilaria immitis*; and for the treatment and control of adult roundworm (*Toxocara canis, Toxascaris leonina*), adult hookworm (*Ancylostoma caninum*), adult whipworm (*Trichuris vulpis*), and adult tapeworm (*Taenia pisiformis, Echinococcus multilocularis, Echinococcus granulosus, and Dipylidium caninum*) infections in dogs and puppies two pounds of body weight or greater and six weeks of age and older.

Dosage and Administration
INTERCEPTOR PLUS should be administered orally, once every month, at the minimum dosage of 0.23 mg/lb (0.5 mg/kg) milbemycin oxime, and 2.28 mg/lb (5 mg/kg) praziquantel. For heartworm prevention, give once monthly for at least 6 months after exposure to mosquitoes (see **EFFECTIVENESS**).

See product insert for complete dosing and administration information.

Contraindications
There are no known contraindications to the use of INTERCEPTOR PLUS.

Warnings
Not for use in humans. Keep this and all drugs out of the reach of children.

Precautions
Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention (see **EFFECTIVENESS**).

Prior to administration of INTERCEPTOR PLUS, dogs should be tested for existing heartworm infections. At the discretion of the veterinarian, infected dogs should be treated to remove adult heartworms. INTERCEPTOR PLUS is not effective against adult *D. immitis*. Mild, transient hypersensitivity reactions, such as labored breathing, vomiting, hypersalivation, and lethargy, have been noted in some dogs treated with milbemycin oxime carrying a high number of circulating microfilariae. These reactions are presumably caused by release of protein from dead or dying microfilariae.

Do not use in puppies less than six weeks of age.

Do not use in dogs or puppies less than two pounds of body weight.

The safety of INTERCEPTOR PLUS has not been evaluated in dogs used for breeding or in lactating females. Studies have been performed with milbemycin oxime alone (see **ANIMAL SAFETY**).

Adverse Reactions
The following adverse reactions have been reported in dogs after administration of milbemycin oxime or praziquantel: vomiting, diarrhea, depression/lethargy, ataxia, anorexia, convulsions, weakness, and salivation.

To report suspected adverse drug events, contact Elanco US Inc. at 1-888-545-5973 or the FDA at 1-888-FDA-VETS.

For technical assistance call Elanco US Inc. at 1-888-545-5973.

Information for Owner or Person Treating Animal:
Echinococcus multilocularis and *Echinococcus granulosus* are tapeworms found in wild canids and domestic dogs. *E. multilocularis* and *E. granulosus* can infect humans and cause serious disease (alveolar hydatid disease and hydatid disease, respectively). Owners of dogs living in areas where *E. multilocularis* or *E. granulosus* are endemic should be instructed on how to minimize their risk of exposure to these parasites, as well as their dog's risk of exposure. Although INTERCEPTOR PLUS was 100% effective in laboratory studies in dogs against *E. multilocularis* and *E. granulosus*, no studies have been conducted to show that the use of this product will decrease the incidence of alveolar hydatid disease or hydatid disease in humans. Because the prepatent period for *E. multilocularis* may be as short as 26 days, dogs treated at the labeled monthly intervals may become reinfected and shed eggs between treatments.

Effectiveness
Heartworm Prevention:
In a well-controlled laboratory study, INTERCEPTOR PLUS was 100% effective against induced heartworm infections when administered once monthly for 6 consecutive months. In well-controlled laboratory studies, neither one dose nor two consecutive doses of INTERCEPTOR PLUS provided 100% effectiveness against induced heartworm infections.

Intestinal Nematodes and Cestodes Treatment and Control:
Elimination of the adult stage of hookworm (*Ancylostoma caninum*), roundworm (*Toxocara canis, Toxascaris leonina*), whipworm (*Trichuris vulpis*) and tapeworm (*Echinococcus multilocularis, Echinococcus granulosus, Taenia pisiformis and Dipylidium caninum*) infections in dogs was demonstrated in well-controlled laboratory studies.

Palatability
In a field study of 115 dogs offered INTERCEPTOR PLUS, 108 dogs (94.0%) accepted the product when offered from the hand as if a treat, 1 dog (0.9%) accepted it from the bowl with food, 2 dogs (1.7%) accepted it when it was placed in the dog's mouth, and 4 dogs (3.5%) refused it.

Storage Information
Store at room temperature, between 59° and 77°F (15-25°C).

How Supplied
INTERCEPTOR PLUS is available in four strengths, formulated according to the weight of the dog. Each strength is available in color-coded packages of six chewable tablets each. The tablets containing 2.3 mg milbemycin oxime/22.8 mg praziquantel or 5.75 mg milbemycin oxime/57 mg praziquantel are also available in color coded packages of one chewable tablet each.

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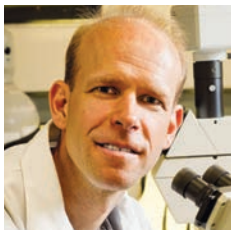

EDITOR IN CHIEF
J. SCOTT WEESE
DVM, DVSc, DACVIM
dr.weese@briefmedia.com
Professor
Ontario Veterinary College
Ontario, Canada

CHIEF VETERINARY OFFICER & EDITOR
INDU MANI
DVM, ScD
dr.indu@briefmedia.com

DIRECTOR OF INTEGRATIVE CONTENT
JENNIFER L. SCHORI
VMD, MS
dr.jen@briefmedia.com

MANAGING EDITOR
SAMANTHA FARLEY
MPS
sam@briefmedia.com

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PREDICTING DISEASE:

The Promise of Artificial Intelligence for Pet Care

The ability to conduct deep analysis of data, detect patterns and trends, and learn from these discoveries makes artificial intelligence (AI) an astounding innovation. AI and machine learning are constantly unearthing new ways to diagnose, treat, and even predict human disease, while promising earlier, more precise care, leading to better quality of life and longevity.

Through deep analysis of large sets of health data collected as part of routine diagnostics, RenalTech™ can predict whether a cat will develop chronic kidney disease (CKD) within two years with greater than 95% accuracy.

Now, the benefits of AI can also be applied to veterinary medicine. With the introduction of RenalTech, available exclusively from Antech Diagnostics, AI is set to transform the way we care for pets.

Through deep analysis of large sets of health data collected as part of routine diagnostics, RenalTech can predict whether a cat will develop chronic kidney disease (CKD) within two years with greater than 95% accuracy. As the industry's first predictive diagnostic tool, RenalTech is the future of veterinary care. For the first time, veterinarians can provide care before CKD strikes.

From Disease Detection to Disease Prediction

CKD is a multifactorial disease that is difficult to detect early enough to positively impact a cat's health and longevity. Traditional diagnostics find disease when about 40% of kidney function is lost, while the SDMA biomarker finds disease when about 25% of kidney function is lost. Nonetheless, by the time either of these diagnostics detect disease, organ damage is underway. With RenalTech, veterinarians can intervene early, deliver highly personalized care plans, and inspire better pet owner compliance.

Millions of Data Points

Initially, researchers at WALTHAM Centre® identified 35 data points as possible predictors of CKD and over time, leveraging machine learning, were able to narrow the list to 6 routine analytes (creatinine, BUN, urine specific gravity, urine protein, urine pH, WBC) and the pet's approximate age. Powered by data from 150 000 cats seen by Banfield Animal Hospital veterinarians over 20 years, the RenalTech algorithm is the result of collaborative research led by the world's largest pet care company, Mars Petcare. The vast repository of historical patient data and RenalTech algorithm combine to produce a RenalTech value that allows veterinarians to predict whether cats are likely or not likely to develop CKD.

Inspiring Better Pet Care

Antech will offer RenalTech at no additional cost as part of routine feline diagnostic panels. In addition to predicting CKD, the new test helps support the value of preventive care, offering a compelling reason for ongoing diagnostics for comorbidities and other undiagnosed conditions.

RenalTech is the first of a new generation of predictive diagnostic tools poised to ensure veterinary care continues to develop parallel to human healthcare. The ability to predict disease offers veterinarians a powerful, tangible way to inspire pet owner compliance with personalized care plans that maintain pet quality of life and the bond between pet owners and their pets.

IN THIS ISSUE

ON THE COVER

TOP 5

Top 5 Postoperative Orthopedic Rehabilitation Considerations

Lisa Corti, DVM, DACVS, CCRP

PG 26

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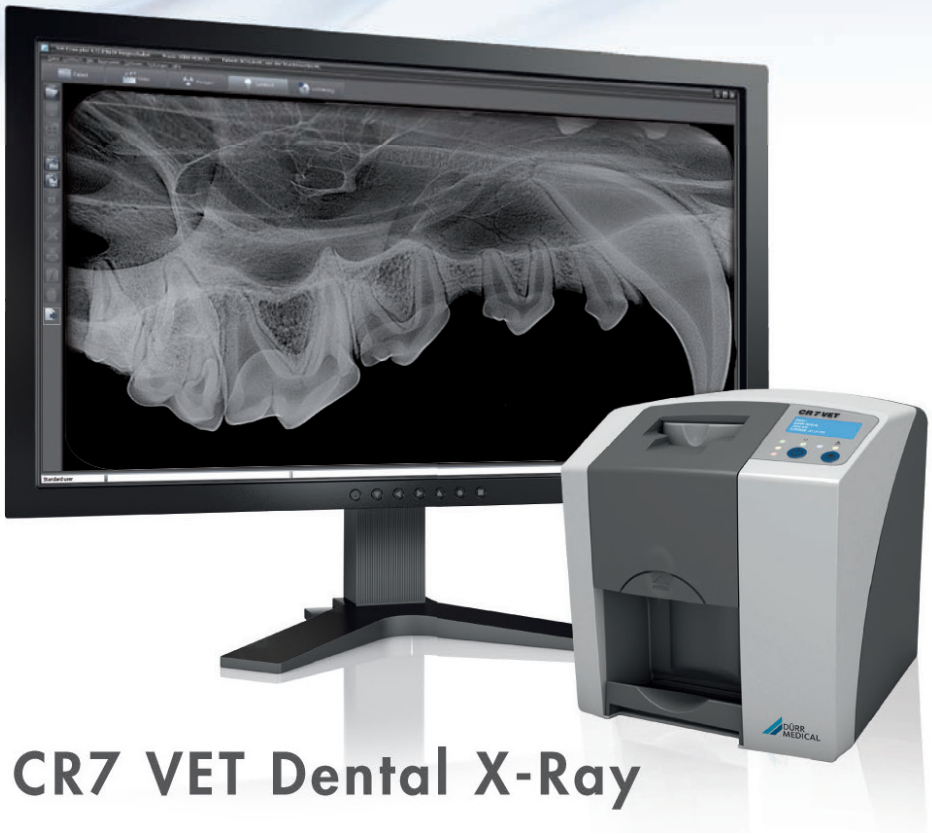

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The advantages of the CR7 Vet over other DR systems when used in the veterinary environment include a unique range of plate sizes from size 0 up to size 5, which covers all pets from small to large. There is even an intraoral plate for rabbits."

Dr. Anthony Caiafa
BVSc BDSc MACVSc (SA Surgery and Veterinary Dentistry)

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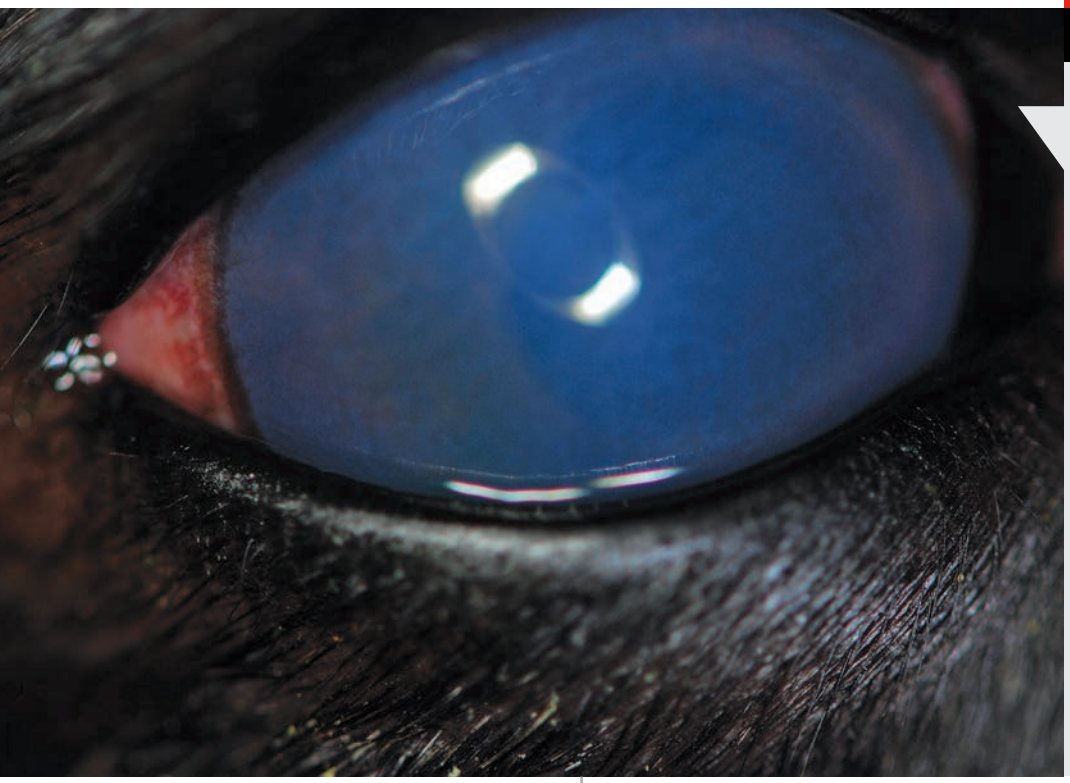

CASE ROUTES

Cloudy Eye in a Labrador Retriever

Mary Rebecca Telle, DVM
Gillian J. McLellan, BVMS, PhD, DVOphthal, DECVO, DACVO, MRCVS
brief.vet/glaucoma

PODCAST

Physical Activity in Cats with Dr. Linder

Are cats excluded from conversations about physical activity? Listen as host of *Clinican's Brief*: The Podcast, Beckie Mossor, RVT, talks with Deborah Linder, DVM, MS, DACVN, about exercise plans for cats and Dr. Linder's recent *Clinician's Brief* article, "Physical Activity Programs for Cats."
brief.vet/podcast-physical-activity-programs

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CASE IN POINT

PELVIC LIMB LAMENESS IN A GOLDEN RETRIEVER PUPPY

Mary Sarah Bergh, DVM, MS, DACVS, DACVSMR
Iowa State University

Maggie, a 5-month-old female golden retriever, was presented 2 hours after her owner observed an acute onset of right pelvic limb lameness. No causative incident for the lameness had been observed.

Physical Examination

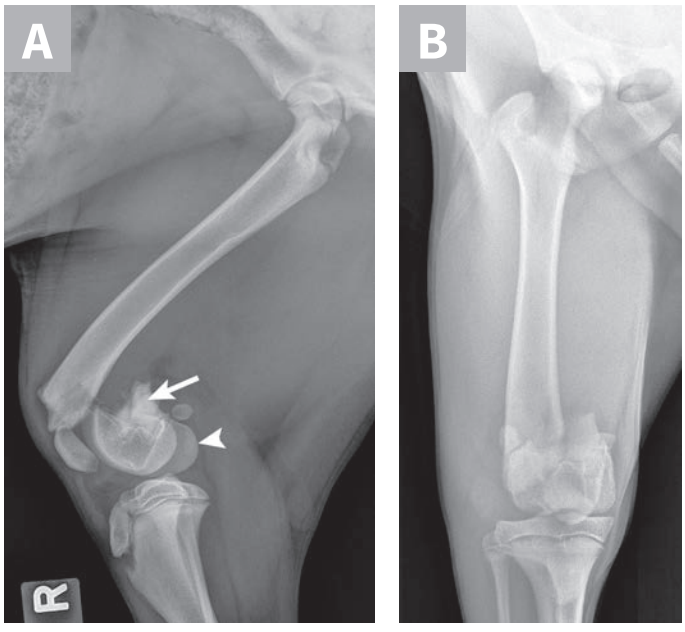
On physical examination, Maggie was bright, alert, and responsive. Vital parameters were within normal limits, aside from an elevated heart rate (140 bpm) presumably due to discomfort. Thoracic auscultation was within normal limits. She was nonweight-bearing on her right pelvic limb, and the stifle joint was visibly swollen with palpable pain. Range of motion in the right stifle was reduced. The remainder of the clinical examination was within normal limits.

Diagnosis

Differential diagnoses for this patient's stifle swelling, pain, and lameness included fracture, patellar luxation, cranial cruciate ligament injury or avulsion, muscle or tendon strain, osteochondritis dissecans, and septic arthritis. Although there was no known trauma, fracture remained on the differential list, as juvenile bone is soft and the physes are weaker than the adjacent bone and ligaments, which can lead to fractures that can occur with little or no apparent trauma.[1-4] Early identification and treatment of physeal fractures are important to minimize the risk for development of significant limb deformities, joint incongruities, and intractable lameness.[1-3]

Hydromorphone (0.05 mg/kg IV) was administered for analgesia, and lateral and ventrodorsal thoracic radiographs were obtained to evaluate for thoracic trauma. Radiographic findings were within normal limits; however, lateral and craniocaudal radiographs of the right pelvic limb (***Figure 1***) revealed a Salter-Harris type II fracture of the distal femur with caudal and medial displacement.

Although Maggie's fracture was not difficult to identify on radiographs, not all physeal fractures are as easily identified. Radiography of the contralateral joint for comparison can help confirm diagnosis.[5,6] Radiography can also be repeated 10 to 14 days later to look for signs of physeal damage if the diagnosis remains unclear.[5,6]



▲ **FIGURE 1** Lateral (***A***) and craniocaudal (***B***) radiographs of this patient's femur. A Salter-Harris type II fracture with caudal and medial displacement is present in the distal femur. The metaphyseal component (***A***; ***arrow***) and the epiphyseal component (***arrowhead***) can be noted.

DIAGNOSIS:
SALTER-HARRIS TYPE II FRACTURE

Treatment & Long-Term Management

Early surgical repair of physeal fractures is key to restoring limb function and minimizing damage to the fractured physis (see ***Treatment at a Glance***). The basic principles for treatment of physeal fractures are preservation of blood supply, anatomic reduction, and stable fixation. Gentle soft tissue handling during fracture reduction and stabilization is essential to avoid damage to the soft juvenile bone and soft tissue surrounding the fracture site. When applied nearly perpendicular to the physeal surface, smooth pins can allow for continued growth, as the proliferating cartilage can slide along the pins. Implants should be placed so they do not interfere with joint function.

Maggie was managed overnight with analgesia (ie, hydromorphone [0.05 mg/kg IV q4-6h]) and

nursing care. The following morning, Maggie was placed under general anesthesia and given a morphine epidural, and surgical fixation of the fracture was performed through a craniolateral approach to the stifle. The distal femoral physis is W-shaped and has inherent stability when reduced; however, additional stabilization is required to provide adequate resistance to the forces applied across the fracture and to allow for the stability needed for healing. Two smooth pins were placed obliquely across the fracture site (***Figure 2***). The pins should cross proximal to the fracture site to provide maximal repair stability.[7]

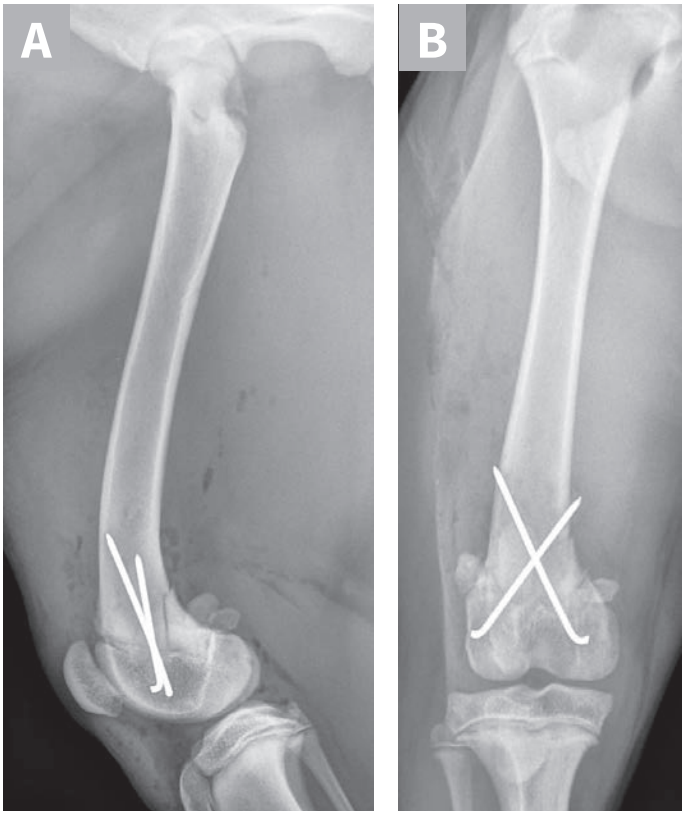
Postoperation, Maggie's pain was managed with cryotherapy and hydromorphone (0.05 mg/kg IV q4-6h) until she was eating, at which time she was transitioned to carprofen (2.2 mg/kg PO q12h); her comfort level was determined to be good. Additional analgesic options to consider could include gabapentin or codeine if deemed necessary. Physical rehabilitation was initiated the first day postoperation and included massage and range-of-motion exercises of the limb. Exercise restriction and continued physical rehabilitation therapy were advised until radiographic follow-up could be performed 5 weeks postoperation. Early mobilization of the limb is important to encourage mobility, prevent periarticular fibrosis, and, in cases of distal femoral fractures, help prevent the development of quadriceps contracture.[8,9]

Prognosis & Outcome

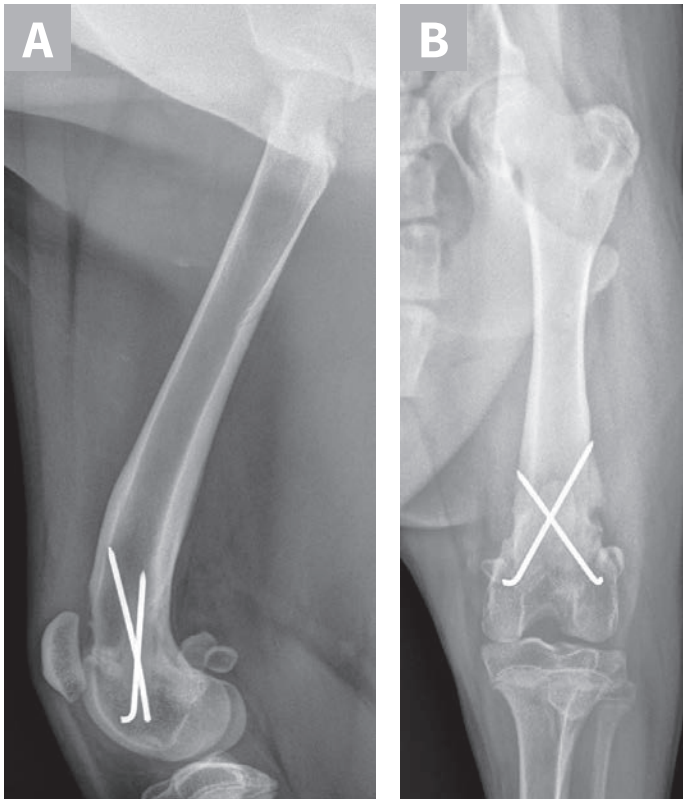
At the 5-week postoperative examination, Maggie was fully weight-bearing on her right pelvic limb and the stifle had full and pain-free range of motion. Radiography of the stifle revealed that the fracture was healed, the implants were stable, and the distal femoral physis was closed (***Figure 3***, next page). A closed distal femoral physis is a common finding after fracture repair, as the germinal cells, which are responsible for physis growth, are frequently irreversibly damaged during the fracture event. Premature physeal closure can result in shortening of the femur, particularly if the animal is young and has large remaining growth potential.[2,10] However,

TREATMENT AT A GLANCE

- A thorough orthopedic examination should be performed on all puppies and kittens presented with acute lameness.
- Surgical repair is indicated in most cases to restore limb alignment and provide stability of the fracture.
- Gentle tissue handling during surgery is important to preserve blood supply to the tissue.
- Smooth pins can be beneficial in the stabilization of physeal fractures.
- Stable fixation is critical to allow for early mobilization of the fractured limb.
- Physical therapy should be initiated postoperatively.
- Implants do not usually need to be removed after the fracture has healed unless they interfere with patient growth or comfort.



▲ **FIGURE 2** Lateral (***A***) and craniocaudal (***B***) radiographs of the femur immediately after open reduction and internal fixation with 2 cross pins. The pins cross proximal to the fracture site, which is important for stability of the repair.



▲ **FIGURE 3** Lateral (***A***) and craniocaudal (***B***) radiographs of the femur 5 weeks after fracture repair. The fracture has healed and the distal femoral physis has closed.

a closed distal femoral physis in a dog of Maggie's age does not usually result in a clinical problem, as dogs are generally able to compensate for mild limb length discrepancies through extension of adjacent joints and compensatory overgrowth of the tibia.[2,10]

Maggie had uncomplicated healing and an excellent outcome and was allowed to return to normal activity by 8 weeks postoperation. The pins were left in situ. Maggie grew into adulthood and continues to have normal function of her fractured limb.

Discussion

Salter-Harris fractures occur through the physes in juvenile animals.[4] The Salter-Harris classification scheme categorizes fractures based on a scale of I to V according to anatomic location of the fracture relative to the physis, epiphysis, and metaphysis (***Table***; see ***Suggested Reading***).[4] A Salter-Harris type II fracture, as seen in Maggie, occurs through the physis and extends into the metaphysis[4] and is a common fracture pattern seen in the distal femur of puppies.[1,8,11] The distal femoral physis closes between 6 and 11 months of age, and bone growth from this physis contributes 75% of the length of the canine femur.[2,12]

TABLE

SALTER-HARRIS FRACTURE CLASSIFICATION

Salter-Harris Type	Separation Involvement
Type I	Physis*
Type II	Physis and metaphysis†; most common location is in the distal femur, as seen in Maggie
Type III	Physis and epiphysis‡
Type IV	Metaphysis, physis, and epiphysis
Type V	Crushing injury to the physis; most common location is the distal ulnar physis due to its conical V-shape

*The physis is the growth plate. The cells in this region are responsible for the longitudinal growth of the bone. Radiographically, this region is more lucent than the adjacent bone.
†The metaphysis is the region of bone between the physis and the diaphysis and consists of newly formed bone from the physis.
‡The epiphysis is the region of bone between the physis and the joint space. Fractures through the epiphysis are articular fractures.

Early identification and treatment of physeal fractures is important to maximize patient outcomes (see ***Take-Home Messages***). Orthogonal radiographs of the area of concern should always be obtained and can be compared with radiographs of the contralateral joint. Careful surgical technique is important when repairing physeal fractures, as excessive dissection may damage the blood supply and germinal cell layer in the fracture plane, resulting in early physis closure. Anatomic reduction of the fracture is essential to maintain the potential for longitudinal growth from the physis and restoration of limb alignment.

Prognosis following physeal fractures can be very good. In humans, prognosis worsens as the fracture classification number increases, although this may not be true in animals, as human prognosis does not take into account patient age, remaining growth potential of the patient, and fracture location, all of which can more significantly impact the outcome in veterinary patients.[1,2,13] Prognosis is best if the fracture is identified and repaired quickly with anatomic reduction and rigid fixation. Perioperative analgesia and postoperative physical rehabilitation can improve patient comfort and maximize clinical outcomes. If the fracture involves the articular surface, some degree of osteoarthritis can be expected over time but is usually minimal when good surgical technique is used. Maggie's outcome is similar to most dogs that undergo surgical repair of Salter-Harris type II fractures.[2,11] Prognosis may be less favorable in younger patients and in patients with more soft tissue trauma, compromised blood supply to the fracture area, chronic fractures, fractures with marginal or unstable repairs, and/or greater amount of remaining growth potential.[2] As in Maggie's case, the implants can remain in place unless they migrate or cause irritation.[2,11]

TAKE-HOME MESSAGES

- A high index of suspicion for Salter-Harris fracture should be maintained in juvenile animals with acute lameness.
- Salter-Harris fractures can occur secondary to minimal trauma because the physis is weaker than the surrounding bone.
- Radiography of the affected area should be performed. Radiographs of the injured region should be compared with radiographs of the contralateral side if the physeal appearance is uncertain.
- Early surgical repair with good technique is critical to a successful patient outcome.
- Physical rehabilitation therapy is an important component that should be implemented to maximize recovery.
- Outcome is typically better in animals with less remaining growth potential (ie, >6 months of age).

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Suggested Reading

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Virbac

sentinel® spectrum® chews

(milbemycin oxime·lufenuron·praziquantel)

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

Description: SENTINEL® SPECTRUM® Chews are available in four strengths in color-coded packages for oral administration to dogs and puppies according to their weight. Each chewable flavored tablet is formulated to provide a minimum of 0.23 mg/pound (0.5mg/kg) of milbemycin oxime, 4.55 mg/pound (10mg/kg) of lufenuron, and 2.28 mg/pound (5mg/kg) of praziquantel.

Milbemycin oxime consists of the oxime derivatives of 5-didehydromilbemycins in the ratio of approximately 80% A4 (C32H45NO7, MW 555.71) and 20% A3 (C31H43NO7, MW 541.68). Milbemycin oxime is classified as a macrocyclic anthelmintic.

Lufenuron is a benzoylphenylurea derivative with the following chemical composition: N-[2,5-dichloro-4-(1,1,2,3,3,3,-hexafluoropropoxy)-phenyl-aminocarbonyl]-2,6-difluorobenzamide (C17H8Cl2F8N2O3, MW 511.15). Benzoylphenylurea compounds, including lufenuron, are classified as insect development inhibitors (IDIs).

Praziquantel is an isoquinolone anthelmintic with the chemical name 2-(Cyclohexylcarbonyl)-1,2,3,6,7,-11b-hexahydro-4H-pyrazino[2,1-a] isoquinolin-4-one.

Indications: SENTINEL SPECTRUM Chews are indicated for the prevention of heartworm disease caused by Dirofilaria immitis; for the prevention and control of flea populations (*Ctenocephalides felis*); and for the treatment and control of adult roundworm (*Toxocara canis*, *Toxascaris leonina*), adult hookworm (*Ancylostoma caninum*), adult whipworm (*Trichuris vulpis*), and adult tapeworm (*Dipylidium caninum*, *Taenia pisiformis*, *Echinococcus multilocularis* and *Echinococcus granulosus*) infections in dogs and puppies two pounds of body weight or greater and six weeks of age and older.

Dosage and Administration: SENTINEL SPECTRUM Chews should be administerd orally, once every month, at the minimum dosage of 0.23 mg/lb (0.5 mg/kg) milbemycin oxime, 4.55 mg/lb (10 mg/kg) lufenuron, and 2.28 mg/lb (5 mg/kg) praziquantel. For heartworm prevention, give once monthly for at least 6 months after exposure to mosquitoes (see **EFFECTIVENESS**).

Dosage Schedule

Body Weight	Milbemycin Oxime per chewable	Lufenuron per chewable	Praziquantel per chewable	Number of chewables
2 to 8 lbs.	2.3 mg	46 mg	22.8 mg	One
8.1 to 25 lbs.	5.75 mg	115 mg	57 mg	One
25.1 to 50 lbs.	11.5 mg	230 mg	114 mg	One
50.1 to 100 lbs.	23.0 mg	460 mg	228 mg	One
Over 100 lbs.	Administer the appropriate combination of chewables			

To ensure adequate absorption, always administer SENTINEL SPECTRUM Chews to dogs immediately after or in conjunction with a normal meal.

SENTINEL SPECTRUM Chews may be offered to the dog by hand or added to a small amount of dog food. The chewables should be administered in a manner that encourages the dog to chew, rather than to swallow without chewing. Chewables may be broken into pieces and fed to dogs that normally swallow treats whole. Care should be taken that the dog consumes the complete dose, and treated animals should be observed a few minutes after administration to ensure that no part of the dose is lost or rejected. If it is suspected that any of the dose has been lost, redosing is recommended.

Heartworm Prevention: SENTINEL SPECTRUM Chews should be administered at monthly intervals beginning within one month of the dog's first seasonal exposure to mosquitoes and continuing until at least 6 months after the dog's last seasonal exposure (see **EFFECTIVENESS**). SENTINEL SPECTRUM Chews may be administered year-round without interruption. When switching from another heartworm preventative product to SENTINEL SPECTRUM Chews, the first dose of SENTINEL SPECTRUM Chews should be given within a month of the last dose of the former product.

Flea Treatment and Prevention: Treatment with SENTINEL SPECTRUM Chews may begin at any time of the year, preferably starting one month before fleas become active and continuing monthly through the end of flea season. In areas where fleas are common year-round, monthly treatment with SENTINEL SPECTRUM Chews should continue the entire year without interruption.

To minimize the likelihood of flea reinfestation, it is important to treat all animals within a household with an approved flea protection product, as necessary.

Intestinal Nematode and Cestode Treatment and Control: Dogs may be exposed to and can become infected with roundworms, whipworms, hookworms, and tapeworms throughout the year, regardless of season or climate. Clients should be advised of appropriate measures to prevent reinfection of their dog with intestinal parasites. Because the prepatent period for *E. multilocularis* may be as short as 26 days, dogs treated at the labeled monthly intervals may become reinfected and shed eggs between treatments.

Contraindications: There are no known contraindications to the use of SENTINEL SPECTRUM Chews.

Warnings: Not for use in humans. Keep this and all drugs out of the reach of children.

Precautions: Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention (see **EFFECTIVENESS**).

Prior to administration of SENTINEL SPECTRUM Chews, dogs should be tested for existing heartworm infections. At the discretion of the veterinarian, infected dogs should be treated to remove adult heartworms. SENTINEL SPECTRUM Chews are not effective against adult *D. immitis*.

Mild, transient hypersensitivity reactions, such as labored breathing, vomiting, hypersalivation, and lethargy have been noted in some dogs treated with milbemycin oxime carrying a high number of circulating microfilariae. These reactions are presumably caused by release of protein from dead or dying microfilariae.

Do not use in puppies less than six weeks of age.

Do not use in dogs or puppies less than two pounds of body weight.

The safety of SENTINEL® SPECTRUM® Chews has not been evaluated in dogs used for breeding or in lactating females. Studies have been performed with milbemycin oxime and lufenuron alone (see **ANIMAL SAFETY**).

Adverse Reactions: The following adverse reactions have been reported in dogs after administration of milbemycin oxime, lufenuron, or praziquantel: vomiting, depression/lethargy, pruritus, urticaria, diarrhea, anorexia, skin congestion, ataxia, convulsions, salivation, and weakness.

To report suspected adverse drug events, contact Virbac at 1-800-338-3659 or the FDA at 1-888-FDA-VETS.

For technical assistance, call Virbac at 1-800-338-3659.

Information for Owner or Person Treating Animal: *Echinococcus multilocularis* and *Echinococcus granulosus* are tapeworms found in wild canids and domestic dogs. *E. multilocularis* and *E. granulosus* can infect humans and cause serious disease (alveolar hydatid disease and hydatid disease, respectively). Owners of dogs living in areas where *E. multilocularis* or *E. granulosus* are endemic should be instructed on how to minimize their risk of exposure to these parasites, as well as their dog's risk of exposure. Although SENTINEL SPECTRUM Chews were 100% effective in laboratory studies in dogs against *E. multilocularis* and *E. granulosus*, no studies have been conducted to show that the use of this product will decrease the incidence of alveolar hydatid disease or hydatid disease in humans. Because the prepatent period for *E. multilocularis* may be as short as 26 days, dogs treated at the labeled monthly intervals may become reinfected and shed eggs between treatments.

Effectiveness

Heartworm Prevention: In a well-controlled laboratory study, SENTINEL SPECTRUM Chews (*milbemycin oxime, lufenuron, praziquantel*) were 100% effective against induced heartworm infections when administered once monthly for 6 consecutive months. In well-controlled laboratory studies, neither one dose nor two consecutive doses of SENTINEL SPECTRUM Chews provided 100% effectiveness against induced heartworm infections.

Intestinal Nematodes and Cestodes Treatment and Control: Elimination of the adult stage of hookworm (*Ancylostoma caninum*), roundworm (*Toxacara canis*, *Toxascaris leonina*), whipworm (*Trichuris vulpis*) and tapeworm (*Dipylidium caninum*, *Echinococcus multilocularis*, *Echinococcus granulosus*, *Taenia pisiformis*) infections in dogs was demonstrated in well-controlled laboratory studies.

Flea Prevention and Control: In well-controlled studies, SENTINEL SPECTRUM Chews were effective in preventing flea eggs from hatching, thus providing control of the development of flea populations (*Ctenocephalides felis*).

Palatability: In a field study of 117 dogs offered SENTINEL SPECTRUM Chews, 113 dogs (96.6%) accepted the product when offered from the hand as if a treat, 2 dogs (1.7%) accepted it from the bowl with food, 1 dog (0.9%) accepted it when it was placed in the dog's mouth, and 1 dog (0.9%) refused it.

Animal Safety: In a margin of safety study, 40 ten-week-old puppies (10 per group) were administered either a sham dose (0X) or doses of 1, 3, or 5X the maximum exposure dose of SENTINEL SPECTRUM Chews once every two weeks for a total of seven treatments. Transient ataxia, lethargy, tremors, and salivation were seen in the 3X and 5X groups following each of the seven doses. Lethargy and ataxia were occasionally reported in sham-dosed (0X) and 1X dogs. Tremors were observed twice post-treatment in the 1X treatment group. Vomiting was seen in all treatment groups but at a higher incidence in the 3X and 5X groups. At the 5X dose, shallow breathing was noted in two dogs and one dog was unable to stand following two different doses. All clinical signs resolved within 24 hours.

In a second margin of safety study, 64 six-week-old puppies (16 per group) were dosed with either a sham (0X) or 1, 3, or 5X the maximum exposure dose of SENTINEL SPECTRUM Chews on days 1, 15, 29, and 43. A dose dependent increase in ataxia, decreased activity, tremors, and salivation was seen within 24 hours of treatment. Splayed hind limbs were observed once in one dog in the 5X treatment group. Vomiting was observed in the 5X treatment group.

For SENTINEL SPECTRUM Chews, the maximum exposure based on product dosing is 2.5 mg/kg for milbemycin oxime, 50.7 mg/kg for lufenuron and 25.1 mg/kg for praziquantel, which is higher than the minimum effective dose used in the safety studies for milbemycin oxime and lufenuron (see below).

Milbemycin Oxime: Two studies were conducted in heartworm-infected dogs treated with milbemycin oxime. Mild, transient hypersensitivity reactions were observed in dogs with high microfilariae counts (see **PRECAUTIONS**).

Safety studies in pregnant dogs demonstrated that doses of 0.6X the maximum exposure dose of SENTINEL SPECTRUM Chews, (1.5 mg/kg of milbemycin oxime), administered daily from mating through weaning, resulted in measurable concentrations of milbemycin oxime in milk. Puppies nursing these females demonstrated milbemycin oxime-related effects (depression, decreased activity, diarrhea, dehydration, nasal discharge). A subsequent study, which evaluated the daily administration of 0.6X the maximum exposure dose of SENTINEL SPECTRUM Chews, from mating until one week before weaning, demonstrated no effects on the pregnant females or their litters. A study, in which pregnant females were dosed once, at 0.6X maximum exposure dose of SENTINEL SPECTRUM Chews before, on the day of, or shortly after whelping, resulted in no effects on the puppies.

Some nursing puppies, at 2, 4, and 6 weeks of age, administered oral doses of 9.6 mg/kg milbemycin oxime (3.8X the maximum exposure dose of SENTINEL SPECTRUM Chews) exhibited tremors, vocalization, and ataxia. These effects were all transient and puppies returned to normal within 24 to 48 hours. No effects were observed in puppies administered 0.5 mg/kg milbemycin oxime (minimum label dose).

A rising-dose safety study conducted in rough-coated Collies resulted in ataxia, pyrexia, and periodic recumbency in one of fourteen dogs administered milbemycin oxime at 12.5 mg/kg (5X the maximum exposure dose of SENTINEL SPECTRUM Chews). Prior to receiving the 12.5 mg/kg dose on day 56 of the study, all animals had undergone a dosing regimen consisting of 2.5 mg/kg milbemycin oxime on day 0, followed by 5.0 mg/kg on day 14, and 10.0 mg/kg on day 32. No adverse reactions were observed in any of the Collies treated with doses less than 12.5 mg/kg.

Lufenuron: In a ten-month study, doses of lufenuron up to 2X the maximum exposure dose of SENTINEL SPECTRUM Chews (10 mg/kg) caused no overt toxicity. A single dose of 200 mg/kg had no marked effect on adult dogs, but caused decreased activity and reduced appetite in eight-week-old puppies. Lufenuron tablets were evaluated with concurrent administration of flea adulticides containing carbaryl, permethrin, chlorpyriphos, and cythioate. No toxicty resulted from these combinations. Lufenuron tablets did not cause cholinesterase inhibition nor did they enhance cholinesterase inhibition caused by exposure to organophoshphates.

Two laboratory and two well-controlled field studies were conducted to evaluate reproductive safety of lufenuron tablets in breeding dogs. In one of the laboratory studies, in which lufenuron was administered to Beagle dogs as three divided doses, equivalent to 17.8X the maximum exposure dose of SENTINEL SPECTRUM Chews (10 mg/kg), the ratio of gravid females to females mated was 8/8 or 100% in the control group and 6/9 or 67% in the lufenuron-treated group. The mean number of pups per litter was two animals higher in the lufenuron versus control groups and mean birth weights of pups from treated females in this study was lower than control groups. These pups grew at a similar rate to the control pups. The incidence of nasal discharge, pulmonary congestion, diarrhea/dehydration, and sluggishness was higher in the lufenuron-treated pup group than in the control pup group. The incidence of these signs was transient and decreasing by the end of lactation.

Results from three additional reproductive safety studies, one laboratory and two field studies, evaluating eleven breeds of dogs, did not demonstrate any adverse findings for the reproductive parameters measured, including fertility, pup birth weights, and pup clinical signs, after administration of lufenuron up to 1X the maximum exposure dose of SENTINEL SPECTRUM Chews. The average milk: blood concentration ratio was approximately 60 (i.e. 60X higher drug concentrations in the milk compared to drug levels in the blood of treated females). Nursing puppies averaged 8-9 times higher blood concentrations of lufenuron compared to their dams.

Storage Information: Store in a dry place at controlled room temperature, between 59° and 77°F (15-25°C).

How Supplied: SENTINEL SPECTRUM Chews are available in four strengths, formulated according to the weight of the dog. Each strength is available in color-coded packages of six or twelve chewable tablets each.

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Important Safety Information for SENTINEL® SPECTRUM® Chews (milbemycin oxime/lufenuron/praziquantel): Dogs should be tested for heartworm infection prior to use. Mild hypersensitivity reactions have been noted in some dogs carrying a high number of circulating microfilariae. Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention. For complete product information, refer to the product insert. To obtain a product insert, contact Veterinary Technical Product Support at 1-800-338-3659, or visit **us.virbac.com**. For complete product information, please see page 12.

*Prevents flea eggs and maggot-like larvae from developing; is not an adulticide.
†*A. caninum.*

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Shaping the future of animal health

Virbac

Top 5 Conditions Affecting the Pinnae

Andrew Rosenberg, DVM, DACVD
Animal Dermatology & Allergy Specialists
Riverdale, New Jersey
White Plains, New York

▲ **FIGURE 1** Canine pinnal vasculitis. Pinnal margin alopecia, scaling, erosion, ulceration, and crusting can be observed.

The pinnal margins and pinnae of dogs and cats can be affected by many dermatologic diseases and disorders. Following are the author's 5 most common conditions that affect only the pinnae, are most severe on the pinnae, or affect the pinnae prior to affecting other regions of the body. Infectious, ectoparasitic, immune-mediated, and neoplastic diseases and keratinization disorders should be considered as potential causes of pinnal diseases.

1 Vasculitis

Vasculitis most commonly affects the pinnal margins of dogs and cats. Clinical signs can include alopecia, scaling, erosion, ulceration, crusting, and necrosis (***Figure 1***). In some cases, tissue loss may cause changes to the shape of the pinnae. Vasculitis is a histopathologic reaction pattern that signals the presence of inflammatory cells in blood vessels and is an immunologic response (ie, type III hypersensitivity disorder) that results in damage to vascular components of the dermis or subcutaneous tissue. Clinical signs can result when adequate oxygenation of tissue does not occur and blood vessels are damaged. A diagnosis of vasculitis is typically obtained through biopsy, and the underlying trigger should be determined. Numerous inciting agents have been implicated as factors that cause vasculitis, including drugs, vaccines (most commonly,

TOP 5 CONDITIONS AFFECTING THE PINNAE

1. Vasculitis
2. Ceruminous Cystadenomatosis
3. Scabies
4. Ear Margin Seborrhea
5. Sebaceous Adenitis

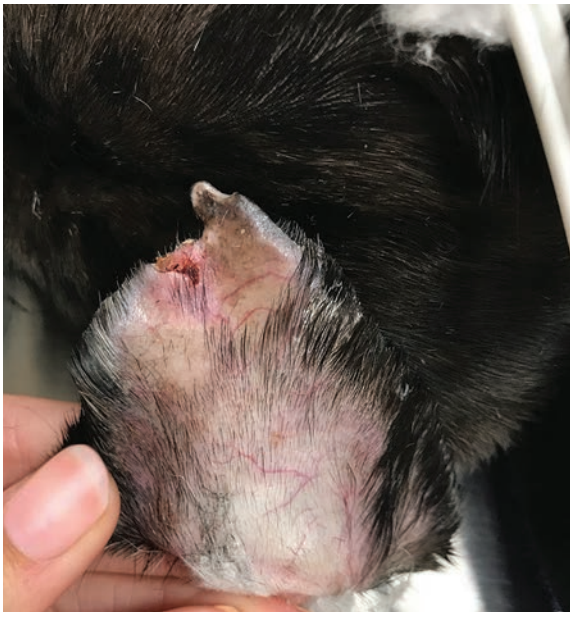
rabies vaccine), food hypersensitivity, insect bites, malignancies, and infectious organisms. Many cases of vasculitis are idiopathic.[1-3]

Treatment of vasculitis depends on the severity of the case and the underlying cause. If an inciting cause can be determined, it should be removed and avoided in the future. Any underlying infectious disease that acts as an inciting cause should be treated (eg, tick-borne diseases can be treated with doxycycline). Immunomodulatory medications can be used to treat vasculitis. Pentoxifylline is often the treatment of choice. Pentoxifylline increases erythrocyte flexibility and decreases blood viscosity, thereby allowing increased oxygenation of damaged tissue. For patients that are nonresponsive to pentoxifylline, strong immunosuppressive medications (eg, glucocorticoids, cyclosporine, azathioprine) may be required. Some severe subforms of vasculitis, namely thrombovascular necrosis of the pinnae (***Figure 2***), may not respond to medication and may require surgical intervention. A partial pinnectomy can be performed, ideally with a CO_2 laser, with care taken to remove all affected tissue.[2]

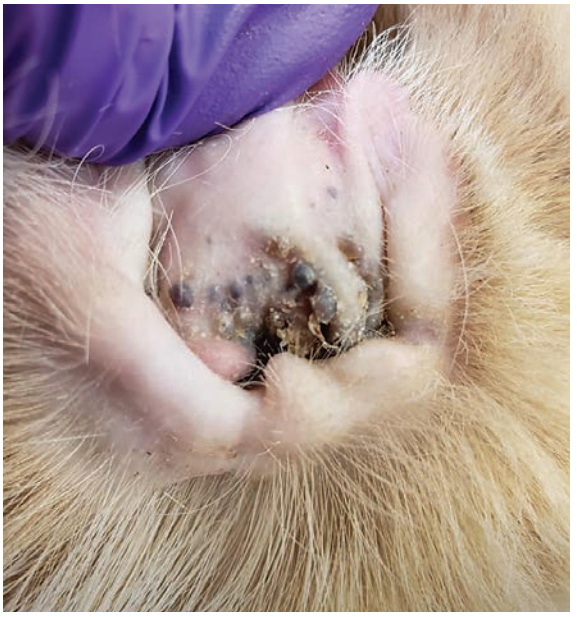
2 Ceruminous Cystadenomatosis

Ceruminous cystadenomatosis is a disease that affects the concave pinnae, external orifices, and/or, occasionally, ear canals of cats. The cause of ceruminous cystadenomatosis is unknown; however, the formation of cystic structures has been suggested to be related to, although not generally associated with, otitis externa.[4] Typical lesions include macules, papules, and/or vesicles and are multifocal-to-coalescing, gray-blue, and filled with a yellow, honey-colored fluid that can be expressed when the lesion is punctured (***Figure 3***). These cysts can be left untreated in mild cases, but severe cases can cause an obstruction that can lead to ear disease, predisposing the affected cat to chronic and recurrent otitis externa.[5]

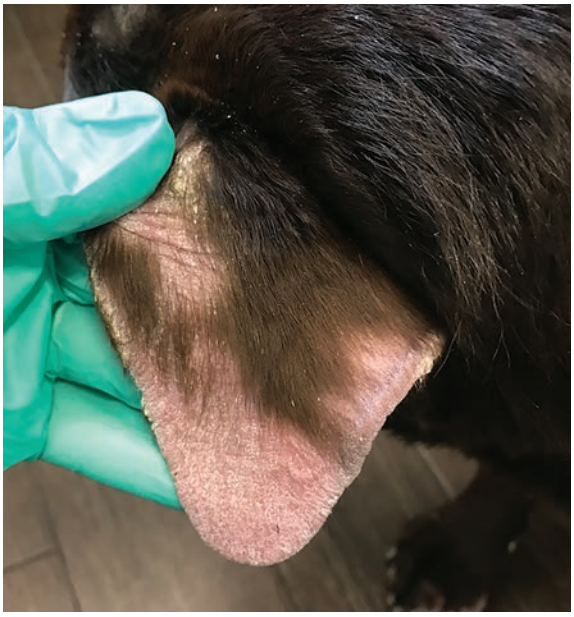
The preferred treatment in advanced cases, particularly those causing recurrent otitis externa, is laser ablation with a CO_2 laser; other medical



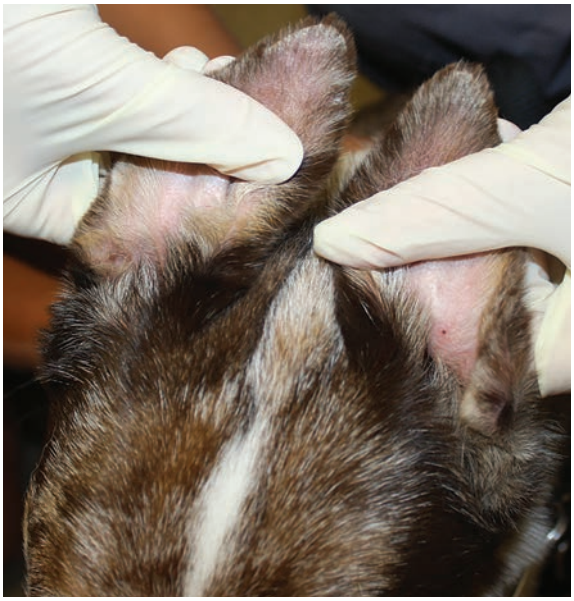
▲ **FIGURE 2** Thrombovascular necrosis of the pinna. Loss of tissue and necrosis of part of the pinnal margin can be observed.



▲ **FIGURE 3** Multifocal-to-coalescing, gray-blue macules, papules, and vesicles partially occluding the external ear canal caused by ceruminous cystadenomatosis



▲ **FIGURE 4** Scaly and crusted alopecia caused by canine scabies



▲ **FIGURE 5** Bilateral scaly and crusted alopecia caused by canine scabies

management options are not effective. Otitis typically resolves once cysts are ablated; however, cysts can occasionally recur or the cat may develop new lesions.

3 Scabies

Canine scabies (ie, sarcoptic mange) is caused by the mite *Sarcoptes scabiei* subsp *canis* and may cause severe, nonseasonal pruritus in affected dogs. Scabies is spread through contact with other dogs or wildlife (eg, foxes, fox dens). In most cases, scabies affects the pinnal margins, with the pinnae being the first affected areas of the body.[6] Other commonly affected areas include elbows and hocks. Lesions on the pinnal margins are typically scaly, crusted, alopecic, and erythematous (***Figures 4*** and ***5***). Most dogs infected with scabies exhibit the pinnal–pedal response (ie, kicking of the pelvic limb in response to the pinnal margin being rubbed).[7]

Although a canine scabies diagnosis is typically made through superficial skin scrapings, it can be difficult to find mites, even when they are present and lesions are apparent. An acaricidal trial is recommended if no mites are found but scabies is still suspected; avermectins can be an effective treatment option. New acaricides in the isoxazoline class of parasiticides (eg, sarolaner, fluralaner, afoxolaner, lotilaner) are the current treatment of choice but are extra-label and not approved for scabies treatment. Drugs in the isoxazoline class act through selective inhibition of arthropod γ-aminobutyric acid and L-glutamate–gated chloride channels.[8-10] Medication should be administered according to normal recommendations for flea and tick control. All dogs in the household should be treated, and affected bedding should be washed in hot water or destroyed. Adjunct therapy with antihistamines, corticosteroids, or oclacitinib may be helpful in reducing pruritus associated with scabies, which is caused by a hypersensitivity reaction. Humans in the household exhibiting symptoms should seek advice from their physician.

4 Ear Margin Seborrhea

Ear margin seborrhea is a localized form of seborrhea that affects the pinnal margins in dogs. Dachshunds are predisposed to ear margin seborrhea, but it can also occur in other breeds (typically those with long, pendulous ears). Lesions start as scaly and adherent greasy casts that can progress and affect the entire ear margin (***Figure 6***). In severe cases, thick crusting with seborrheic debris and fissures can occur. Crusting and fissures can be painful and may result in shaking of the head and scratching, which can cause additional fissures and hemorrhage. Differential diagnoses include scabies, vasculitis, and sebaceous adenitis.

Ear margin seborrhea is not curable but can be controlled with various well-tolerated medications. Seborrheic shampoos that contain benzoyl peroxide, sulfur–salicylic acid, and/or phytosphingosine or ceramides are recommended. Affected areas can be bathed with these shampoos daily until resolution, then at a maintenance frequency. Weekly use of a topical blend of essential fatty acids may also be effective. It has been recommended that affected dogs not be allowed to sleep near forced-air heating ducts. Glucocorticoids may be administered if severe inflammation is present.[11]

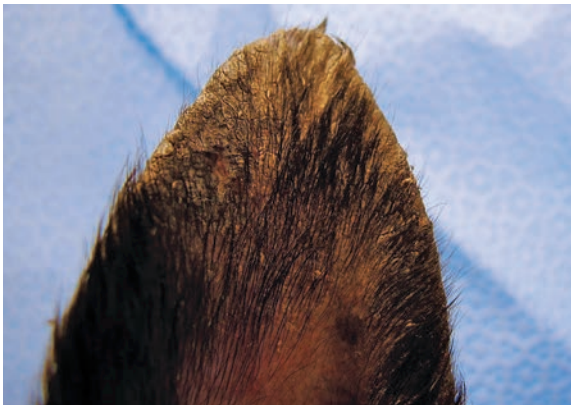
5 Sebaceous Adenitis

Sebaceous adenitis is an inflammatory disease of the sebaceous glands that causes destruction and loss of these glands. Although the cause and pathogenesis of the disease are not known, breed predisposition and occurrence in family lines suggest a possible genetic component. Sebaceous adenitis can occur in any breed but is seen most often in standard poodles, Akitas, Samoyeds, vizslas, and poodle crossbreeds.[12-14] Cats are rarely affected.

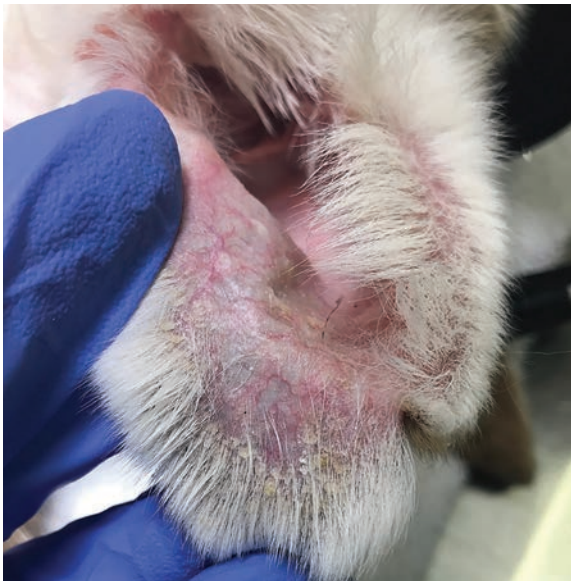
Sebaceous glands typically produce oils and other related substances that keep skin and hair moisturized and lubricated. Skin becomes dry and hair becomes brittle when these glands are missing.

Secondary bacterial infection can occur. Lesions can occur anywhere and are typically widespread; however, many affected dogs may initially have lesions only on the pinnal margins, and there have been cases limited to the pinnae.[13] Clinical signs include scaly alopecia with hair casting (ie, keratin debris adherent to hairs; ***Figure 7***). In cats, lesions typically start on the pinnae or face.

Continues ▶



▲ **FIGURE 6** Scaly and crusted hyperkeratotic adherent debris caused by ear margin seborrhea



▲ **FIGURE 7** Sebaceous adenitis causing scaly alopecia on the pinna

Diagnosis of sebaceous adenitis is typically made through skin biopsy and histopathology. Treatment includes topical and systemic therapies. Frequent bathing of the affected dog or cat with moisturizing, keratolytic shampoos is typically necessary. In more severe cases, soaking the dog or cat in diluted propylene glycol or diluted baby oil may be helpful and should be followed by bathing with keratolytic shampoos. Use of a topical blend of essential fatty acids on a weekly basis may also be effective. Cyclosporine is the only systemic treatment of choice shown to result in an increase in sebaceous glands along with clinical improvement.[15,16] Other treatment options include omega-3 and -6 fatty acids, vitamin A, and doxycycline or niacinamide.[12]

Conclusion

Numerous diseases affect the pinnae, including infectious, ectoparasitic, immune-mediated, and neoplastic diseases and keratinization disorders. The clinical conditions discussed here are not an exhaustive list but are common causes of changes to the pinnae.

POLL

Which of the following pinnal conditions do you see most often?

A. Vasculitis
B. Ceruminous cystadenomatosis
C. Scabies
D. Ear margin seborrhea
E. Sebaceous adenitis
F. Other

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.

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*Based on available peer-reviewed published studies.

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apoquel®
(oclacitinib tablet)

3.6 mg 5.4 mg 16 mg

Brief Summary of Prescribing Information

For oral use in dogs only

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

Indications: Control of pruritus associated with allergic dermatitis and control of atopic dermatitis in dogs at least 12 months of age.

Dosage and Administration: The dose of APOQUEL (oclacitinib maleate) tablets is 0.18 to 0.27 mg oclacitinib/lb (0.4 to 0.6 mg oclacitinib/kg) body weight, administered orally, twice daily for up to 14 days, and then administered once daily for maintenance therapy. APOQUEL may be administered with or without food.

Dosing Chart

Weight Range (in lb)		Weight Range (in Kg)		Number of Tablets to be Administered		
Low	High	Low	High	3.6 mg Tablets	5.4 mg Tablets	16 mg Tablets
6.6	9.9	3.0	4.4	**0.5**	-	-
10.0	14.9	4.5	5.9	-	**0.5**	-
15.0	19.9	6.0	8.9	**1**	-	-
20.0	29.9	9.0	13.4	-	**1**	-
30.0	44.9	13.5	19.9	-	-	**0.5**
45.0	59.9	20.0	26.9	-	**2**	-
60.0	89.9	27.0	39.9	-	-	**1**
90.0	129.9	40.0	54.9	-	-	**1.5**
130.0	175.9	55.0	80.0	-	-	**2**

Warnings:

APOQUEL is not for use in dogs less than 12 months of age (see **Animal Safety**).

APOQUEL is not for use in dogs with serious infections.

APOQUEL may increase susceptibility to infection, including demodicosis, and exacerbate neoplastic conditions (see **Adverse Reactions** and **Animal Safety**).

Human Warnings:

This product is not for human use. Keep this and all drugs out of reach of children. For use in dogs only. Wash hands immediately after handling the tablets. In case of accidental eye contact, flush immediately with water or saline for at least 15 minutes and then seek medical attention. In case of accidental ingestion, seek medical attention immediately.

Precautions:

APOQUEL is not for use in breeding dogs, or pregnant or lactating bitches.

The use of APOQUEL has not been evaluated in combination with glucocorticoids, cyclosporine, or other systemic immunosuppressive agents.

Dogs receiving APOQUEL should be monitored for the development of infections, including demodicosis, and neoplasia.

Adverse Reactions:

Control of Atopic Dermatitis

In a masked field study to assess the effectiveness and safety of oclacitinib for the control of atopic dermatitis in dogs, 152 dogs treated with APOQUEL and 147 dogs treated with placebo (vehicle control) were evaluated for safety. The majority of dogs in the placebo group withdrew from the 112-day study by Day 16. Adverse reactions reported (and percent of dogs affected) during Days 0-16 included diarrhea (4.6% APOQUEL, 3.4% placebo), vomiting (3.9% APOQUEL, 4.1% placebo), anorexia (2.6% APOQUEL, 0% placebo), new cutaneous or subcutaneous lump (2.6% APOQUEL, 2.7% placebo), and lethargy (2.0% APOQUEL, 1.4% placebo). In most cases, diarrhea, vomiting, anorexia, and lethargy spontaneously resolved with continued dosing. Dogs on APOQUEL had decreased leukocytes (neutrophil, eosinophil, and monocyte counts) and serum globulin, and increased cholesterol and lipase compared to the placebo group but group means remained within the normal range. Mean lymphocyte counts were transiently increased at Day 14 in the APOQUEL group.

Dogs that withdrew from the masked field study could enter an unmasked study where all dogs received APOQUEL. Between the masked and unmasked study, 283 dogs received at least one dose of APOQUEL. Of these 283 dogs, two dogs were withdrawn from study due to suspected treatment-related adverse reactions: one dog that had an intense flare-up of dermatitis and severe secondary pyoderma after 19 days of APOQUEL administration, and one dog that developed generalized demodicosis after 28 days of APOQUEL administration. Two other dogs on APOQUEL were withdrawn from study due to suspected or confirmed malignant neoplasia and subsequently euthanized, including one dog that developed signs associated with a heart base mass after 21 days of APOQUEL administration, and one dog that developed a Grade III mast cell tumor after 60 days of APOQUEL administration. One of the 147 dogs in the placebo group developed a Grade I mast cell tumor and was withdrawn from the masked study. Additional dogs receiving APOQUEL were hospitalized for diagnosis and treatment of pneumonia (one dog), transient bloody vomiting and stool (one dog), and cystitis with urolithiasis (one dog).

In the 283 dogs that received APOQUEL, the following additional clinical signs were reported after beginning APOQUEL (percentage of dogs with at least one report of the clinical sign as a non-pre-existing finding): pyoderma (12.0%), non-specified dermal lumps (12.0%), otitis (9.9%), vomiting (9.2%), diarrhea (6.0%), histiocytoma (3.9%), cystitis (3.5%), anorexia (3.2%), lethargy (2.8%), yeast skin infections (2.5%), pododermatitis (2.5%), lipoma (2.1%), polydipsia (1.4%), lymphadenopathy (1.1%), nausea (1.1%), increased appetite (1.1%), aggression (1.1%), and weight loss (0.7).

Control of Pruritus Associated with Allergic Dermatitis

In a masked field study to assess the effectiveness and safety of oclacitinib for the control of pruritus associated with allergic dermatitis in dogs, 216 dogs treated with APOQUEL and 220 dogs treated with placebo (vehicle control) were evaluated for safety. During the 30-day study, there were no fatalities and no adverse reactions requiring hospital care. Adverse reactions reported (and percent of dogs affected) during Days 0-7 included diarrhea (2.3% APOQUEL, 0.9% placebo), vomiting (2.3% APOQUEL, 1.8% placebo), lethargy (1.8% APOQUEL, 1.4% placebo), anorexia (1.4% APOQUEL, 0% placebo), and polydipsia (1.4% APOQUEL, 0% placebo). In most of these cases, signs spontaneously resolved with continued dosing. Five APOQUEL group dogs were withdrawn from study because of: darkening areas of skin and fur (1 dog); diarrhea (1 dog); fever, lethargy and cystitis (1 dog); an inflamed footpad and vomiting (1 dog); and diarrhea, vomiting, and lethargy (1 dog). Dogs in the APOQUEL group had a slight decrease in mean white blood cell counts (neutrophil, eosinophil, and monocyte counts) that remained within the normal reference range. Mean lymphocyte count for dogs in the APOQUEL group increased at Day 7, but returned to pretreatment levels by study end without a break in APOQUEL administration. Serum cholesterol increased in 25% of APOQUEL group dogs, but mean cholesterol remained within the reference range.

Continuation Field Study

After completing APOQUEL field studies, 239 dogs enrolled in an unmasked (no placebo control), continuation therapy study receiving APOQUEL for an unrestricted period of time. Mean time on this study was 372 days (range 1 to 610 days). Of these 239 dogs, one dog developed demodicosis following 273 days of APOQUEL administration. One dog developed dermal pigmented viral plaques following 266 days of APOQUEL administration. One dog developed a moderately severe bronchopneumonia after 272 days of APOQUEL administration; this infection resolved with antimicrobial treatment and temporary discontinuation of APOQUEL. One dog was euthanized after developing abdominal ascites and pleural effusion of unknown etiology after 450 days of APOQUEL administration. Six dogs were euthanized because of suspected malignant neoplasms: including thoracic metastatic, abdominal metastatic, splenic, frontal sinus, and intracranial neoplasms, and transitional cell carcinoma after 17, 120, 175, 49, 141, and 286 days of APOQUEL administration, respectively. Two dogs each developed a Grade II mast cell tumor after 52 and 91 days of APOQUEL administration, respectively. One dog developed low grade B-cell lymphoma after 392 days of APOQUEL administration. Two dogs each developed an apocrine gland adenocarcinoma (one dermal, one anal sac) after approximately 210 and 320 days of APOQUEL administration, respectively. One dog developed a low grade oral spindle cell sarcoma after 320 days of APOQUEL administration.

To report suspected adverse events, for technical assistance or to obtain a copy of the MSDS, contact Zoetis Inc. at 1-888-963-8471 or www.zoetis.com.

For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at http://www.fda.gov/AnimalVeterinary/SafetyHealth.

Storage Conditions:

APOQUEL should be stored at controlled room temperature between 20° to 25°C (68° to 77°F) with excursions between 15° to 40°C (59° to 104°F).

How Supplied:

APOQUEL tablets contain 3.6 mg, 5.4 mg, or 16 mg of oclacitinib as oclacitinib maleate per tablet. Each strength tablets are packaged in 20 and 100 count bottles. Each tablet is scored and marked with AQ and either an S, M, or L that correspond to the different tablet strengths on both sides.

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*Common side effects of steroids include polyuria, polydipsia and polyphagia.[4,5] Side effects of APOQUEL reported most often are vomiting and diarrhea.[6]

†Based on survey data from veterinarians (n=250) and pet owners (n=150).[2,3]

INDICATIONS

Control of pruritus associated with allergic dermatitis and control of atopic dermatitis in dogs at least 12 months of age.

IMPORTANT SAFETY INFORMATION

Do not use APOQUEL® (oclacitinib tablet) in dogs less than 12 months of age or those with serious infections. APOQUEL may increase the chances of developing serious infections, and may cause existing parasitic skin infestations or pre-existing cancers to get worse. APOQUEL has not been tested in dogs receiving some medications including some commonly used to treat skin conditions such as corticosteroids and cyclosporine. Do not use in breeding, pregnant, or lactating dogs. Most common side effects are vomiting and diarrhea. APOQUEL has been used safely with many common medications including parasiticides, antibiotics and vaccines.

For more information, please see Brief Summary of full Prescribing Information on adjacent page.

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ZOETIS PETCARE

Veterinary Cancer Society 2018 Conference

October 18-20, 2018
Louisville, Kentucky

The Potential Role of Traditional Chinese Herbal Medicine in Treating Canine Splenic Hemangiosarcoma

Canine splenic hemangiosarcoma (HSA) is an aggressive cancer with a high metastatic rate and poor prognosis, even when treated with surgery and chemotherapy. Median survival time (MST) for stage II HSA treated with surgery alone is 2 months; when chemotherapy is added, MST is 3.1 to 5.9 months. Overall 1- and 2-year survival rates with surgery and chemotherapy are 6% to 13% and 12% to 20%, respectively.

Considering the aggressiveness of this disease and minimal response rates with traditional therapy, novel and affordable treatments would be of benefit.

Many herbal medicines have demonstrated mechanisms of action relevant to the development and progression of canine malignancies. In the study described in this presentation, 14 patients with stage II HSA treated with surgery and traditional Chinese herbal medicine compounds were retrospectively evaluated; standard chemotherapy had been declined. MST for these patients was 8.7 months. One- and 2-year survival rates were 36% and 21%, respectively. Based on these results, a multi-institutional, prospective clinical trial evaluating the survival of dogs with stage II splenic HSA when treated with a standardized herbal therapy protocol following splenectomy is now underway.
—Bannink E, Marsden S

SAVE THE DATE

Veterinary Cancer Society 2019 Conference

October 17-19, 2019
Houston, Texas

Targeted Therapy for Feline Oral Squamous Cell Carcinoma

Although oral squamous cell carcinoma (OSCC) is the most common oral tumor in cats, effective treatments are lacking. In the study described in this presentation, investigators prospectively enrolled 18 cats with OSCC for a clinical trial in which the cats received a novel anticancer agent, isobutyl-deoxynyboquinone (IB-DNQ), and radiation therapy (RT). IB-DNQ is a cytotoxic agent that can target the enzyme NQO1, which is highly upregulated in patients with OSCC. The investigators had previously demonstrated IB-DNQ to have tolerability and anticancer effects in vivo in cats with OSCC; for this study, it was hypothesized that the combination of IB-DNQ and RT in treatment-naïve cats with OSCC would be tolerated by the patients and would exert measurable tumor activity. Weekly RT and IB-DNQ treatments were administered for 4 consecutive weeks, and serial CT scans were performed to quantify clinical response. This therapy combination was well-tolerated by all cats with minimal toxicity. Moderate anticancer activity was observed, with 27.7% of patients achieving partial remission, 50% remaining stable, and 22.2% experiencing progressive disease. Further study of this novel therapy is warranted in cats with OSCC.
—Lundberg A, Boudreau M, Samuelson J, et al

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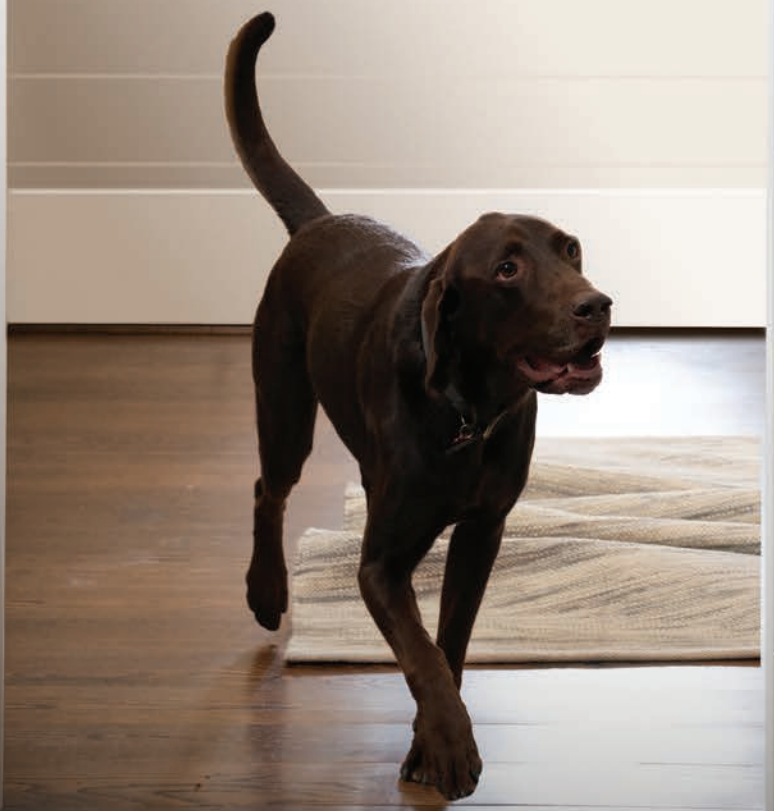


[1] Freedom of Information: NADA140-971 (January 15, 1993).

[2] Data on file at Boehringer Ingelheim.

[3] Data on file at Boehringer Ingelheim.

Boehringer Ingelheim

IMPORTANT SAFETY INFORMATION: HEARTGARD® Plus (ivermectin/pyrantel) is well tolerated. All dogs should be tested for heartworm infection before starting a preventive program. Following the use of HEARTGARD Plus, digestive and neurological side effects have rarely been reported. For more information, please see full prescribing information or visit www.HEARTGARD.com.

See page 25 for product information summary.

From Zero to Hero: Matching Your Patients with the Best Clinical Trial

Pet owners and clinicians may seek clinical trials for the opportunity to receive cutting-edge treatments, help guide future treatments in animals and humans, and receive subsidized care to offset the cost of promising new treatments. Oncologic clinical trials can target improved treatment options for animals with cancer but can also serve as proof-of-concept trials for human therapies, as dogs and cats can serve as models for human diseases, including osteosarcoma, oral squamous cell carcinoma, and lymphoma.

Clinical trials are divided into phases 0 through 4:

- **Phase 0:** Trials are for proof of concept and target validation and involve small numbers of animals.
- **Phase 1:** Trials are for determining the correct dose and schedule for a treatment that has not yet been used in a clinical patient. Pharmacokinetics of the drug are often determined in this phase as well.
- **Phase 2:** Trials may immediately follow or be combined with phase 1 trials to determine treatment efficacy. In oncology, phase 2 trials evaluate what types of cancer will respond or how well a specific cancer will respond to a new therapy.
- **Phase 3:** Trials compare a new treatment with standard treatments.
- **Phase 4:** Trials typically occur following FDA approval and compare 2 or more well-established treatment protocols. Phase 4 veterinary oncology trials are uncommon due to the lack of FDA-approved veterinary oncology drugs and the scarcity of well-established, standard-of-care treatment regimens. Phase 3 and 4 trials also evaluate chronic toxicity.

If enrollment in a clinical trial is being considered, referring clinicians should avoid certain diagnostic and therapeutic options, including excisional biopsies and corticosteroids. A searchable database of cancer clinical trials is available at vetcancertrials.org. *—Selting KA*

Weight Change in Patients with Multicentric Lymphoma Undergoing 15-Week CHOP Chemotherapy

Weight loss in cancer patients has been well-described in human medicine and has been attributed to hyporexia or alterations in patient metabolism or nutrient absorption caused by the disease itself or its treatment, but this weight loss has not been well-described in veterinary medicine.

In the study described in this presentation, the medical records of 104 dogs with lymphoma that underwent a 15-week CHOP protocol were evaluated. Body weight (BW) was recorded at the start of treatment and again at weeks 2, 4, and 8. Also examined were possible weight loss predictors and whether a change in BW could be linked to the progression free interval (PFI). Median BW loss was 2.1%, with 30 dogs losing 5% to 10% of their BW and 17 dogs experiencing >10% loss in BW. The remaining 57 dogs experienced either no significant weight change or had a >5% increase in BW. PFI was significantly longer in patients exhibiting 5% to 10% weight loss (258 days) but was significantly shorter (160 days) in dogs that gained >5% of BW. Predictors of weight loss included baseline BW and lymphoma clinical substage and immunophenotype. It was concluded that dogs experiencing mild weight loss during the first 8 weeks of chemotherapy may have a survival advantage. Future studies assessing GI-related adverse effects, body condition scoring, and objective evaluations of drug exposure may be of benefit.*—Fernandez M, Curran K, Thamm D*

Dogs experiencing mild weight loss during the first 8 weeks of chemotherapy may have a survival advantage.

Evaluation of the Potency & Accuracy of Compounded Toceranib Phosphate Formulations

Toceranib phosphate is a tyrosine kinase inhibitor approved by the FDA for use in dogs; however, limited tablet strengths of the proprietary brand and contraindications to splitting the tablets make dosing difficult for small patients.

In the study described in this presentation, investigators examined the potency and accuracy of toceranib in compounded form. Capsules (5 mg) and suspension (5 mg/mL) were obtained from 2 national veterinary compounding pharmacies (Pharmacy A and Pharmacy B); tablets (5 mg) were obtained from Pharmacy A. Formulations were ordered at 3 time points and quantitative analysis performed in triplicate. High-performance liquid chromatography was used to extract and measure toceranib concentration. Investigators found that measured potencies of the compounded samples were significantly lower than the requested strength. Average capsule strength was 76% and 93.3% of expected target strength for each from Pharmacy A and Pharmacy B, respectively, and mean suspension concentration was 32.9% and 45% of expected target strength. Mean tablet strength from pharmacy A was 45.9% of expected target strength. Overall, one out of 15 ordered lots was within a 90% to 110% range of label strength, whereas one was of greater strength and 13 were of lesser strength than indicated on the label. Such discrepancies could lead to underdosing. Further evaluation of the clinical utility and efficacy of compounded toceranib is needed.—*Marnin S, Berger D, Viall A, Schrunk D, Musser M, Johannes C*

TOP 5

TOP 5 POSTOPERATIVE ORTHOPEDIC REHABILITATION CONSIDERATIONS

Lisa Corti, DVM, DACVS, CCRP
North Shore Veterinary Surgery
Andover, Massachusetts
North Shore Community College
Danvers, Massachusetts

Orthopedic surgery and postoperative rehabilitation can maximize functional outcomes in patients. Orthopedic repair can help prevent permanent loss of limb function, and a well-designed postoperative rehabilitation program can help prevent complications that could permanently affect quality of life.[1,2] A multimodal approach involving surgical and rehabilitation teams can help achieve a successful outcome.[1,3]

TOP 5 POSTOPERATIVE ORTHOPEDIC REHABILITATION CONSIDERATIONS

1. Inflammation & Pain
2. Tissue Healing
3. Joint Range of Motion
4. Gait Retraining
5. Strength Training

Following are the author's top 5 considerations during postoperative orthopedic rehabilitation.

1 Inflammation & Pain

Administration of NSAIDs, based on their well-researched efficacy, is currently the standard treatment for postoperative orthopedic inflammation and pain.[4-7] The inflammatory phase of tissue healing typically occurs the first 3 to 5 days after injury[8]; however, edema, swelling, and pain from orthopedic surgery can last much longer. Thus, it is recommended that the duration of NSAID administration be determined on a case-by-case basis and NSAIDs be prescribed until suture removal when the patient can be reassessed and a decision made whether NSAID administration should be continued.[5-7]

▲ **FIGURE 1** Cryotherapy via a commercial canvas ice pack applied to the stifle of a dog. The ice pack is wrapped around the entire stifle, not just the lateral side. The contralateral limb is protected with a blanket.

In dogs and cats, a liposomal encapsulated bupivacaine formula infused into the surgical incision at the time of closure can help prevent proinflammatory cytokines from stimulating peripheral nociceptors, which may block transmission of pain for 72 hours.[9] In humans, peripheral nerve blocks have been shown to provide better postoperative analgesia, promote earlier mobilization, and have a positive influence on surgical and rehabilitation outcomes.[10,11] Peripheral nerve blocks can also improve a patient's ability to tolerate manual rehabilitation therapies in the immediate postoperative period.[11,12] Although peripheral nerve blocks have not yet been investigated for this purpose in veterinary medicine, the same benefit is likely to be seen in dogs and cats.

Cryotherapy uses cold temperatures to decrease inflammation and pain at the surgery site. Lowering tissue temperature can slow the metabolic rate of traumatized tissue, induce vasoconstriction, decrease sensory nerve conduction, decrease proinflammatory cytokine concentrations, and downregulate muscle excitability.[3,13,14] The result is typically less inflammation and tissue damage, decreased edema and swelling, and reduced muscle spasms and pain levels.[3,13] A cold pack made of a bag of ice or frozen vegetables wrapped in a thin towel or pillowcase, a commercial canvas ice pack (***Figure 1***), or a commercial cold pack that uses Velcro to fasten around the patient's limbs and joints may be applied. The cold pack should be large enough to cover the entire surgical site, not just the incision; an application regimen of 10 to 30 minutes per session with an interval of 6 hours between sessions is recommended.[3,13,14] Some cryotherapy devices can also apply compression, which improves contact between the cold source and the affected area on the patient. Improvements in pain scores, lameness scores, and stifle joint range of motion were noted when a pneumatic cold compression wrap was used around the

stifle in dogs during the first 24 hours after tibial plateau-leveling osteotomy.[3]

2 Tissue Healing

Laser therapy (ie, photobiomodulation therapy [PBMT]) exposes tissue to electromagnetic radiation in a certain spectrum of light, leading to changes in electron and proton transfer that have biologic effects.[15,16] These effects may include activation and production of growth factors, stimulation of cell growth and stem cell differentiation, promotion of vasodilation, angiogenesis, fibroblast proliferation, and epithelialization, with an overall acceleration in tissue healing.[16,17] There is no standard dose or frequency recommended in veterinary medicine for PBMT. Doses using class 3B or class 4 lasers from 4 to 6 J/cm^2 to 8 to 10 J/cm^2 have been recommended by practitioners with experience in this field.[15,18] In the acute postoperative period, daily administration of PBMT may be recommended with a greater interval between treatments as healing progresses.[15,18]

Massage has mechanical and physiologic effects that can aid in tissue healing during the postoperative period.[19,20] Massage creates pressure differentials in which high-pressure areas increase venous and lymphatic outflow and low-pressure areas have an influx of new fluid. This flushing effect may enhance circulation, nutrient delivery, and waste removal and may decrease inflammation, pain, swelling, and edema.[13,21] Deposition of scar tissue can also be minimized, as massage loosens muscles and tendons and enhances movement between tissue layers.[20] A massage may be started immediately postoperation, with initial sessions performed with greater frequency and shorter duration. Several massage techniques exist, and there are many specialists certified in veterinary rehabilitation or massage.

Protected weight-bearing in the early stages after orthopedic surgery is an essential component of rehabilitation. In human medicine, no other technique has been shown to aid in the proper healing of injured bone, fibrous tissue, and muscle more than controlled physical activities.[22] When a force or load is applied to connective tissue early after surgery, it causes increases in circulation and matrix synthesis that result in repair and remodeling of that tissue.[22,23] Without the application of early controlled loading, the tissue would, at best, heal in a disorganized manner and, at worst, not heal at all.[22-24] Dogs can be taken on a slow, controlled outdoor leash walk, with or without a sling or harness, or led to walk on an underwater treadmill. Cats can be encouraged to walk by placing trails of kibble on the floor, dividing meals into 3 to 4 separate food bowls placed around a room, or dragging a feather wand slowly across the floor. As tissue healing progresses and the patient improves clinically, the duration, frequency, and speed of walks or activity can be increased.[24] It is generally safe to increase the amount of activity by 10% to 15% per week if the patient remains comfortable and the surgery site is not compromised.[24]

3 Joint Range of Motion

Passive range of motion (PROM) therapy involves movement of a joint with no muscle contraction and is commonly used in the early postoperative period to decrease pain and scar tissue formation, restore joint pliability, maintain flow and health of synovial fluid, and prevent muscle contracture.[23,25,26] Patients are typically maintained in lateral recumbency with the affected limb pointed up. The joint to be manipulated is isolated, then passed slowly, gently, and continuously into flexion and extension while a range of motion that is comfortable for the patient is maintained.

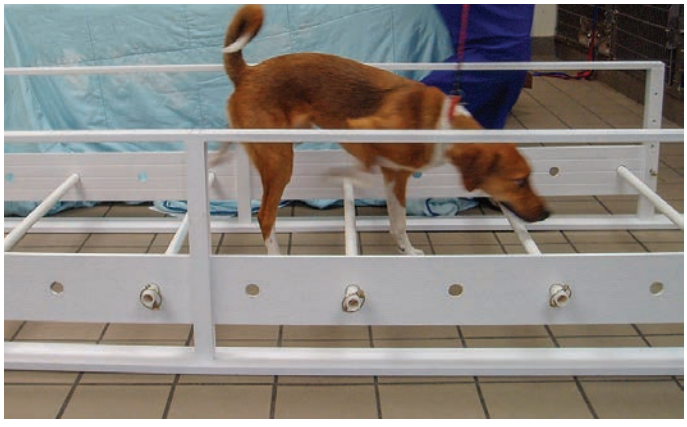
PROM therapy can be stopped once the patient is able to consistently bear weight on the affected limb and undergo active range of motion (AROM) therapy. Techniques that enhance AROM include assisted or independent leash walks, underwater

AROM = active range of motion
PBMT = photobiomodulation therapy
PROM = passive range of motion

treadmill therapy,[27,28] and use of stairs and ramps[29] and cavalletti rails (***Figure 2***).[30] Swimming may improve AROM and, in postoperative cranial cruciate surgery patients, has been shown to result in greater range of motion in the stifle and tarsal joints as compared with walking[31]; however, this increase in range of motion is attributed to an increase in joint flexion.[31] Because diminished joint extension is a common finding in both pre- and postoperative orthopedic patients, underwater treadmill therapy may be more effective in restoring joint extension than swimming.[28] Underwater treadmill therapy can be tailored to the individual needs of the patient through alterations in water depth, belt speed, and activity duration and can begin as soon as the patient's incision is healed.

4 Gait Retraining

In gait retraining (ie, neuromuscular rehabilitation), certain exercises are performed to stimulate reconnection between injured skeletal muscles and neurons. This typically results in limbs being retrained to function as they did prior to surgery.[32,33] Exercise performed during muscle reinnervation stimulates the healing of injured and atrophied motor pathways, improves recovery of the neuromuscular response, restores neuromuscular feedback systems at peripheral and central levels, and accelerates recovery of the affected limb.[32,33] These exercises are designed to challenge the patient's balance and stimulate proprioception and may consist of the patient participating in underwater treadmill therapy; walking on and off different surfaces (eg, grass, pavement, dirt, leaves); navigating a makeshift obstacle course made of objects varying in height and length; walking through, over, and around cavalletti rails, caution cones, or tires; undergoing instability training on a wobble board; and/or standing on a physioroll (***Figure 3***). Additional exercises can include the therapist walking while holding the patient's thoracic limbs in a "dance" position or walking while holding the patient's pelvic limbs in a "wheelbarrow" position (***Figure 4***).



▲ **FIGURE 2** A dog walking over cavalletti rails. The left thoracic limb and right pelvic limb are fully extended, whereas the right thoracic limb and left pelvic limb are hyperflexed. Navigating cavalletti rails is a versatile activity in which changes in distance between and the height of the rails boost AROM, gait retraining, and strength training. This dog is also engaging and strengthening core muscles.

AROM = active range of motion

5 Strength Training

Strength training involves repetitive use of exercises that challenge muscles to contract against greater mechanical resistance.[34,35] This should increase the patient's muscle mass and strength and help the patient regain previous levels of muscle and limb function.[34] Techniques used to increase the effort with which the limbs have to work may include decreasing the water depth in an underwater treadmill and increasing the speed at which the treadmill belt rotates.[30] Similar techniques can be applied to land exercises: Increasing walking speed or jogging increases the impact on the force applied to limbs, and dogs can be trained to wear small leg weights; dogs can be encouraged to pull a sled with weights gradually added over time; poles can be raised during cavalletti training; walking pace can be increased during "dancing" and/or "wheelbarrowing"; and walking up and down steeper inclines can improve strength. Having the patient perform repetitive sit-to-stand exercises, which

engage the hip and pelvic limb muscles, and down-to-stand exercises, which engage the thoracic and pelvic limbs, can strengthen specific muscle groups.

Strengthening Core Muscles

The need for strong abdominal and lower back muscles (ie, a strong core) is emphasized in humans, as a strong core improves the ability for physical activity.[35,36] Although it may be more difficult, working on core strength in dogs and cats should not be overlooked. Having a patient stand on an unstable platform (eg, wobble boards, Bosu balls, physiorolls) can encourage engagement of the patient's core muscles while the patient tries to maintain balance and avoid falling.[30] The patient's abdomen can be scratched or tickled while it stands on a moving wobble board to promote further contraction of the core muscles.[37] Both dogs and cats can be trained to roll over on command. Rolling requires significant core strength; patients can be encouraged to repeat this activity during timed sessions.[30] Patients can be made to stand with 2 paws up for a specified amount of time and a given frequency while the therapist holds a thoracic limb and the contralateral pelvic limb off the ground.[37] Standing on 2 limbs in this manner stimulates contraction of the abdominal wall, back, and upper limbs and may aid in strengthening core muscles.

Conclusion

Postoperative physical rehabilitation is an important component in the treatment of surgical orthopedic conditions in dogs and cats. Although there is a need for more high-quality scientific research in veterinary medicine, strong evidence-based research in human medicine can be used for rehabilitative methods in dogs and cats. Methods that treat inflammation and pain, promote tissue healing, enhance joint range of motion, support gait retraining, and improve muscle strength should be considered for any postoperative orthopedic rehabilitation program.

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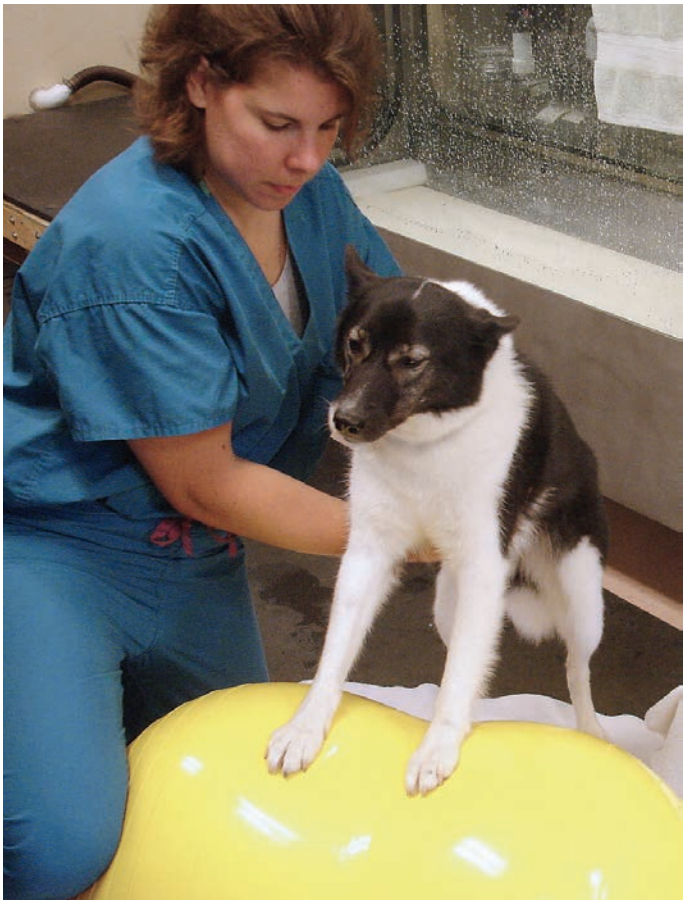
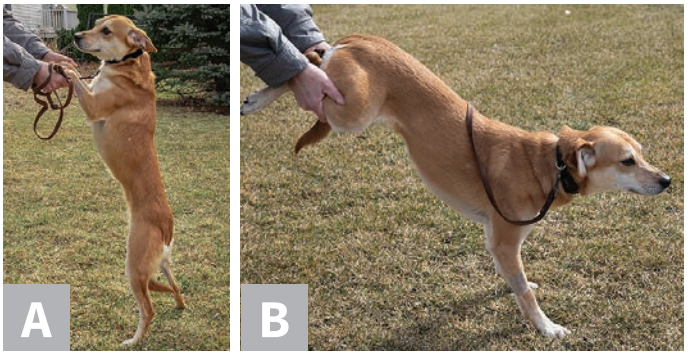


▲ **FIGURE 3** A dog being held with its thoracic limbs on an unstable physioroll. Simultaneous gait retraining and strength training occur while the patient also engages core muscles.



▲ **FIGURE 4** A therapist walks while holding a dog's thoracic limbs in a "dancing" position (***A***) and with a dog's pelvic limbs held in a "wheelbarrow" position (***B***). These exercises are used for gait retraining that also strengthens specific muscle groups in the limbs.

POLL

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D. I refer my patients to a rehabilitative center.

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Continues on page 72

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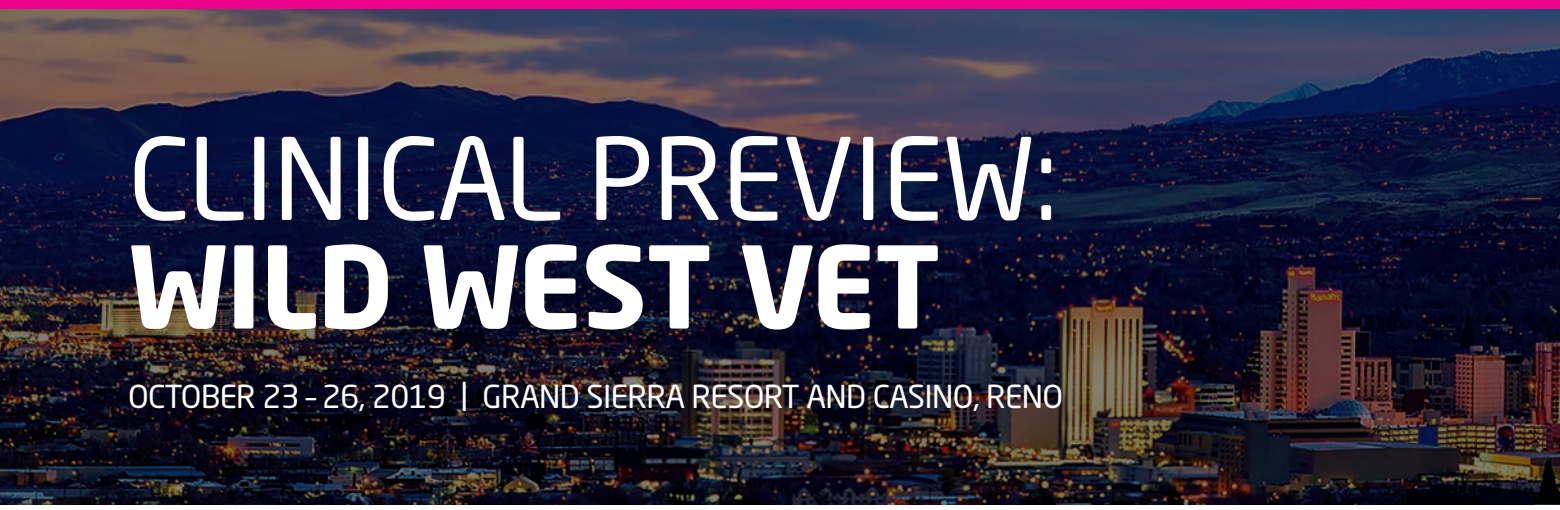

CLINICAL PREVIEW: WILD WEST VET

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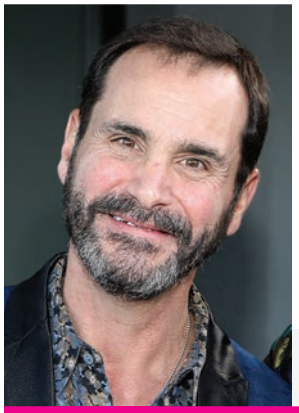
When Loving Hurts: Caregiver Burden & Relief

Assessing the quality of life of a family pet is a delicate balance between managing client emotions, the progression of the disease, and the happiness of the pet. Though key issues are not always in harmony, the veterinary team must balance each party's interests with the natural progression of disease. Learn how to help pet owners make the best decisions with fewer regrets.

Mary Gardner, DVM, is cofounder and chief innovation officer of Lap of Love Veterinary Hospice. Her professional goal is to increase awareness of and medical care for the geriatric veterinary patient and to help make the final life stage as peaceful as possible.

At Wild West Vet, she will be sharing her tips for staying sane in the veterinary practice as well as insight into assessing quality of life and managing veterinary hospice and palliative care.

Business Theater | Crystal 1-2 | Wednesday, October 23 | See full program for session time.



Dermatology or Ophthalmology? The Eyelid Margin Wars

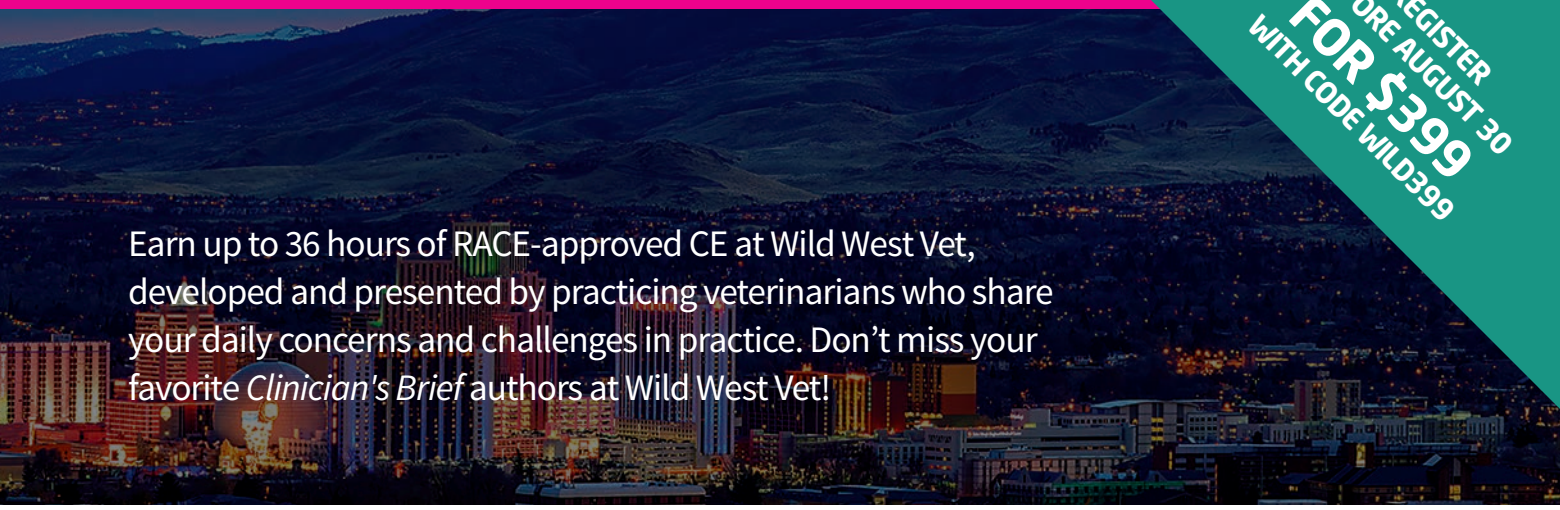
Drugs or surgery? Ophthalmoscope or hand lens? Diseases of the eyelid are frequently thought to be an extension of ocular disease, but often, there is no ocular disease, and medical evaluation of the skin disease is required. Is it a dermatology problem or an ophthalmology case? Review the basic anatomy of the eyelid, and explore a pictorial overview of the common diseases affecting the eyelids and the eyelid margins.

Alexander Werner Resnick, VMD, DAVCD, is the editor of the dermatology section of the *5-Minute Veterinary Consult* textbook and coauthor of the second and third editions of *Small Animal Dermatology Clinical Companion.* He practices at the Animal Dermatology Center in Studio City and Westlake Village, California, and Reno, Nevada.

At Wild West Vet, he'll be speaking on dermatology versus ophthalmology as well as cutaneous drug interactions and common food allergy myths.

Clinical Theater 1 | Tahoe Room | Friday, October 25 | See full program for session time.

See the full program and register at wildwest.vetshow.com.



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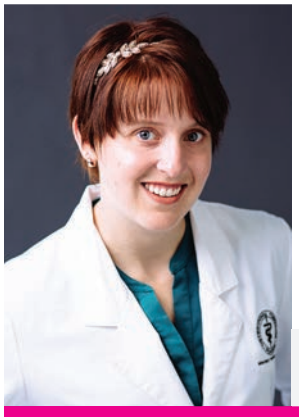
It's Complicated: Anesthetizing Patients With Heart Disease

Explore examples from a variety of cases to determine best practices for anesthesia management of common acquired cardiac diseases in dogs and cats. Plus, consider anesthetic management of congenital diseases.

Khursheed Mama, DVM, DACVAA, is professor of anesthesiology at Colorado State University. She earned her DVM from Washington State University and completed an internship in large animal medicine and surgery at University of Guelph and a residency in anesthesiology and critical patient care at University of California, Davis. Her interests are improving anesthetic safety and appropriate treatment of perioperative pain in veterinary patients.

At Wild West Vet, she will explore anesthesia management and share sedation protocols and alternatives for perioperative pain management.

Clinical Theater 2 | Carson 1-2 | Wednesday, October 23 | See full program for session time.



In-House Compounding: Do's & Don'ts in General Practice

Compounded medications are often necessary for providing medications in a dosage form and strength appropriate for each patient. However, news reports make it clear that compounding comes with many risks. Discover the basic requirements and standards for compounded medications, as well as ways to decrease risk when using compounded medications.

Lauren Eichstadt Forsythe, PharmD, DICVP, FSVHP, veterinary clinical pharmacist at University of California, Davis, enjoys teaching both pharmacy and veterinary students and is active in providing CE to both professions. Her research interests include the safety and efficacy of compounded products and behavioral medications.

At Wild West Vet, she will be covering the ins and outs of compounding as well as tips for communication between pharmacists and veterinarians.

Clinical Theater 1 | Tahoe Room | Friday, October 25 | See full program for session time.

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Basophilia

Julie Allen, BVMS, MS, MRCVS, DACVIM (SAIM), DACVP
Cornell University

FOR MORE
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- Eosinophilia
- Increased & Decreased Blood Urea Nitrogen
- Hypokalemia
- Hyperkalemia
- Increased & Decreased Creatinine
- Neutropenia
- Panting
- Hypercholesterolemia
- Hypocholesterolemia
- Hypoalbuminemia
- Increased Total Thyroxine
- Decreased Total Thyroxine
- Hypoglycemia
- Epistaxis
- Regurgitation

Following are differential diagnoses, listed in order of likelihood, for patients presented with basophilia. Of note, because basophilia is typically seen in association with eosinophilia, many of the differentials are associated more with eosinophilia. Basophilia alone is rare and, when noted, is often a paraneoplastic phenomenon.

- Parasitism (eg, *Dirofilaria immitis*, *Acanthocheilonema reconditum*, *Aelurostrongylus abstrusus*, *Angiostrongylus vasorum*, ticks)
- Hypersensitivity/allergic disease
- Idiopathic hypereosinophilic syndromes (eg, eosinophilic bronchopneumopathy)
- Paraneoplastic cause
  - Lymphoma
  - Mast cell neoplasia
  - Chronic myeloid leukemia
  - Essential thrombocythemia
  - Polycythemia vera
  - Miscellaneous tumors (eg, primary hepatic chondroblastic osteosarcoma in a cat)
- Basophilic leukemia
- Drug reaction
  - Heparin
  - Penicillin

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Stress management

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Diabetes mellitus

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Heart disease

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Liver disease
Convalescence

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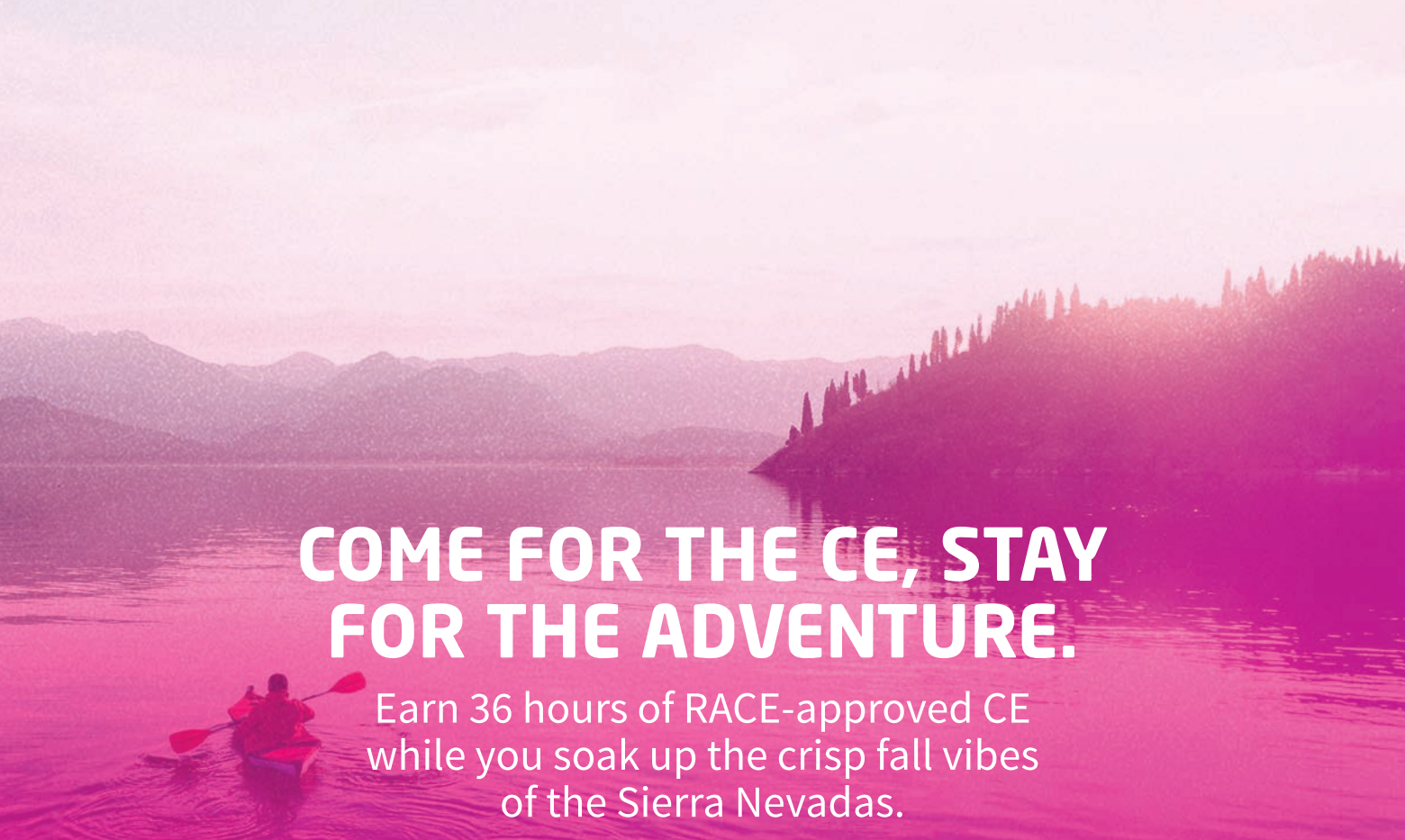
*Houston DM, et al. *Can Vet J* 2016; 57: 196–201.
*Houston DM, et al. *Can Vet J* 2017; 58: 45–50.



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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.

IMMITICIDE® STERILE POWDER (MELARSOMINE DIHYDROCHLORIDE)
Brief Summary: Before Using IMMITICIDE, please consult the product insert, a summary of which follows.

CAUTION
Federal law restricts this drug to use by or on the order of a licensed veterinarian.

WARNING
IMMITICIDE should be administered by deep intramuscular injection in the lumbar (epaxial) muscles (between L3 - L5) ONLY.
DO NOT USE IN ANY OTHER MUSCLE GROUP. DO NOT USE INTRAVENOUSLY.
Care should be taken to avoid superficial injection or leakage. (See SAFETY).

INDICATIONS
IMMITICIDE Sterile Power is indicated for the treatment of stabilized Class 1, 2, and 3 heartworm disease caused by immature (4-month-old, stage L5) to mature adult infections of *Dirofilaria immitis* in dogs. See full package insert for Heartworm Disease Classification.

CONTRAINDICATIONS
IMMITICIDE is contraindicated in dogs with very severe (Class 4) heartworm disease. Patients in this category have Caval Syndrome (*D. immitis* present in the venae cavae and right atrium).

WARNINGS
(See boxed Warning). For use in dogs only. Safety for use in breeding animals and lactating or pregnant bitches has not been determined.

HUMAN WARNINGS
Keep this and all medications out of the reach of children. Avoid human exposure. Wash hands thoroughly after use or wear gloves. Potentially irritating to eyes. Rinse eyes with copious amounts of water if exposed. Consult a physician in cases of accidental exposure by any route (dermal, oral, or by injection).

PRECAUTIONS
Dogs with heartworm disease are at risk for post-treatment pulmonary thromboembolism (death of worms which may result in fever, weakness, and coughing). Dogs with severe pulmonary arterial disease have an increased risk and may exhibit more severe signs (dyspnea, hemoptysis, right heart failure and possibly death). Dogs should be restricted from exercise after treatment. Studies indicate that adverse reactions may occur after the second injection in the series even if no problems were encountered with the first injection. All patients should be closely monitored during treatment and for up to 24 hours after the last injection.

Special Considerations for Class 3 dogs: Following stabilization, severely ill (Class 3) dogs should be treated according to the alternate dosing regime in an attempt to decrease post-treatment mortality associated with thromboembolism. Post-treatment mortality due to thromboembolism and/or progression of the underlying disease may occur in 10 to 20% of the Class 3 patients treated with IMMITICIDE. Hospitalization post-treatment and strict exercise restriction are recommended. If the alternate dosing regime is used, expect increased injection site reactions on the side receiving the second injection since the skeletal muscles at the first injection site may not have fully recovered (healed). If persistent swelling is present at 1 month, the second injections may be delayed for several weeks up to 1 month.

Special Considerations for Older Dogs: In clinical field trials, dogs 8 years or older experienced more post-treatment depression/lethargy, anorexia/inappetence, and vomiting than younger dogs.

DOSAGE AND ADMINISTRATION
Care must be taken to administer the proper dose deep into epaxial muscles ONLY (see boxed WARNING). Accurately weigh the dog and calculate the volume to be injected based on the dose of 2.5 mg/kg (1.1 mg/lb). This is equivalent to 0.1 mL/kg (0.045 mL/lb). See full product insert for dosing table. Use a 23 gauge 1 inch needle for dogs equal to or less than 10 kg (22 lb) in weight. Use a 22 gauge 1 ½ inch needle for dogs greater than 10 kg (22 lb). Use alternating sides with each administration and avoid injecting at the same lumbar location.

Disease Classification: It is vital to classify the severity of heartworm disease to apply the appropriate dosage regime for IMMITICIDE. See full product insert for Heartworm Disease Classification criteria.
Class 1 and 2: IMMITICIDE should be given in two intramuscular injections of 2.5 mg/kg, 24 hours apart. Four months following treatment, a second treatment series (2.5 mg/kg twice, 24 hours apart) can be elected.
Class 3: Alternate Dosing Regime: Dogs with severe (Class 3) heartworm disease should be stabilized prior to treatment and then dosed intramuscularly in the lumbar (L3 - L5) muscles with a single injection of 2.5 mg/kg then approximately 1 month later with 2.5 mg/kg administered twice, 24 hours apart.

SAFETY
IMMITICIDE has a low margin of safety. A single dose of 7.5 mg/kg (3X the recommended dose) can result in pulmonary inflammation, edema, and death. Symptoms of overdose (2x recommended dose) may include excessive salivation, panting, restlessness, fever, vomiting and diarrhea. These symptoms were seen in the clinical trials and all signs resolved within 24 hours. Symptoms of up to 3x the recommended dose included tremors, lethargy, unsteadiness, restlessness, panting, shallow and labored breathing, pulmonary inflammation, edema, and vomiting which progressed to respiratory distress, collapse, and death. Daily administration of 2X and 3X the recommended dose for 14 days caused renal damage in healthy dogs.

In Case of Overdosage:
BAL in Oil Ampules (Dimercaprol Injection, USP) [Akorn, San Clemente, California, at 1-800-223-9851] is reported in the literature to be an antidote for arsenic toxicity and was shown in one study to reduce the signs of toxicity associated with over-dosage of IMMITICIDE. The efficacy of IMMITICIDE may be reduced with co-administration of BAL.

ADVERSE REACTIONS (SIDE EFFECTS)
In clinical field trials, the most common reactions seen in dogs treated with IMMITICIDE were coughing/gagging, depression/lethargy, anorexia/inappetence, fever, lung congestion, and vomiting. Hypersalivation and panting occurred more rarely, however, these signs may occur within 30 minutes of injection and may be severe. Significant irritation was also observed at the intramuscular injection sites, accompanied by pain, swelling, tenderness, and reluctance to move. Generally, injection site reactions were mild to moderate in severity and recovery occurred in 1 week to 1 month, however, firm nodules can persist indefinitely. Avoid superficial or subcutaneous injection and leakage. Heartworm disease may cause death in dogs with or without treatment, especially in the Class 3 dogs.

Post Approval Experience: There have also been rare reports of paresis and paralysis in dogs following administration of IMMITICIDE.

The information provided here is not comprehensive.
The full FDA-approved product insert is available at http://www.merial.us/SiteCollectionDocuments/Immiticide_PI_8.5x11_version.pdf. Consult your veterinarian for further information. For technical assistance, to request a Safety Data Sheet or to report suspected adverse events, call 1-888-637-4251. For additional information about adverse event reporting for animal drugs, contact FDA at 1-888-FDA-VETS, or http://www.fda.gov/AnimalVeterinary.

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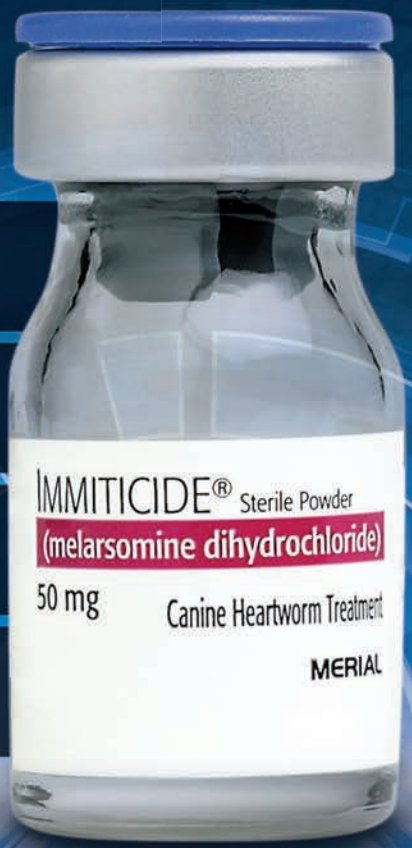

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IMMITICIDE®
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IMPORTANT SAFETY INFORMATION: IMMITICIDE should not be used in dogs with very severe (Class 4) heartworm disease. IMMITICIDE should be administered by deep intramuscular injection in the lumbar (epaxial) muscles (L3–L5) only. Do not use in any other muscle group. Do not use intravenously. Care should be taken to avoid superficial injection or leakage. Serious adverse reactions may occur in any dog with heartworm disease due to the killing of heartworms in the pulmonary arteries. Reactions may include thromboembolism, dyspnea, coughing, depression, right side heart failure, and death. Dogs should be cage rested following treatment due to possible thromboembolic disease. Post-injection site reactions (eg, pain, swelling) were the most commonly reported adverse events. See full prescribing information for dosing and administration directions prior to each use of IMMITICIDE.

For more information, please see full prescribing information on page 40.

Boehringer Ingelheim

18625

Research Note: **Luteinizing Hormone in Intact vs Neutered Cats**

This study* tested the accuracy of a commercial point-of-care luteinizing hormone (LH) test in differentiating intact versus neutered cats. Spayed or neutered animals typically have higher LH levels than intact animals, as negative feedback from gonadal sex hormones on the pituitary and hypothalamus has been removed. Serum LH was evaluated in intact female ($n = 87$), spayed female ($n = 129$), intact male ($n = 19$), and neutered male ($n = 34$) cats. Overall sensitivity and specificity were 89.3% and 92.6%, respectively. Overall accuracy was 91.1%, although the LH surge at the onset of estrus may cause false-positive results in intact females. The commercial point-of-care LH test may be a useful adjunct to patient history and physical examination for determining reproductive status in cats.

*Zoetis supplied the Witness LH tests and, at the time of this study, paid the salary of MR Krecic.

Source

Krecic MR, DiGangi BA, Griffin B. Accuracy of a point-of-care luteinizing hormone test for help in distinguishing between sexually intact and ovariectomized or castrated domestic cats. *J Feline Med Surg*. 2018;20(10):955-961.

Research Note: **Concurrent Administration & Pharmacokinetics of Extended-Release Levetiracetam**

This study evaluated the pharmacokinetics of extended-release levetiracetam administered as a single agent or concurrently with phenobarbital or zonisamide in epileptic dogs. Results indicated that concurrent administration with phenobarbital led to variability in pharmacokinetics of extended-release levetiracetam, an effect that was not noted with zonisamide. The authors noted that higher doses of extended-release levetiracetam may be needed in some dogs to achieve concentrations considered therapeutic in humans and that drug monitoring may help to determine the optimal dose in individual patients.

Source

Muñana KR, Otamendi AJ, Nettifee JA, Papich MG. Population pharmacokinetics of extended-release levetiracetam in epileptic dogs when administered alone, with phenobarbital or zonisamide. *J Vet Intern Med*. 2018;32(5):1677-1683.

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[1] Zollers B, Huebner M, Armintrout G, Rausch-Derra LC, Rhodes L. Evaluation of the safety in dogs of long-term, daily oral administration of capromorelin, a novel drug for stimulation of appetite. *J Vet Pharmacol Ther.* 2017 Jun;40(3):248-255. doi: 10.1111/jvp.12358. Epub 2016 Sep 25.

IMPORTANT SAFETY INFORMATION: ENTYCE® (capromorelin oral solution) is for use in dogs only. Do not use in breeding, pregnant or lactating dogs. Use with caution in dogs with hepatic dysfunction or renal insufficiency. Adverse reactions in dogs may include diarrhea, vomiting, polydipsia, and hypersalivation. Should not be used in dogs that have a hypersensitivity to capromorelin. Please see the full Prescribing Information on page 42 for more detail.

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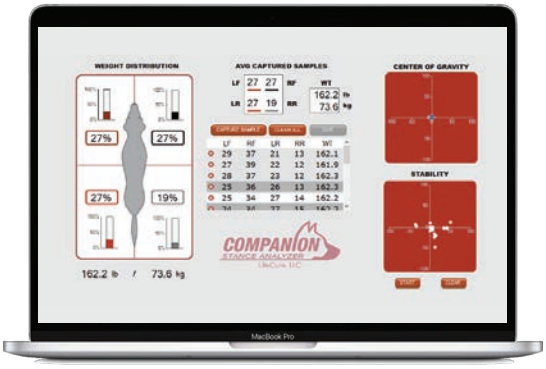

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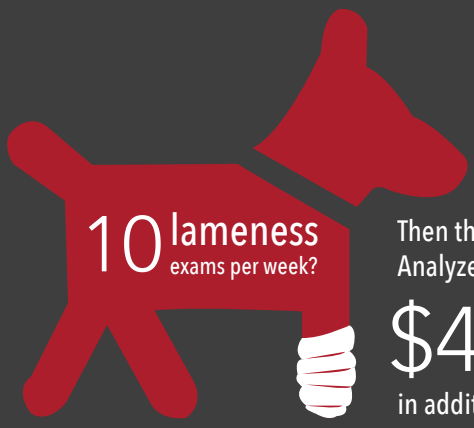

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COMPANION ANIMAL HEALTH

ADVERTORIAL

The Use of Stance Analysis in Early Lameness Detection for General Practitioners

Heather Owen, DVM, MAV, CCRP

Many patients, whether coming in for a musculoskeletal examination or wellness visit, may experience subtle lameness that can be difficult to pinpoint through visual observation alone. Pets often do not show symptoms, and pet owners can be hesitant to move forward with workups for hidden, unquantifiable conditions.

A Stance Analyzer, when used appropriately, can become an important part of early orthopedic disease detection. Stance analysis involves measuring the weight distribution of a patient at a stance; using a Stance Analyzer instead of a traditional scale allows body weight to be obtained simultaneously. A compact and sensitive tool for lameness detection, the Stance Analyzer does not require the additional space or cost of more expensive diagnostic tools.

Stance analysis can be performed on any dog able to stand and enables the veterinarian to take a snapshot of the general orthopedic health of a patient. With this tool, the practitioner can easily detect lameness with patients earlier, leading to quicker intervention. Normal weight distribution in a dog is defined as 30% in each front limb, and 20% in each hind limb: 30/30/20/20 (LF/RF/LH/RH).

The veterinary teams in each of the following cases observed proper stance analysis data collection technique. A minimum of 15 weight distribution samples were obtained for each patient. Upper and lower extremes were discarded and the average of the remaining samples were stored and used to help evaluate the patient's ongoing progress.

Additional objective data assessed included each patient's physical examination, goniometry of joints, and measurement of thigh circumference. After stance analysis, each patient underwent further diagnostic testing, including radiography and musculoskeletal ultrasound to help definitively diagnose the cause of lameness.

CASE 1

A 7-year-old, male neutered border collie was presented after 3 months of unsuccessful medical management with NSAIDs for a shoulder injury sustained during an agility trial. The owner's goal was for the patient to run agility again. The patient's physical evaluation showed most prominently reduced extension of the right shoulder as compared with the left, as well as some changes in coxofemoral extension. It was unknown which limb the dog had originally injured.

The right biceps tendon was thickened with palpable right shoulder effusion. Stance analysis revealed a weight distribution of 40/24/20/16. Stance analysis indicated additional diagnostics to determine whether additional abnormalities were present. Musculoskeletal ultrasound revealed supraspinatus insertional tendinopathy, bicipital tenosynovitis, and inflamed joint capsule of the right shoulder. Radiographs obtained of the hips and stifles revealed bilateral coxofemoral degenerative joint disease, which had not been previously diagnosed.

Regenerative medicine using platelet rich plasma and hobbles were initiated, as well as an intense rehabilitation program, as arthroscopy or surgical repair of medial shoulder syndrome were not options for this patient. Objective measurements obtained every 2 weeks during rehabilitation revealed continued progression towards normal, as well as continued strength, flexibility, and control. At discharge from rehabilitation, the patient measured 34/28/20/18 on the Stance Analyzer.

CASE 2

A 16-week-old female spayed corgi was presented for a new puppy evaluation. Her owners had no concerns about gait or joints prior to presentation. On physical examination, the patient's hip joints had decreased range of motion with hip extension at 142 degrees left hind and 152 degrees right hind. A stance analysis revealed a weight distribution of 37/38/10/15.

Radiographs revealed bilateral coxofemoral joint subluxation. The patient was started on chondroprotectants and rehabilitation. The patient's final stance analysis was 25/37/13/25. Hip extension had improved to 163 degrees bilaterally. Now, at 4 years of age, the patient is able to compete in agility and obedience.

CONCLUSION

By including stance analysis as part of the annual examination and lameness evaluations, underlying orthopedic disease can be investigated and treated earlier, reducing morbidity among veterinary patients.

COMPANION ANIMAL HEALTH

Owner Understanding of Heartworm

Ray M. Kaplan, DVM, PhD, DACVM (Parasitology), DEVPC
University of Georgia

In the Literature

Ledesma NA, Kaufman PE, Xue RD, et al. Entomological and sociobehavioral components of heartworm (*Dirofilaria immitis*) infection in two Florida communities with a high or low prevalence of dogs with heartworm infection. *J Am Vet Med Assoc*. 2019;254(1):93-103.

FROM THE PAGE ...

Heartworm disease, caused by *Dirofilaria immitis* infection, is a common parasitic disease in dogs.[1] As a consequence of being transmitted by a mosquito intermediate host, heartworms have a complicated life cycle and epidemiology.[2] Heartworm cases continue to increase despite availability of highly effective drugs that can prevent infection; the American Heartworm Society reported that the average number of cases diagnosed by veterinary hospitals between 2013 and 2016 increased by 21.7%.[3]

This questionnaire-based study assessed the knowledge, attitudes, and practices regarding *D immitis* and mosquito vectors among residents with differing incomes and educational levels in 2 Florida communities. In addition, entomologic surveys of mosquito species were conducted in those communities to identify mosquito species distribution and *D immitis* infection rates.

Although the study sample size was small (n = 96 residents), thus limiting statistical interpretation, the results provided useful insights. Seventy-one percent of dogs reportedly received a heartworm preventive; only one owner administered a heartworm preventive to their cat. Among the pet owners not administering a heartworm preventive, cost was the least common reason cited. The top 3 reasons given for not administering a preventive were that the owner did not believe the pet was at risk, the owner did not consider the pet could be infected, and the owner did not know why they were not administering a preventive. These reasons may reflect the relatively poor understanding owners may have of the biology and risks for heartworm transmission; only 61% of dog-owning and 18% of non-dog–owning respondents knew that heartworms are transmitted by mosquitoes. Many respondents did not realize that yard vessels capable of holding water (eg, garden ornaments, plant pots, children's toys) can also serve as mosquito-breeding sites. Most pet-owning respondents claimed their veterinarian was their primary source for information regarding heartworm, suggesting that access to veterinary care may be a limiting factor for dispensation of heartworm information in these communities.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Pet owners should be encouraged to engage with opportunities to improve heartworm education, such as engaging in messaging throughout the year through various sources (eg, internet, television, published pamphlets).
2. Public messaging could be improved to emphasize the importance of mosquitoes as disease vectors and to motivate mosquito-reduction efforts. Given the number of potentially serious mosquito-borne diseases, this may have significant benefits beyond the control of *D immitis*.
3. Improved veterinarian–pet owner communication may help improve heartworm preventive compliance rates.

References

1. Bowman DD, Atkins CE. Heartworm biology, treatment, and control. *Vet Clin North Am Small Anim Pract*. 2009;39(6):1127-1158.
2. McCall JW, Genchi C, Kramer LH, Guerrero J, Venco L. Heartworm disease in animals and humans. *Adv Parasitol*. 2008;66:193-285.
3. Drake J, Wiseman S. Increasing incidence of *Dirofilaria immitis* in dogs in USA with focus on the southeast region 2013–2016. *Parasit Vectors*. 2018;11(1):39.

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[1] Data on file.
[2] Data on file.
[3] Data on file.

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Characteristics of Dogs with Biofilm-Forming *Escherichia coli* Urinary Tract Infections

Julie K. Byron, DVM, MS, DACVIM (SAIM)
The Ohio State University

In the Literature

Kern ZT, Jacob ME, Gilbertie JM, Vaden SL, Lyle SK. Characteristics of dogs with biofilm-forming *Escherichia coli* urinary tract infections. *J Vet Intern Med*. 2018;32(5):1645-1651.

FROM THE PAGE ...

Some strains of *Escherichia coli* have the ability to form biofilms, either in vivo or in vitro. Biofilm formation can lead to antibiotic resistance or tolerance and can be associated with complicated and/or recurrent UTIs in humans. The role of biofilms in UTIs in dogs, however, is not well-defined.

In this study of UTIs caused by *E coli* in dogs, 52.6% of the 78 *E coli* isolates tested had biofilm-forming capability. There were no differences in breed, age, sex, or body condition among dogs with biofilm-forming and non-biofilm–forming *E coli*, and presence of lower urinary tract signs was similar between groups (biofilm-forming, 34%; non-biofilm–forming, 32%). Although previous studies have typically shown associations between biofilm-forming bacteria and multidrug resistance, this study found biofilm-forming *E coli* to be less likely to exhibit multidrug resistance than were non-biofilm–forming *E coli*. It is important to note that susceptibility testing is performed on bacteria in a planktonic (vs biofilm) state, so antibiotic tolerance resulting from biofilm formation would not be included in a susceptibility report.

Results from this study did not address whether testing for biofilm-forming capability in *E coli* UTI cases is warranted or whether the presence of biofilm-forming *E coli* affects the patient's ability to clear infection. It is unknown whether *E coli* that form biofilms in laboratory settings also do so in patients. In addition, even if *E coli* do form biofilms in a patient, it is unknown whether this will impact antibiotic susceptibility in the patient. If there is difficulty in clearing a UTI, culture and susceptibility testing should be performed, as the bacteria may still be susceptible to less-restricted antibiotics (eg, amoxicillin–clavulanic acid, first-generation cephalosporin). This is also true of biofilms that may form on a urolith in the bladder. In cases in which the patient has an implant or urolith, both of which are not perfused with blood, bacteria may be protected in a biofilm from the action of antibiotics in the urine; thus, implant and/or urolith removal may be the best option.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Approximately half of *E coli* found in the urinary tract have the capability to form a biofilm.
2. The ability to form a biofilm does not necessarily mean the bacteria will be resistant to commonly used antibiotics.
3. Patients that may have an *E coli* biofilm on a urolith or urinary implant may require removal of the stone or replacement of the implant to eliminate the infection.

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QUARTERLY UPDATE
SUMMER 2019

AMERICAN HEARTWORM SOCIETY™
EST. 1974

LEADING THE FIGHT AGAINST HEARTWORM DISEASE

HEARTWORM TREATMENT

Heartworm Disease Causes Lifelong Damage

STEPHEN JONES, DVM
IMMEDIATE PAST PRESIDENT, AMERICAN HEARTWORM SOCIETY
LAKESIDE ANIMAL HOSPITAL
MONCKS CORNER, SOUTH CAROLINA

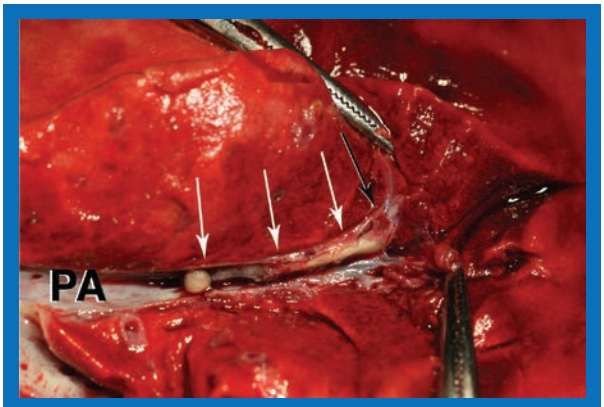
Q. You have studied the short- and long-term effects of heartworm disease in dogs in order to better understand the pathology it causes. What have you learned?

A. By conducting necropsies of experimentally infected dogs and documenting my findings, I've learned that heartworm disease actually begins long before clinical signs are evident—in fact, the damage to the pulmonary vasculature begins before heartworms can be diagnosed with standard antigen tests.

Once the worms reach their adult length of 10 to 12 inches, the larger pulmonary arteries are affected and the disease progresses, with the number of worms present, the duration of the infection, and the activity level of the dog all affecting disease severity. Given time, heartworm infection leads to a significant thickening of the pulmonary arteries, obstructive disease, perivascular inflammation and fibrosis, while natural, random worm death can cause dramatic embolic and inflammatory disease with significant acute and long-term consequences.

Q. While necessary, treatment of adult heartworms can present complications of its own. Can these complications be mitigated?

A. The American Heartworm Society (AHS) protocol recommends concurrent use of a a macrocyclic lactone, doxycycline, and a glucocorticoid to reduce the degree of embolic and inflammatory disease that typify complications of worm death. Restriction of a pet's activity is also a critical factor in treatment success. Exercise, overheating and excitement during treatment increase blood flow to blocked vessels, causing capillary delamination, rupture and fibrosis.



This image is from a dog treated for heartworms four years prior to necropsy. Within a small branch of the left caudal pulmonary artery (PA) is a luminal obstruction (white arrows) representing the linear remnants of dead heartworms and partial recanalization of the vessel. This vessel ends abruptly (black arrow) in complete obstruction and fibrosis.

While adulticide treatment can result in complications, it is important to eliminate adult heartworm infections as quickly as possible. The AHS protocol was designed to improve the condition of the patient, curtail disease progression and eliminate all stages of heartworms with minimal post-treatment complications.

Q. What should veterinarians take away from these findings?

A. The goal of heartworm treatment is to halt the progression of disease and to substantially resolve the acute disease over time. However, in my necropsy work, I have never seen a dog with a heartworm infection that didn't have heartworm disease—and I have never necropsied a dog treated for heartworms that did not have permanent damage, even when the infection occurred many years before. While many of these dogs remained clinically normal throughout their natural lives, evidence of mummified heartworms remnants along with vascular and pulmonary fibrosis on necropsy offer proof that at least some heartworm disease is lifelong.

It's important to understand that these observed permanent changes are not the result of adulticide treatment but, rather, a consequence of having had heartworms in the first place. The takeaway should be that year-round, lifelong prevention is one of the most important recommendations veterinarians can give to protect the lifelong health of their patients.

Transdermal Phenobarbital for Feline Idiopathic Epilepsy

JD Foster, VMD, DACVIM
Friendship Hospital for Animals
Washington, DC

In the Literature

Barnes Heller HL, Trepanier LA, Robertson M, Mei C. Prospective crossover clinical trial comparing transdermal with oral phenobarbital administration in epileptic cats. *J Feline Med Surg*. 2019:1098612X18823577.

FROM THE PAGE ...

Once recognized as an uncommon cause of seizures in cats, idiopathic epilepsy has become more commonly identified as the cause of recurrent seizures in 25% to 50% of cats, although intracranial disease, metabolic causes, infection, and toxicities should also be considered, as they are also common causes of seizures in cats.[1] Once a diagnosis of idiopathic epilepsy has been made, chronic antiepileptic therapy should be recommended if seizures occur more frequently than once every 12 to 16 weeks, cluster seizures (>1 seizure in a 24-hour period) occur, status epilepticus occurs, or seizure frequency increases.[2]

Phenobarbital is the recommended antiepileptic drug to treat cats with idiopathic epilepsy.[3] However, oral administration may be associated with adverse effects, poor pet owner compliance, and, in some patients, administration difficulties. Transdermal administration may be easier for some owners to perform, particularly those with noncompliant cats.

In this crossover pilot study, the authors administered oral phenobarbital to cats with idiopathic epilepsy for 14 weeks, then transitioned cats to transdermal phenobarbital for an additional 14 weeks. Therapeutic drug monitoring was performed, with a target serum phenobarbital concentration of 15 to 45 µg/mL. This therapeutic range was extrapolated from data on dogs, but other authors have recommended a lower target range for cats (ie, 20-30 µg/mL).[2] The dose of the transdermal formulation did not correlate with serum phenobarbital concentrations, suggesting inconsistent administration or bioavailability. Dose adjustments were more frequently needed in cats receiving transdermal phenobarbital as compared with oral phenobarbital. Six of 9 owners preferred transdermal administration, but both formulations were well-tolerated. Although it may require more dose adjustments and greater drug monitoring, transdermal phenobarbital may be an effective option in the management of epileptic cats, particularly when oral administration may be difficult.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Due to differences in absorption, it is recommended that transdermal phenobarbital be administered at a dose 3 times greater than the recommended dose of oral phenobarbital.
2. Monitoring of serum phenobarbital concentrations after 14 days of transdermal therapy is highly recommended to ensure the patient has obtained a therapeutic concentration, as serum concentration does not correlate with the transdermal phenobarbital dose.
3. Patients experiencing adverse effects (eg, sedation, ataxia) should have serum phenobarbital concentrations evaluated, as concentrations in these patients often exceed the therapeutic window. Dose reduction is recommended in these patients.

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Research Note: **Effects of Alfaxalone in Guinea Pigs**

Radiography is an important diagnostic tool in guinea pigs and frequently requires sedation; however, neither inhalational nor injectable anesthesia (ie, benzodiazepines, α_2 agonists, ketamine) have been shown to be optimal in terms of effectiveness, reliability, safety, and reversibility. This prospective study evaluated the use of intramuscular alfaxalone as a sedative for guinea pigs undergoing survey radiography. Thirty guinea pigs were administered alfaxalone (5 mg/kg IM), and physiologic variables were assessed. No respiratory depression or decreased temperatures were noted. Recoveries were uneventful. One disadvantage, however, was the lack of reversibility of effects, as no antagonist was available at the time of the study. Further studies are required to evaluate cardiovascular effects, use in unhealthy guinea pigs, and potential benefits of combining alfaxalone with other drugs for more invasive procedures.

Source

d'Ovidio D, Marino F, Noviello E, Lanaro E, Monticelli P, Adami C. Sedative effects of intramuscular alfaxalone in pet guinea pigs (*Cavia porcellus*). *Vet Anaesth Analg.* 2018;45(2):183-189.

Research Note: ***Microsporum canis* in Dermatophyte Cultures**

This observational retrospective study aimed to determine how frequently *Microsporum canis* was isolated from untreated cats with suspected skin lesions or cats being treated for dermatophytosis after 1, 2, and 3 weeks of incubation on dermatophyte culture mediums. Of 13 772 fungal cultures, 20.9% were positive for *M canis*. Samples tested positive within 14 days of culture in 98.2% of untreated cats and 96.8% of treated cats. Samples requiring more than 14 days of culture demonstrated abnormal gross morphology. The authors concluded that culture results for *M canis* may be finalized after 14 days with no growth as compared with the current standard of 21 days. This shortened culture period may improve patient quality of life and decrease costs by minimizing the isolation period for cats with suspected infection.

Source

Stuntebeck R, Moriello KA, Verbrugge M. Evaluation of incubation time for *Microsporum canis* dermatophyte cultures. *J Feline Med Surg*. 2018;20(10):997-1000.

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See page 52 for product information summary.

Rabies: The Impact of Pet Travel & Delayed Vaccination

Jason W. Stull, VMD, MPVM, PhD, DACVPM
University of Prince Edward Island
The Ohio State University

In the Literature

Singh AJ, Chipmen RB, de Fijter S, et al. Translocation of a stray cat infected with rabies from North Carolina to a terrestrial rabies-free county in Ohio, 2017. *MMWR Morb Mortal Wkly Rep*. 2018;67(42):1174-1177.

FROM THE PAGE ...

More than 4000 animals test positive for rabies in the United States every year. These animals are predominately wildlife rabies reservoirs (eg, bats, raccoons) but can include domestic animals (eg, cats, dogs, cattle).[1] In the United States, the number of human rabies cases has dramatically decreased due to intense animal and public health efforts. Circulation of distinct rabies virus variants (RVVs) associated with terrestrial reservoir species occurs in geographically defined regions and greatly impacts rabies risk; for example, states in which the raccoon RVV was considered enzootic accounted for 98% of all rabid raccoons reported in 2017.[1] These RVVs readily transmit between members of the reservoir species but also transmit to other domestic and wildlife species. Considerable efforts have been made to help prevent geographic spread of RVVs, such as requiring domestic animals to be vaccinated prior to interstate movement and leaving oral rabies vaccine-laden bait for raccoons along the Ohio–Pennsylvania border to prevent westward expansion of the raccoon RVV.

This article describes the 2017 investigation into a rabies-positive cat that was identified in Ohio west of the oral rabies vaccine barrier. During investigation, it was discovered that the cat had previously been taken in as a stray by its owner in North Carolina, who then moved to Ohio and later relinquished the cat due to inability to care for it. This cat had not been vaccinated for rabies, despite being relinquished to a county humane society and moved to a different state by the owner. Following progressive onset of clinical neurologic signs, including agitation and hind-limb ataxia, the cat was euthanized and was confirmed to be infected with rabies on testing. The virus was confirmed to be the raccoon RVV and, based on phylogenic analysis, was deemed most likely to have originated from North Carolina. This information suggests that the cat had been infected in North Carolina at least 5 months prior to being moved to Ohio. The public health investigation identified all likely animal and human exposures to this cat so appropriate control and prevention responses could be implemented (eg, postexposure prophylaxis in humans, quarantine and vaccination in domestic animals).

This report highlights the potential consequences of animal travel and failure to vaccinate. In this case, an unvaccinated cat incubating rabies was moved from a terrestrial rabies-endemic area (ie, North Carolina) through 8 states to a terrestrial rabies-free area (ie, Ohio). In this case, prompt suspicion of rabies with subsequent testing and response allowed for containment of the virus, but similar previous episodes have not been so fortunate. Previous human-mediated translocation of rabid raccoons to Virginia in the 1970s and to Hamilton, Canada, in 2015 resulted in movement of the raccoon RVV and large-scale wildlife rabies epizootics, with far-reaching animal and public health consequences.[2,3]

… TO YOUR PATIENTS

Key pearls to put into practice:

1 Clinicians should educate themselves and owners on local and adjacent jurisdictional rabies vaccination regulations. Individuals traveling or moving with a pet must comply with the regulations of their destination, which may include a recently issued health certificate and proof of rabies vaccination, among others. Resources for determining interstate and international travel requirements are available.[4]

2 Rabies vaccination should be administered as soon as animals are older than the minimum age for vaccination and should never be delayed. Rabies is rare in vaccinated animals, and vaccinated animals serve as an important barrier to reducing the need for costly postexposure prophylaxis in humans and reducing human and animal rabies-related deaths. Following a known exposure to rabies, quarantine for vaccinated pets is considerably shorter than for unvaccinated pets; euthanasia may be required in some jurisdictions.

3 Clinicians should know and follow their local jurisdictional rabies control regulations, including pet quarantine, testing, and communication with human and animal health authorities. National guidelines are available and followed by many jurisdictions.[2]

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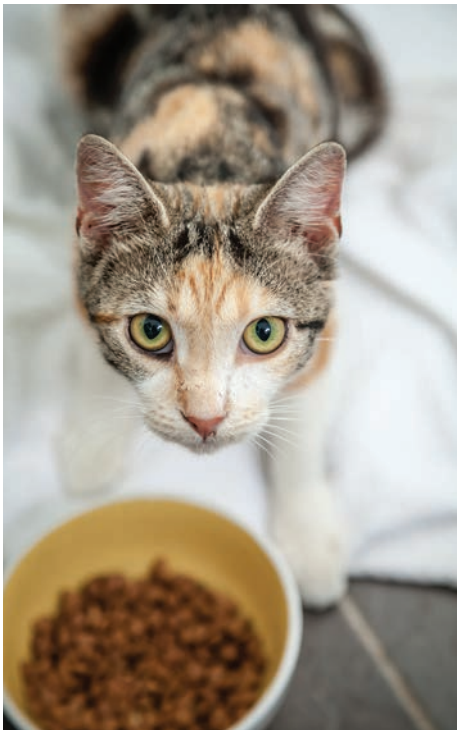
Feline Hyperparathyroidism

Jonathan Miller, DVM, MS, DACVS
Oradell Animal Hospital
Paramus, New Jersey



In the Literature

Singh A, Giuffrida MA, Thomson CB, et al. Perioperative characteristics, histological diagnosis, and outcome in cats undergoing surgical treatment of primary hyperparathyroidism. *Vet Surg*. 2019;48(3):367-374.

FROM THE PAGE ...

Parathyroid disease in cats is rare. In this study, 32 cases were identified in a medical record search encompassing a 12-year period in 10 different institutions. Clinical signs were vague but included lethargy, weight loss, anorexia, and vomiting; no signs were noted in 18.8% of the cases, and polyuria/polydipsia was seen in <20%.

Diagnosis was made based on a combination of cervical ultrasonography, presence of hypercalcemia, and a parathyroid hormone concentration in or above reference range. Surgery was performed in all cats, with 6 out of 32 requiring bilateral tissue removal. Adenoma was diagnosed in 62.5% of cats, with carcinoma, hyperplasia, and cystadenoma diagnosed less frequently. No difference in survival time was noted based on histologic diagnosis.

In most cats (65.6%), serum calcium decreased to normal levels within 24 hours postoperation, although some cats remained hypercalcemic and others became hypocalcemic. Thus, serial monitoring of serum calcium for the first few days postoperation is important. No correlation was found between serum calcium levels preoperatively and postoperatively. Median survival time was 1109 days and was not associated with serum calcium levels or histologic findings of the mass.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Parathyroid disease is rare in cats, and clinical signs are often vague.
2. A high serum calcium level should trigger further diagnostic tests (eg, ultrasonography of the neck, parathyroid hormone concentration testing).
3. Surgery is associated with a favorable long-term prognosis, with a median survival time of just over 3 years, regardless of histopathology results.

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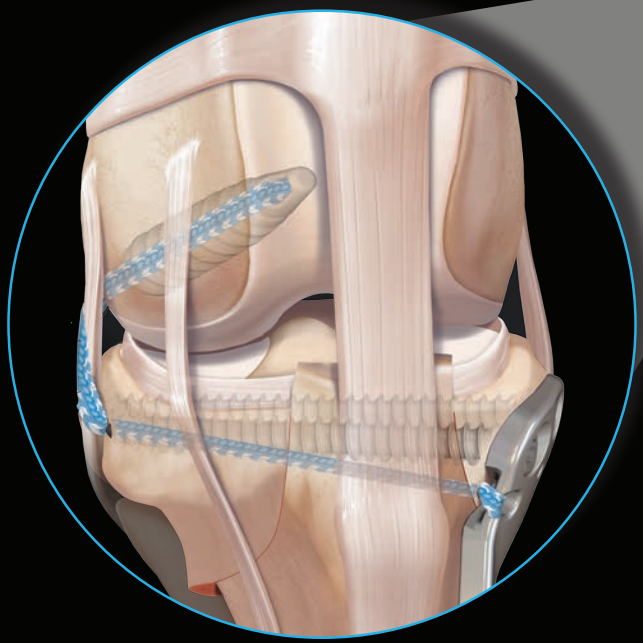

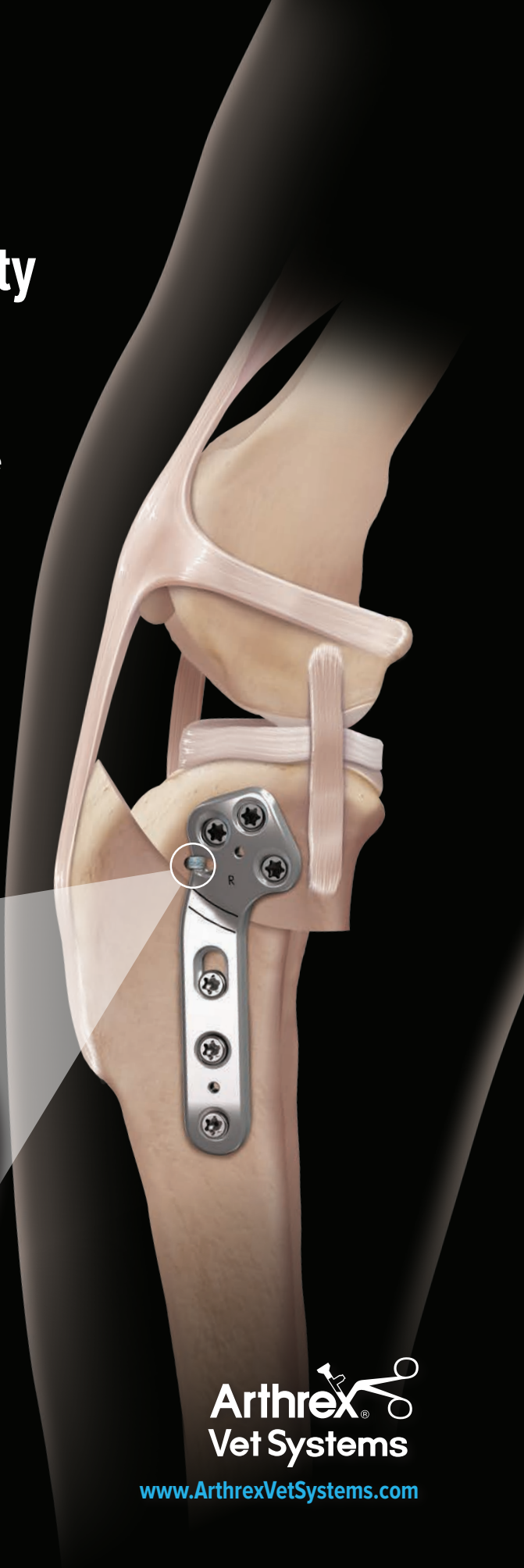

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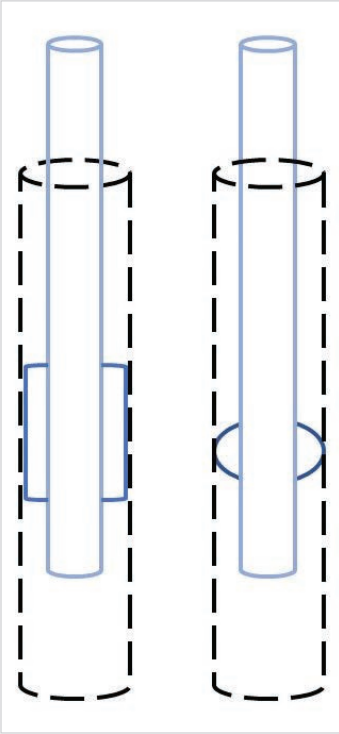
Excessive Endotracheal Tube Cuff Pressure

Tamara Grubb, DVM, MS, PhD, DACVAA
Washington State University



▲ **FIGURE** In this diagram, the trachea is denoted by ***dotted lines*** and the endotracheal tube and ETTC by ***solid lines***. The high-volume, low-pressure cuff (left) exerts minimum pressure on the tracheal mucosa, whereas the high-pressure, low-volume cuff (right) can cause excessive pressure on the tracheal mucosa.

In the Literature

Bird AR, Bird DJ, McMillan MW. Aspects of in vivo endotracheal tube intracuff pressure in cats. *Vet Anaesth Analg*. 2019;46(1):55-63.

FROM THE PAGE ...

Endotracheal intubation has been identified as a risk factor for anesthesia-related morbidity and mortality in cats.[1,2] A contributing factor is overinflation of the endotracheal tube cuff (ETTC), as this puts excessive pressure on tracheal mucosa and can cause pain; mucosal ischemia, ulceration, and tearing; and tracheal stricture, which often results in death. Although seemingly uncommon, these events may occur more often than realized, as anesthetic adverse events are rarely self-reported in veterinary medicine. Airway compromise is a likely cause of sudden death during recovery from anesthesia; in a large mortality study, most of the cats died in the recovery phase of anesthesia, primarily of unknown causes.[1] Regardless of frequency, tracheal damage can be a severe adverse effect and should be prevented.

In the present study, 2 methods commonly used to assess appropriate ETTC pressure (ie, palpation of pilot balloon tension, listening for a leak while delivering a self-defined "normal" breath) were evaluated by measuring ETTC pressure after inflation.[3] With both techniques, ETTC pressure was significantly and often dangerously higher (range, 36-66 cm H_2O) than the pressure generally considered to be safe in cats (ie, 20 cm H_2O). In addition, ETTC pressure differed between 2 brands of tubes, each with a cuff of different shape and pilot balloon of different size. Because the techniques used to assess ETTC pressure and the use of different brands of endotracheal tubes in a practice are common in veterinary medicine, overinflation of ETTCs is likely a common occurrence. Conversely, underinflation of ETTCs can also be problematic, as it allows for aspiration of foreign material (eg, regurgitated GI fluid).

In human medicine, special manometers that directly measure ETTC pressure are commonly used.[4] A number of products are available, reusable, and relatively inexpensive. Based on the data reported in this and similar studies,[4-6] adoption of means to directly measure ETTC pressure should be strongly considered in veterinary medicine, particularly for cats.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. All patients, particularly cats, should be carefully intubated using high-volume, low-pressure cuffed tubes, which are less likely to create excess pressure (***Figure***).
2. Patients should be disconnected from the breathing system when being moved or having their position changed (eg, during dentistry), as tracheal damage can occur when the breathing system forces the endotracheal tube to twist inside the trachea.
3. Although likely the most commonly used technique, palpation of pilot balloon tension is the least accurate method to assess ETTC pressure. In a human study, this method led to the highest pressures and most postoperative cases of sore throat,[4] which likely occurs in veterinary patients as well.
4. Using the breathing system monitor to pressurize the breathing system while listening for a leak around the ETTC is more consistent than delivering a breath with no pressure guidance. The AAFP recommends inflating the cuff using air in 0.5-mL increments from a 3-mL syringe until no leak can be heard when the rebreathing bag is squeezed and the pressure in the breathing circuit is 16 to 18 cm H_2O.[5] For nonrebreathing systems, use of a Bain or mounting block allows inclusion of a manometer.
5. The purchase of equipment specially designed to assess ETTC pressure should be considered.

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Lead Contamination in Backyard Chickens

Radford Davis, DVM, MPH, DACVPM
Iowa State University

In the Literature

Sobhakumari A, Hargrave SA, Hill AE, Poppenga RH. Lead contamination in backyard chicken layer flocks in California. *J Vet Diagn Invest*. 2019;31(3):359-363.

FROM THE PAGE ...

Raising backyard chickens for eggs has grown in popularity as humans look for healthier, safer, local alternatives to commercially produced eggs; however, rearing chickens carries some zoonotic concerns[1] and potential risk for the birds being exposed to chemicals or heavy metals (eg, lead) and passing these on to consumers through eggs or meat.[2] Birds may pick up lead from various sources (eg, contaminated water and feed), but the main source of lead exposure for backyard poultry is likely contaminated soil. Soil can be tainted by flakes of lead-based paint, which was banned in 1978,[3] from older buildings[2,4] and can even be contaminated residually after shooting activities.[2]

This study looked at the risks for lead exposure in backyard chickens in California, subsequent lead contamination in eggs, and the risks to human health from lead-positive egg consumption.[2] Over a 1-year period, liver lead concentrations were measured from chickens submitted for postmortem examination. Of the 1476 livers tested, 3.05% were positive for lead, of which 22% had toxic exposures. Most positive cases had lived in urban areas ($n = 18$); fewer cases came from the suburbs ($n = 11$) and rural areas ($n = 11$). At the highest lead concentrations detected, one egg would contain more than double the recommended provisional tolerable daily intake of lead allowed in children younger than 6 years. Frequent exposure at this level in children can lead to behavior disorders, attention-deficit/hyperactivity disorders, decreased brain volume, and/or IQ deficits.[2] Even at low levels, repeated consumption poses a risk. Lead was found in all soil samples tested and, at one home, was found in chicken feed, paint chips, and blood from other chickens in the flock.

Clinical signs of lead toxicosis in chickens are not well-described, making early diagnosis challenging. Most chickens in this study did not have clinical signs or postmortem lesions suggesting lead intoxication; only 3 of the 45 that tested positive for lead had neurologic signs (eg, head wobbling, incoordination, swollen crop, inability to walk). Chickens that test positive for lead pose a risk to humans in the home, as humans may be exposed to the same primary source of lead contamination in addition to lead in the eggs.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Owners of backyard chickens should be educated about potential sources of lead exposure for their chickens, particularly the threat posed by paint on older buildings on the premises.
2. Owners should be encouraged to test their soil and other environmental samples for lead prior to obtaining birds.
3. Owners should consider periodic monitoring of lead levels in their birds and eggs.
4. The lack of characteristic clinical signs or postmortem lesions in chickens with lead toxicosis presents a significant challenge for early detection and diagnosis in the absence of routine lead screening.

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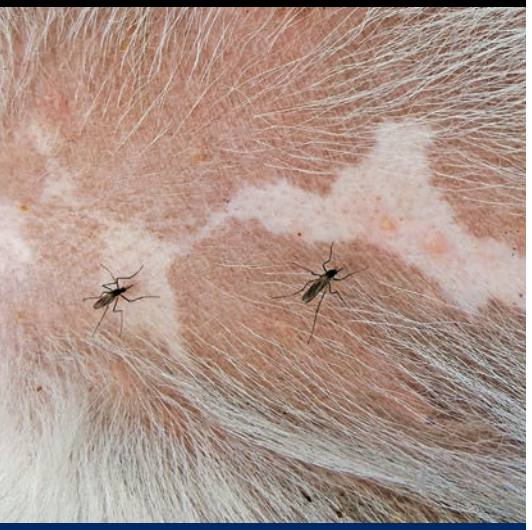
LINDSAY STARKEY, DVM, PHD, DACVM (PARASITOLOGY)
Auburn University



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Heartworm: Updates in Diagnostics & Prevention

Heartworm (ie, *Dirofilaria immitis*) is a global parasite that predominantly affects dogs but can affect cats, ferrets, and other hosts, including humans. Transmission of *D immitis* relies on the presence of mosquito intermediate hosts, a number of different species of which have been proven as competent vectors for this parasite, including mosquitoes in the genera *Aedes*, *Anopheles*, and *Culex*. With so many potential competent vectors, *D immitis* transmission can occur throughout many geographic regions, has been diagnosed in all 50 US states, and is an important mosquito-borne infection of both dogs and cats worldwide.

KEY POINTS

- Although the life cycle of *D immitis* is similar in dogs and cats, some differences exist, as cats exhibit only a partially adapted relationship with *D immitis*.
- Many dogs and cats infected with heartworms do not show clinical signs.
- A thorough patient history and American Heartworm Society-recommended blood testing are crucial in the diagnosis of heartworm infection.
- Several treatment strategies are available for dogs. There is no approved treatment for cats; however, a heartworm preventive product is recommended in heartworm-positive cats to prevent further infection.
- Many FDA-approved heartworm preventives are available for dogs and cats. Clinicians should consider patient lifestyle, parasite risks, compliance history, and client preferences to determine the ideal preventive product for each patient.

Life Cycle

Dogs

The life cycle of *D immitis* in dogs and cats is quite similar, with a few key distinctions. In dogs, it takes several (ie, 6 to 9) months from the time of the infected mosquito bite until adult worms are present in the pulmonary vasculature. Third-stage *D immitis* larvae (ie, L3s) are deposited near the bite wound during the feeding of the female mosquito. Those L3s then migrate into the bite wound and spend the next several days in nearby tissue. Third-stage larvae then molt to L4s, migrating in subcutaneous tissue and muscle while moving toward the thorax. The final molt occurs around 2 months post-infection; these immature adult worms subsequently make their way into the blood vascular system, where they are carried to the pulmonary arteries. Some worms may end up in aberrant locations.

Once arriving to their destination, immature adult worms continue to grow and ultimately reach sexual maturity around 4 months post-infection. Should a male and female worm reside in close enough proximity, mating will occur, yielding the release of microfilariae into the blood vascular system. Adult worms have been shown to live up to 7 years, whereas microfilariae may survive a couple of years in circulation.

Cats

D immitis has different co-evolutionary timelines in cats and dogs, with cats exhibiting only a partially adapted relationship with *D immitis*. This likely also explains why the life span of the worms that make it to adulthood in cats may be truncated (2-4 years) as compared with adult worms in dogs. Differences in cats as compared with dogs include a decreased likelihood that heartworms reach the adult stage, with often high mortality of the immature worms in the lungs and a low likelihood for developing a patent infection (circulating microfilariae). These phenomena occur consistently in cats experimentally infected with *D immitis*.

Clinical Signs

Many heartworm-infected dogs and cats may never develop any clinical signs or abnormalities associated with infections, even though inflammation and damage are occurring.[1,2] If present, signs in dogs may include cough and exercise intolerance. Signs consistent with a more severe infection include hepatomegaly, syncope, ascites, and/or hemoglobinuria.[1]

In cats, respiratory signs may be present, leading to possible misidentification of respiratory-related diseases (eg, feline asthma). Emesis is also frequently described. In addition, neurologic signs and sudden death have been reported with feline heartworm infection.[2,3]

Diagnostic Strategies

Diagnosis of heartworm relies heavily on obtaining a thorough patient history—including travel history and use of heartworm preventive medications—and blood tests. The American Heartworm Society (AHS) recommends that dogs older than 7 months be tested annually with both an antigen test and a microfilariae test.[1] In dogs with no history of preventive application, with a history of noncompliant use of heartworm preventive, or for which a different type of heartworm preventive has been prescribed, testing should be conducted to determine the dog's status first before administration of product; the dog should be retested 6 months later.

Many tests are commercially available for the detection of *D immitis* antigen, which should be present in the whole blood, serum, or plasma of dogs or cats with mature infections. These tests are available for use in clinic or by referral laboratories, and users should be familiar with the reported sensitivities and specificities of the available tests. A positive antigen result in dogs should always be confirmed with an additional methodology (eg, detection of microfilariae, positive result on a different type of antigen test, imaging results) before starting therapy. A negative antigen result does not rule out the presence of *D immitis*, as animals with immature infections, single-sex infections, or infections where available antigen is bound by circulating antibodies may test falsely negative. If there is clinical suspicion that the antigen test may be falsely negative, additional testing options are available.

Dogs

Microfilariae testing strategies (from least sensitive to most sensitive) include:

- **Wet mount:** A drop of blood is mounted on a slide to allow visualization of moving microfilariae.
- **Microhematocrit tube:** Microfilariae are often lodged in the buffy-coat layer and can be visualized with the aid of a microscope.
- **Modified Knott test:** A combination of 1 mL of whole blood collected in an EDTA tube and 9 mL of 2% formalin is mixed and centrifuged, with stain applied to the remaining sediment for microscopic visualization.

Determining whether a dog has microfilariae and to what extent is useful for reducing the likelihood of introducing or returning a microfilaria-positive dog to an area where it can serve as a reservoir to infect the local mosquito population; it can also be helpful in discussing and circumventing potential treatment reactions that may be associated with the rapid death of microfilariae and for monitoring the dog following treatment to ensure clearance of microfilariae from circulation.

Cats

Because cats are rarely microfilaremic, strategies used in dogs are of less use for diagnosing heartworm. Diagnostics in cats are not as straightforward and use a combina-

A NOTE ON IMAGING

To assist with heartworm diagnosis, imaging options commonly include echocardiography to detect the distinct, echogenic signal signifying the worm cuticle or radiography to identify pulmonary or cardiac changes consistent with heartworm infection.

tion of patient history, clinical suspicion, serologic tests, and imaging to help confirm a diagnosis. Antibody tests are available (both in clinic and through referral laboratories) exclusively for cats; these tests provide valuable information that the cat has been or is still infected with *D immitis* and that its immune system has responded to the infection by generating detectable antibodies. Antibody results allow the clinician to more accurately discuss risks and clinical outcomes with the client as compared with antigen test results, which are less likely to yield a positive result in heartworm-infected cats than in heartworm-infected dogs.

Additional Options

Should the suspicion of heartworm infection in the absence of detectable antigen remain (regardless of the antigen test used), the option to perform immune-complex dissociation (ICD) through heat or chemical treatment is available at several reference laboratories. ICD methods have been shown to enhance antigen recovery in both canine and feline samples; however, ICD should be used only when the clinician believes the initial antigen test resulted in a false negative.[4]

Treatment Strategies

Dogs[5,6]

A 3-injection protocol with melarsomine dihydrochloride is recommended for all dogs confirmed to be heartworm-positive unless they have a medical contraindication, such as caval syndrome (for which surgical extraction is recommended), organ compromise or failure, or terminal illness. Adjunctive therapy includes doxycycline, steroids, exercise restriction, and heartworm preventives. In addition, if microfilariae are present, administration of a microfilaricidal compound is recommended. Currently, only one product, transdermal moxidectin, is FDA-approved for the treatment and elimination of circulating microfilariae in heartworm-positive dogs. A thorough heartworm management protocol is available in the AHS canine guidelines.

Use of slow-kill regimens (eg, long-term administration of macrocyclic lactone-based preventive products in combination with doxycycline) for treating heartworm-infected dogs is not recommended. Although these strategies may ultimately be effective at eliminating the majority of worms, worm death can take years, and pathology will continue to progress in the interim.

Cats[2,7]

There is no approved treatment for the presence of adult heartworms in cats. Regardless of the presence or absence of clinical signs, administration of an approved heartworm preventive product is recommended to prevent further infection with additional heartworms. If clinical signs are present, supportive care (eg, steroids +/- bronchodilators, oxygenation, fluids) is also recommended.

Prevention Strategies[5,7,8]

An increasing number of FDA-approved heartworm preventives are available for dogs and cats. All products are based on one of 4 macrocyclic lactone ingredients for killing L3 and early L4 stages of heartworm: ivermectin, milbemycin oxime, moxidectin, or selamectin.

Monthly products are available in oral or topical formulations for both dogs and cats. Formulation differences can influence how long the product stays in the animal's system. For example, transdermal moxidectin remains present in fat and tissue for an entire month. This allows for the continued killing of newly acquired L3 larvae and subsequent prevention of heartworm disease for the entire month after application. There is also a long-acting injectable moxidectin heartworm prevention product available for dogs.

Many of these products contain additional ingredients or high-enough levels of a macrocyclic lactone to extend the label claims to include other internal parasites, such as hookworms, roundworms, whipworms, and tapeworms, as well as ectoparasites (eg, fleas, ear mites, sarcoptic mange, ticks). One product, transdermal moxidectin, is also labeled for the treatment of circulating microfilariae in heartworm-positive dogs.[9]

When tailoring recommendations, clinicians should carefully consider the animal's lifestyle, parasite risks, historical factors regarding client compliance, and client preferences, as the ideal heartworm preventive may vary by household.

When tailoring recommendations, clinicians should carefully consider the animal's lifestyle, parasite risks, historical factors regarding client compliance, and client preferences.

In addition to use of a heartworm preventive, mosquito control can also be used to break the heartworm life cycle.[10] Exposure to mosquito vectors can be reduced by bringing the animal indoors as much as possible, using monthly flea and tick control products that also kill and repel mosquitoes, treating the yard, and hindering mosquito breeding grounds.

Although some strains of *D immitis* can survive treatment with all currently available heartworm preventives, consistent, compliant, year-round use of an approved heartworm preventive is still recommended and highly effective at preventing heartworm disease, especially when combined with a multimodal mosquito control strategy.[11]

Summary

Even with the wealth of knowledge regarding the heartworm life cycle and reservoir hosts, cost-effective and accurate diagnostics, and a growing number of efficacious, broad-spectrum heartworm preventives, heartworm continues to be a threat, as more animals in more areas are diagnosed each year.[12] It remains vital that veterinarians continue to recommend year-round, compliant use of broad-spectrum heartworm preventives for dogs and cats. Veterinarians should likewise remain vigilant when it comes to understanding and accurately interpreting the available diagnostic methods, discussing this life-threatening parasite with clients, and appropriately treating all aspects of the heartworm infection.

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Smartphone Technology in Clinical Ophthalmology

Lucien V. Vallone, DVM, DACVO
Texas A&M University

▲ **FIGURE 1** A miniature schnauzer presented for red eye. This representative image of poor photographic technique was taken from a close working distance, but shadowing obscures details of the ocular surface from being perceived.

Advancing smartphone technology is allowing clinicians to capture high-resolution photos and videos and facilitate convenient means of medical examination, documentation, and subsequent consultation in multiple disciplines, without the need for special techniques or accessory products.[1]

Reports of smartphone photography and examination techniques in animals are limited mostly to individual descriptions of smartphone camera adapters used for fundoscopy.[2-4] Successful fundus imaging has been achieved using such equipment; however, this incurs additional cost and equipment is often limited to specific smartphone models. The following outlines techniques for fundus and anterior segment imaging that predominantly do not require the purchase of accessory equipment.[5,6]

Maximizing Smartphone Camera Features

It is important to capture as much detail as possible when documenting ophthalmologic disorders. Examiners should maximize intrinsic smartphone camera features that can be adjusted to create adequately magnified, focused, and illuminated images of the eye. To achieve this, the smartphone camera should be brought to the minimum focusing distance (ie, the closest point at which a focused image is still maintained) before capturing the image. If available, optical zoom should be enabled to capture enhanced (typically ≤2×) magnification without losing image quality. Image quality (ie, resolution) is degraded when digital zoom—for most smartphones, typically anything >2× magnification—is used. Modern 4K image resolution (ie, 3840 × 2160 pixels) allows smartphone photographers to significantly crop and enlarge photographs while still maintaining high-definition images capable of being printed or published at ≥300 pixels per inch.

Shadowing and underexposure of the ocular surface and intraocular structures are common problems with smartphone photography, often yielding images of poor diagnostic quality (***Figure 1***). Close working distances,

delayed flash, and patient movements all make smartphone flash photography of the eye difficult. These obstacles can be overcome and shadowing and underexposure avoided by enabling the continuous flash in the camera's video mode (see ***Continuous Flash Technique***). When capturing images in this manner, it is often helpful to direct light into the pupil so a fundic/tapetal reflection is generated (***Figure 2***). External illumination (eg, overhead surgical lamp, transilluminator, penlight) can also be used to reduce shadowing of the eye (***Figure 3***).

CONTINUOUS FLASH TECHNIQUE

This technique helps improve illumination of the eye when imaging the anterior segment and/or adnexa or performing direct or indirect fundoscopy. The continuous flash technique can be used by following these steps:

- The flash should be dimmed, either by using a camera app (eg, FiLMiC Pro, MAVIS, MoviePro, Cinema FV-5) or by applying 1 to 3 layers of white medical tape to act as a diffuser.
  - Although the LED flash of one common smartphone model has been determined to be safe in humans,[16] it is important to recognize that the smartphone flash is extremely bright and, as such, may cause significant patient discomfort, potentially leading to resistance or lack of cooperation, particularly when used in a close working distance.
- The camera application should be toggled to video mode, and the camera's flash should be enabled to run continuously.
- The examiner should then capture video, attempting to record all representative features of the subject.
- Still frames can be captured in real time by taking photographs while in video mode or, retrospectively, by reviewing the video and taking screenshots.

Most smartphones are capable of imaging the fundus without modifying the phone with accessory attachments.

Macro Photography

The unaided human eye and the unassisted smartphone are both insufficient when screening for many of the most common ocular pathologies encountered in small animal practice. These pathologies are too small to be easily observed without visual assistance but are crucial to the accurate diagnosis and treatment of many ocular disorders. Thus, in these circumstances, achieving magnification beyond optical zoom is required; numerous, inexpensive smartphone accessory products can help accomplish this. For example, macro lens smartphone camera attachments can be used to considerably enhance photographic and video magnification.

The author routinely uses a commercial universal smartphone macro lens attachment (ie, Easy-Macro) that provides 4× magnification via a small plastic lens embedded in a rubber band. The rubber band wraps around the body of the smartphone, and the lens is situated in front of the camera (***Figure 4***). Once the lens attachment is affixed to the smartphone camera lens, the camera application should be toggled to video mode. The focal point is dramatically shortened with this technique, requiring the examiner to bring the phone 1 to 2 cm from the eye until a focused image can be observed on the screen. Further magnification can be achieved by enlarging and cropping these still images (***Figure 5***, page 68).

Direct Fundoscopy

Most smartphones are capable of imaging the fundus without modifying the phone with accessory attachments (see ***Ideal Smartphones for Direct Fundoscopy***, page 69). The technique is simple to perform, and images can be obtained at very high quality.

The camera application should be toggled to video mode and the flash should be set to run continuously (see ***Continuous Flash Technique***). The camera lens should be brought within 1 to 2 cm of the patient's pupil until a focused image is observed on the screen. The central and peripheral fundus should be scanned and the examination completed.

Autofocus & Autoexposure

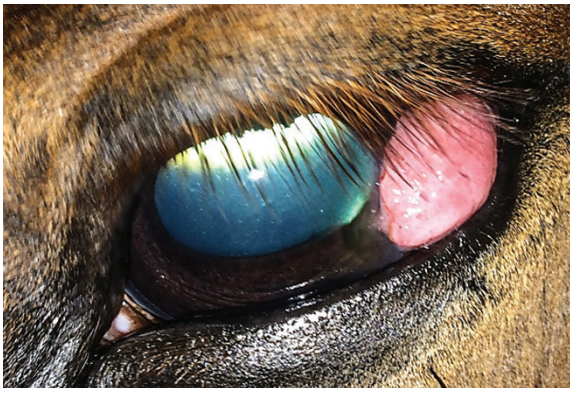
Default settings on most smartphones automatically adjust the focus and exposure settings to enhance photo quality. This does not always benefit the examiner when performing direct smartphone fundoscopy, as lens opacities and tapetal reflections can interfere with autofocus and autoexposure adjustments, respectively. To mitigate this issue, the examiner can lock these settings; to do so on iPhones, the examiner can press and hold the screen over the subject when in camera/video mode and when the camera is focused on an object several paces away (eg, the far wall of an examination room).

Pupil Constriction

Although direct fundoscopy is possible in nondilated patients, ocular examination can be improved considerably with the use of a topical mydriatic (eg, tropicamide). However, examiners can still capture fundus images in a nonpharmacologically dilated patient by reducing the light in the examination room, covering the camera flash with additional filters (eg, white medical tape), and/or downloading an accessory camera smartphone application that facilitates manual adjustments to the flash intensity (eg, FiLMiC Pro).[3-5]

Indirect Fundoscopy

For indirect fundoscopy, smartphones can be used as a light source while simultaneously serving as a recording device. This technique is applicable to nearly all smartphones capable of running a continuous flash while video mode is selected (see ***Continuous Flash Technique***) and requires a condensing lens be positioned over the eye to create an image that appears inverted and transposed.



▲ **FIGURE 2** A horse evaluated for recurrence of ocular squamous cell carcinoma. The image was captured as a screenshot of a continuous-flash video in which light had been directed toward the pupil. This technique provides adequate illumination of both the intraocular and extraocular structures.

▲ **FIGURE 3** A close working distance and overhead illumination of this patient's right eye help avoid shadowing and demonstrate the distinctive clinical appearance of feline eruptive bullous keratopathy (ie, corneal hydrops).

▲ **FIGURE 4** Mounted appearance of a macro lens (Easy-Macro) to an iPhone XS Max. The flash component of many smartphones is aligned horizontally, rather than vertically, as shown here; this may obscure the flash and require the examiner to provide independent illumination (eg, penlight) to the eye.

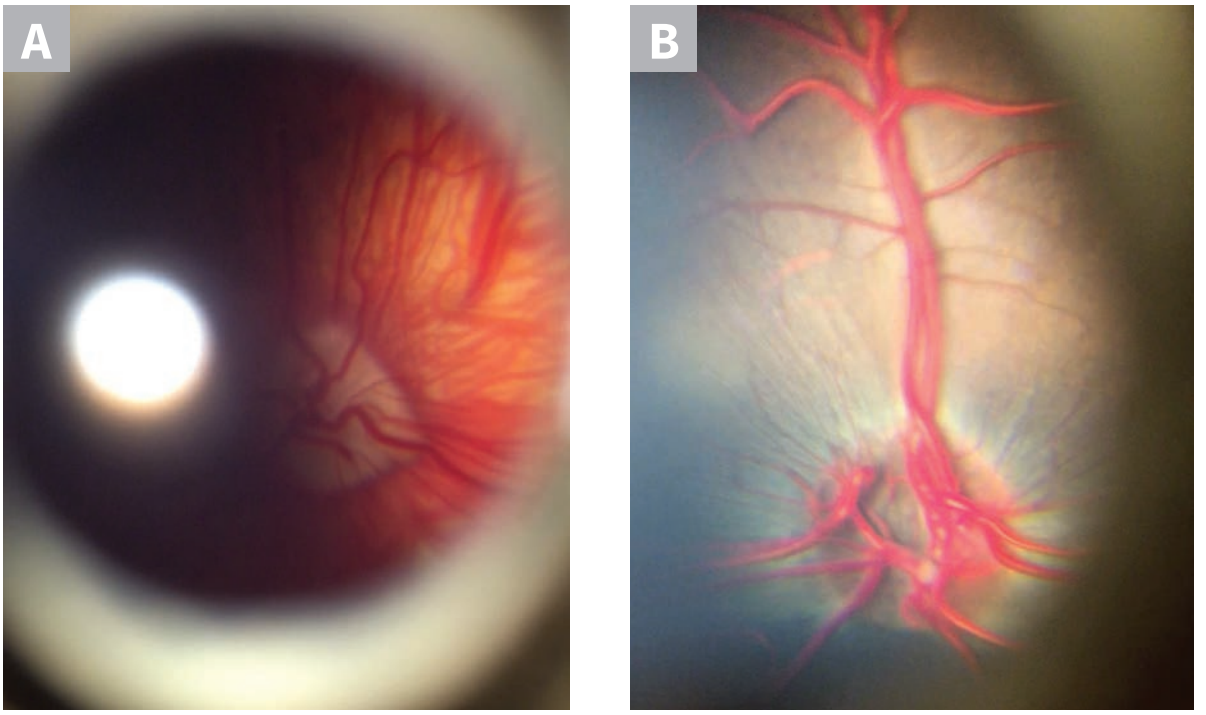
▲ **FIGURE 5** Magnification obtained at the smartphone's minimum focusing distance without magnification (***A***) as compared with 4× magnification achieved using a universal macro lens attachment (***B***). Very high-resolution photos (ie, 4K) captured by modern smartphones facilitate subsequent cropping and enlargement (***C***-***E***) of the original image to demonstrate subtle pathologies while also maintaining adequate resolution. Superficial neovascularization (***C*** and ***D***) and distichia (***E***) are apparent.

The iPhone X may be better suited for direct fundoscopy as compared with the iPhone 7 Plus and iPhone 8 Plus, as the flash is located closer to the wide-angle lens.

IDEAL SMARTPHONES FOR DIRECT FUNDOSCOPY

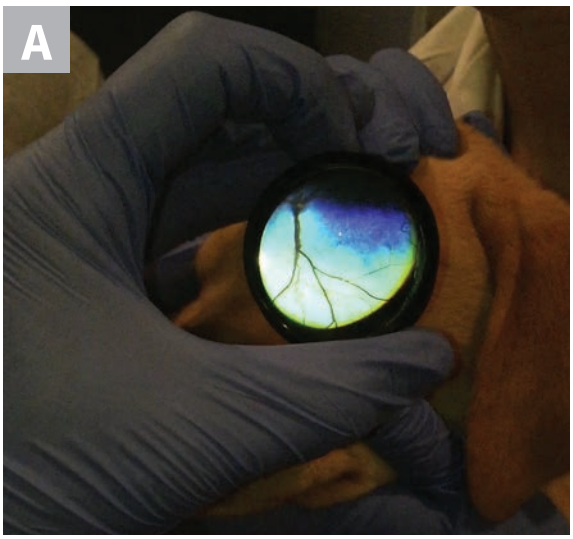
There are 2 important factors to consider when selecting a smartphone that is ideal for direct fundoscopy:

- **Whether the rear-facing camera lens is located centrally or peripherally on the back of the smartphone.** Due to the requisite proximity and alignment of the camera lens to the eye and pupil, respectively, the direct fundoscopy technique is most practical for smartphones with peripherally positioned cameras (eg, iPhones, Google Pixel). Smartphones with centrally positioned rear-facing cameras (eg, Samsung Galaxy Note, LG) can be difficult to align with the pupil of dogs and cats, as the peripheral body of the smartphone will encounter the patient's muzzle before camera alignment can be achieved. With a peripherally positioned rear-facing camera, the patient's muzzle does not interfere with this alignment. Both eyes can be imaged directly with these types of smartphones by rotating the phone so the rear-facing camera is positioned medially near the muzzle. This technique can take time and patience, particularly with larger smartphone models, which can be difficult to handle.
- **The smartphone's flash position relative to the camera lens.** The camera flash should ideally be positioned as close to the camera lens as possible to reduce shadowing from the iris (***Figure 6***). The camera and flash position vary among models (range, ≈5-25 mm), making some smartphones better suited for direct fundoscopy than others. Assessing the distance between the lens and flash is less intuitive when evaluating smartphones with dual-camera designs (eg, iPhone 7 Plus, iPhone 8 Plus, iPhone X). Dual-camera smartphones typically possess a traditional wide-angle lens and an added telephoto lens, which does not support the techniques outlined in this article. The wide-angle lens is well-suited for direct fundoscopy and, in iPhone models, is located closer to the top left corner of the smartphone, regardless of vertical or horizontal dual-lens orientation. The iPhone X may be better suited for direct fundoscopy as compared with the iPhone 7 Plus and iPhone 8 Plus, as the flash is located closer to the wide-angle lens.

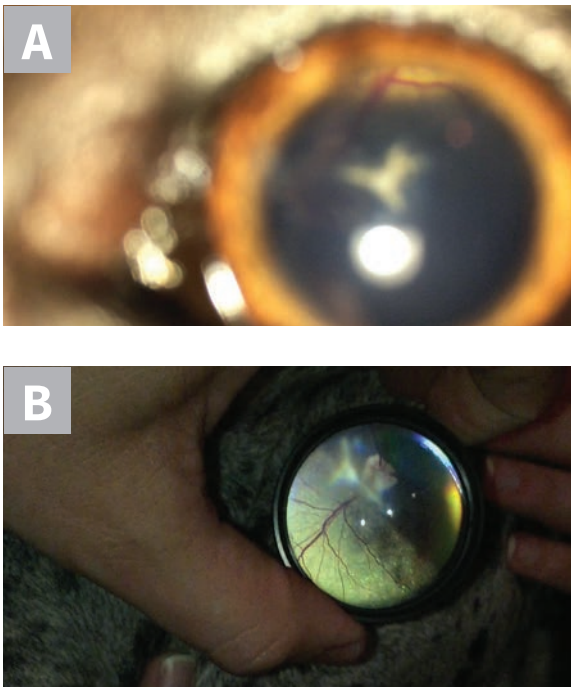


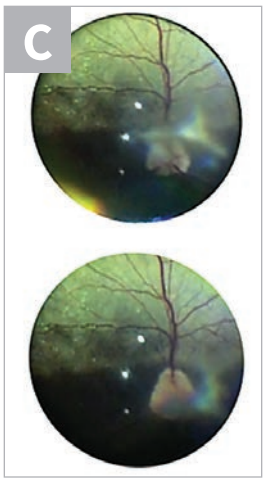
▲ **FIGURE 6** With direct fundoscopy, shadowing occurs most often when the flash is positioned relatively far from the camera lens, as shown in these images of an Australian shepherd dog (***A***) and an alpaca (***B***) obtained using an iPhone 8 Plus.

The indirect technique requires an assistant to restrain the patient and, ideally, to open the patient's eyelids. The examiner should position a condensing lens in front of the eye with one hand and the smartphone between the lens and the examiner's eye with the other. The lens should be moved into a position that brings a virtual image of the fundus into focus (***Figure 7***). This technique is more difficult than the direct technique but can be used to successfully view and record the fundus in many circumstances in which the direct technique fails. In particular, the indirect technique is better suited to image the fundus when the pupil is poorly dilated and also forms better fundus images when lens opacity is present (***Figure 8***). Furthermore, the indirect technique generates images with a much wider field of view as compared with the direct technique and allows the examiner to evaluate peripheral aspects of the fundus with greater ease.



▲ **FIGURE 7** Representative images from a nonvisual Labrador retriever puppy evaluated with the indirect technique (***A***). Cropped images (***B***) demonstrate optic nerve hypoplasia. The optic nerve is dark and very small as compared with a normal, well-myelinated optic nerve, as shown in ***Figures 8B*** and ***8C***.





▲ **FIGURE 8** A Great Dane with a triangular-shaped cataract that obstructs and blurs the fundus when the direct technique is used (***A***). However, the indirect technique (***B***) proved to be successful in this patient; the cataract can still be observed, but the fundus can now be better appreciated (***C***) in these 2 images from different angles of the same evaluation. The blurry appearance of the cataract obscuring part of the optic nerve changes based on angle alteration.

Smartphone Technology in Veterinary Education

Teaching clinical ophthalmology,[7] particularly fundoscopy, is a well-documented challenge in human[8]

and veterinary[9] medical training programs that has led to decreased confidence in practitioners' ability to diagnose and manage common and potentially vision-threatening ophthalmologic disorders.[10] Numerous methods of improving fundoscopy training have been published, including the use of novel software programs,[11] augmented reality simulators,[12] and inexpensive fundus-simulating models.[9] Similarly, the acquisition and interpretation of fundus photography has recently been shown to enhance the examiner experience, lesion identification, and long-term retention of fundoscopy skills among medical trainees.[13,14] Smartphones are being used with these educational targets in mind. In a study, medical students who used an FDA-approved smartphone adapter to image the fundus reported greater confidence and proficiency when identifying normal fundus structures as compared with settings in which the direct ophthalmoscope was used.[15]

The use of smartphones for teaching ophthalmoscopy skills in veterinary medical training programs has tremendous potential and deserves further research. In this author's experience, students and practitioners who have previously been intimidated by the ophthalmologic examination typically find that smartphone imaging techniques make the ophthalmologic examination more accessible.

Conclusion

Smartphones are versatile in medical settings and capable of augmenting the ophthalmologic examination in clinical practice. In the near future, veterinary medicine may see an expansion of teleophthalmology in the broader context of telehealth. Smartphones will be integral to this development. By incorporating some of the imaging techniques outlined above and using basic means of smartphone communication while adhering to prevailing state jurisprudence privacy statutes, veterinary practitioners may find themselves better equipped to triage and monitor ophthalmologic disorders, consult with specialists, and educate pet owners.

See next page for references.

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OUR AUTHORS

JULIE ALLEN, BVMS, MS, MRCVS, DACVIM (SAIM), DACVP, is a former clinical assistant professor of clinical pathology at Cornell University. She earned her veterinary degree from University of Glasgow and her master's degree from Iowa State University, where she completed a rotating internship in small animal medicine and surgery and a residency in small animal internal medicine. She also completed a residency in clinical pathology at North Carolina State University. Dr. Allen focuses on cachexia/anorexia, endocrinology, and hepatobiliary and pancreatic disease and has committed her career to improving the diagnosis of disease.

DIFFERENTIAL DIAGNOSIS PAGE 36

MARY SARAH BERGH, DVM, MS, DACVS, DACVSMR, is an affiliate associate professor at Iowa State University and a veterinary surgeon at Edinger Surgical Options in Madison, Wisconsin. She earned her DVM from University of Wisconsin–Madison and her master's degree from The Ohio State University, where she also completed a small animal surgery residency. Dr. Bergh also completed an internship at University of Pennsylvania. Her interests include canine sporting injuries, fracture management, joint replacement, treatments for cruciate ligament disease, and physical rehabilitation.

CASE IN POINT PAGE 6

LISA CORTI, DVM, DACVS, CCRP, is the owner of North Shore Veterinary Surgery, in Andover, Massachusetts, and is an adjunct instructor at North Shore Community College in Danvers, Massachusetts. Dr. Corti earned her DVM from Cummings School of Veterinary Medicine at Tufts University and completed a residency at Iowa State University. She is certified as a canine rehabilitation practitioner by University of Tennessee. Her interests are in pain management and rehabilitation for dogs and cats, anesthesia, and the medical treatment of osteoarthritis and tendon and ligament injuries.

TOP 5 PAGE 26

ANDREW ROSENBERG, DVM, DACVD, is the owner of Animal Dermatology & Allergy Specialists in Riverdale, New Jersey, and Westchester County, New York. He earned his DVM from Cornell University and completed a dermatology residency at Animal Dermatology Clinic in Tustin, California. He received the American College of Veterinary Dermatology research award for his work with cyclosporine-associated gingival overgrowth and serves as the chair of the American College of Veterinary Dermatology education committee. Dr. Rosenberg has been published in multiple journals and lectures worldwide. His interests are in allergies and autoimmune skin diseases.

TOP 5 PAGE 14

LUCIEN V. VALLONE, DVM, DACVO, is a clinical assistant professor at Texas A&M University. He earned his DVM from Mississippi State University and completed a rotating internship in small animal medicine and surgery and a residency in comparative ophthalmology at Cornell University. Dr. Vallone's clinical interests include advanced imaging of the ocular surface, smartphone ophthalmoscopy, and surgeries of the ocular surface and lens.

CONSULT THE EXPERT PAGE 65

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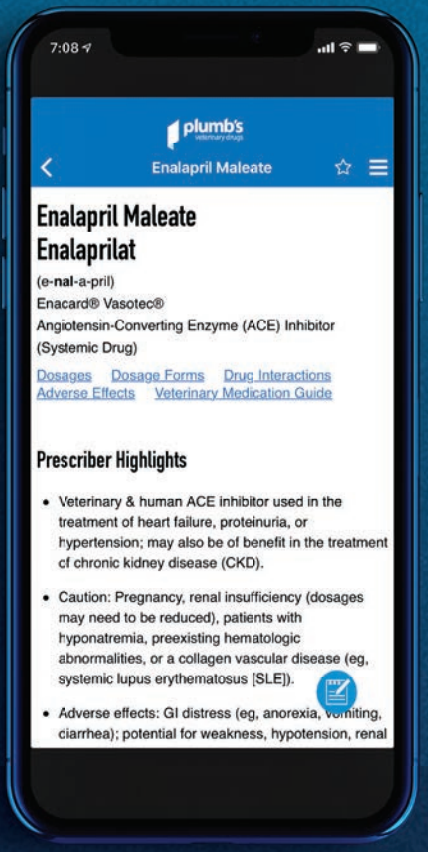

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From *Clinician's Brief* on Social Media

WE ASKED . . .

What is the lowest hematocrit you have seen in a patient?

"4%; the cat lived."—*Emily B*

"3%; he lived with a transfusion."—*Meghan B*

"8% in my dog that had immune-mediated hemolytic anemia. Unfortunately, he passed away after several blood transfusions."—*Cassandra K*

"4% in a bald eagle, which survived and has since been released in the wild."—*Maude G*

For those veterinarians not in clinical practice, what do you do?

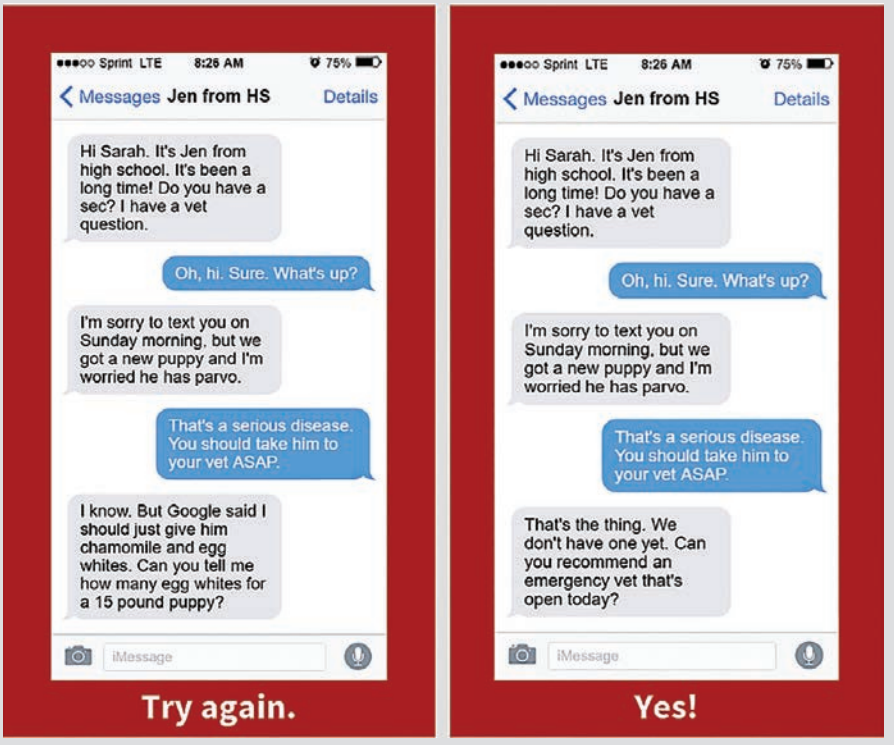
"I am a veterinary medical officer for the Louisiana Department of Agriculture and the director of its poultry diagnostic laboratory. No, I never thought I would work with chickens."—*Amanda N*

"I have a PhD and am now in academia. I love it!"—*Gura B*

"I am a public health veterinarian with the USDA Food Safety and Inspection Service."—*Hannah H*

"I am in the US Army Veterinary Corps."—*Matthew M*

WE ALL HAVE THAT OLD FRIEND FROM HIGH SCHOOL . . .



"We all know the struggle, and then you hear nothing more from them."—*Charlotte E*

"Happens to veterinary nurses also. A lot."—*Anichka R*

"I have not graduated yet, and I am already getting these messages!"—*Nikki M*

"The real problem here is that Google is obviously wrong. You cure parvo by making your dog wear an amethyst crystal soaked in apple cider vinegar, not by feeding them egg whites. Come on, people!"—*Tiger P*

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The CO_2 laser-assisted no-gauze spay

By Masahiro Seki, DVM, Dipl. ABLS

At our small animal clinic we perform multiple surgeries a day. Our routine usage of Aesculight surgical CO_2 laser allows for greatly simplified soft-tissue surgeries, such as femoral head osteotomy and enucleation surgery[1] and ovariohysterectomy (OHE) described in detail in this article.

Background

OHE is a fundamental abdominal surgery and is one of the most frequently performed soft tissue surgeries in veterinary practices today.

The main complications of OHE, traditionally performed with a steel scalpel and electrocautery, are postoperative pain, hemorrhage, swelling and infection.[2] At our clinic we perform all OHE procedures with a CO_2 surgical laser because this technique addresses all of the aforementioned complications.

Pets undergoing CO_2 laser-assisted OHE appear to feel less to no pain, and they recover and resume their usual activities faster than after the same procedure done with a scalpel and electrocautery.

Below is a step-by-step description of the "no gauze" spay procedure performed with CO_2 laser on a young female cat. We refer to this procedure as no-gauze as there is no need to use gauze to manage bleeding, and we only use one or two moist gauzes as a backstop and for wiping off the "char".

'No-Gauze' Spay

Step 1: Initial skin incision.

The skin is incised (Figure 1) with the CO_2 laser set to 20 watts in the Super Pulse mode with 0.25mm focal spot size. High power Super Pulse (SP) is especially effective as it assures minimum thermal damage to adjacent tissues. High power SP mode permits a surgeon to move the laser handpiece much faster, which minimizes thermal necrosis.

Step 2: Subcutaneous tissue avulsion.

After the skin is incised in high power SP mode, the subcutaneous tissue is avulsed with Metzenbaum scissors; then the scissors are inserted under the subcutaneous tissue as a backstop and a laser incision is made (Figure 2), also with 0.25 mm spot size at 20 watts SuperPulse. Note the completely blood-free surgical field.

Step 3: Abdominal muscle incision.

Linea alba is located and carefully picked up with forceps (Figure 3). The muscle tissue is pulled outward and laser beam is directed horizontally from the side so that the beam cannot pass through to the intraperitoneal organs. Then, a small hole is made through linea alba with 0.25mm spot size, using a CO_2 laser setting 20W SP (Figure 4). Next, the winged groove director. is inserted along peritonea, tension to membrane is applied and a laser cut is made (0.25mm spot size, 20W SP) (Figures 5 and 6).

Step 4: Cutting the suspensory ligament.

The suspensory ligament is cut with a CO_2 laser after pulling the ovary out (Figure 7). The power setting of the laser is 8-10W CW, and the spot size is increased to 0.4-0.8 mm. The coagulation effect of the lower power density continuous wave (CW) mode on small blood vessels is more effective, and is recommended for the best hemostasis in highly vascular tissues. It is a much safer method with no bleeding, compared to the usual breaking of the ligament with the index finger.

Step 5: Ligation and cutting of the blood vessel.

A figure-eight ligature is placed at the site. Then, using moistened gauze as a backstop, the blood vessel is cut with the laser beam (0.4-0.8 mm spot size, 8-10W CW) for coagulation (Figure 8).

Step 6: Cutting the broad ligament.

The broad ligament is cut without ligation using 0.4-0.8mm spot size and the lower power setting of 6-8W CW. Note the complete lack of bleeding in the absence of ligatures (Figure 9).

Step 7: Do the other ovary the same way.

Step 8: Cutting the uterine body.

Ligation is done with a modified Miller's knot (Figure 10) and the uterine body is cut off using 0.4-0.8mm spot size and 8-10W CW setting of the CO_2 laser (Figure 11). Laser energy is applied to the uterine stump to contract and sterilize.

Step 9: Closure.

The abdominal walls are closed and the skin is sutured (Figure 12); wiping skin margins with moist gauze sometimes is desirable if char traces are present. Stainless suture wire or skin stapler is used for suturing because they do not cause foreign body reaction and the animal doesn't want to lick the wound. Another advantage of suture wire is that it retains its oval loop shape which helps to avoid over-restriction of the skin. It makes the wound site heal beautifully.

Summary

A CO_2 laser assisted no-gauze spay is performed much faster than the conventional OHE procedure, and without the risk of post-operative complications and bleeding, allowing us to avoid post-surgery hospitalization. It is much appreciated by the pet owners and clinical personnel alike.


FIGURE 1.


FIGURE 2.


FIGURE 3.


FIGURE 4.

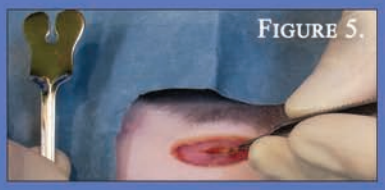
FIGURE 5.

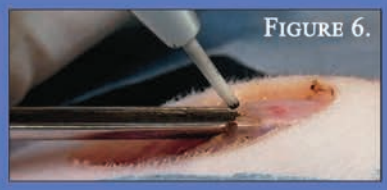
FIGURE 6.


FIGURE 7.


FIGURE 8.


FIGURE 9.

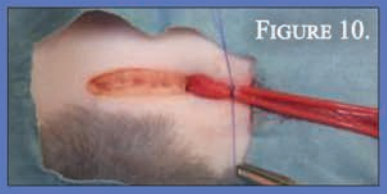
FIGURE 10.


FIGURE 11.


FIGURE 12.

REFERENCES

1. Seki, Masahiro. "Introducing Veterinary CO_2 Laser Surgery in Japan." Veterinary Practice News, Oct. 2012, p. 24
2. Welch Fossum, Theresa, et al. Small Animal Surgery. 3rd ed, St. Louis: Mosby, 2007, p. 726

WATCH CO_2 LASER SURGERY VIDEOS: www.Aesculight.com/video/

About Dr. Seki:

Dr. Masahiro Seki is the owner of a small animal clinic Animal Laser Center in Nagoya, Japan. He is the first board-certified veterinary laser surgeon in Japan. Dr. Seki is a diplomate of the American Board of Laser Surgery, and a director at the Japanese Laser Veterinary Science Society.

Aesculight's VetScalpel® VS-4530

PRACTICE HOTLINE

The latest in products and services

FDA Approval of ProHeart 12

Zoetis (**zoetis.com**) has announced that the US Food and Drug Administration has approved **ProHeart 12** (moxidectin; **ProHeartDVM.com**), a once-yearly injection administered in-practice to prevent heartworm disease (caused by *Dirofilaria immitis*) in dogs 12 months of age and older. ProHeart 12 also treats for existing larval and adult hookworms (*Ancylostoma caninum* and *Uncinaria stenocephala*). The active ingredient, moxidectin, is released over 12 months and is contained in slow-dissolving microspheres that are stored in a dog's adipose tissue. Zoetis plans to start shipping ProHeart 12 to customers in August. Veterinarians can place advance orders online or by contacting Zoetis.—*Press Release 7/2019*

SEND INFORMATION FOR PRACTICE HOTLINE TO editor@cliniciansbrief.com

Denamarin Advanced for Cats Launched

Nutramax Laboratories (**nutramaxlabs.com**) has announced that Denamarin Advanced (**denamarinadvanced.com**) is now available for cats. **Denamarin Advanced for Cats** contains NMXSS75A S-adenosylmethionine, which has higher serum concentrations from better bioavailability as compared with the SAMe in original Denamarin enteric-coated tablets. This advanced formulation is available in a smaller tablet and allows for easier administration to cats. Denamarin Advanced for Cats is now available for purchase through authorized distributors.—*Press Release 6/2019*

New Physiologic Monitor Announced

Digicare Animal Health (**digi-vet.com**) has introduced **LifeWindow One**, a portable physiologic monitor engineered with gold-standard, veterinary-specific modules for improved patient outcomes. LifeWindow One uses Digicare's VetECG algorithms, which are optimized for veterinary QRS detection and classification and allow the monitor to deliver measurements from critical care to routine checkups on any species. LifeWindow One allows configurations of up to 5 measurement parameters, including ECG, oximetry, capnography, noninvasive blood pressure, and temperature, and can be remotely controlled and viewed by a Wi-Fi–connected iPad companion application. The iPad application also allows for recording, capturing, and printing of up to 2 hours of ECG waveforms. LifeWindow One features a touch screen interface with a battery life of up to 7 hours and includes a port for temperature measurement.—*Press Release 6/2019*

ADVERTISERS INDEX

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PRACTICE MARKETPLACE

Brief Summary
NADA 141-213, Approved by FDA

Metacam®

(meloxicam oral suspension)
1.5 mg/mL (equivalent to 0.05 mg per drop) /0.5 mg/mL (equivalent to 0.02 mg per drop)
Non-steroidal anti-inflammatory drug for oral use in dogs only

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

Warning: Repeated use of meloxicam in cats has been associated with acute renal failure and death. Do not administer additional injectable or oral meloxicam to cats. See Contraindications, Warnings, and Precautions for detailed information.

Description: Meloxicam is a non-steroidal anti-inflammatory drug (NSAID) of the oxicam class. Each milliliter of METACAM Oral Suspension contains meloxicam equivalent to 0.5 or 1.5 milligrams and sodium benzoate (1.5 milligrams) as a preservative. The chemical name for Meloxicam is 4-Hydroxy-2-methyl-N-(5-methyl-2-thiazolyl)-2H-1,2-benzothiazine-3-carboxamide-1, 1-dioxide. The formulation is a yellowish viscous suspension with the odor of honey.

Indications: METACAM Oral Suspension is indicated for the control of pain and inflammation associated with osteoarthritis in dogs.

Contraindications: Dogs with known hypersensitivity to meloxicam should not receive METACAM Oral Suspension. **Do not use METACAM Oral Suspension in cats. Acute renal failure and death have been associated with the use of meloxicam in cats.**

Warnings: Not for use in humans. Keep this and all medications out of reach of children. Consult a physician in case of accidental ingestion by humans. **For oral use in dogs only.**

As with any NSAID all dogs should undergo a thorough history and physical examination before the initiation of NSAID therapy. Appropriate laboratory testing to establish hematological and serum biochemical baseline data is recommended prior to and periodically during administration. Owner should be advised to observe their dog for signs of potential drug toxicity and be given a client information sheet about METACAM.

Precautions: The safe use of METACAM Oral Suspension in dogs younger than 6 months of age, dogs used for breeding, or in pregnant or lactating dogs has not been evaluated. Meloxicam is not recommended for use in dogs with bleeding disorders, as safety has not been established in dogs with these disorders. As a class, cyclo-oxygenase inhibitory NSAIDs may be associated with gastrointestinal, renal and hepatic toxicity. Sensitivity to drug-associated adverse events varies with the individual patient. Dogs that have experienced adverse reactions from one NSAID may experience adverse reactions from another NSAID. Patients at greatest risk for renal toxicity are those that are dehydrated, on concomitant diuretic therapy, or those with existing renal, cardiovascular, and/or hepatic dysfunction. Concurrent administration of potentially nephrotoxic drugs should be carefully approached. NSAIDs may inhibit the prostaglandins that maintain normal homeostatic function. Such anti-prostaglandin effects may result in clinically significant disease in patients with underlying or pre-existing disease that has not been previously diagnosed. Since NSAIDs possess the potential to induce gastrointestinal ulcerations and/or perforations, concomitant use with other anti-inflammatory drugs, such as NSAIDs or corticosteroids, should be avoided. If additional pain medication is needed after administration of the total daily dose of METACAM Oral Suspension, a non-NSAID or non-corticosteroid class of analgesia should be considered. The use of another NSAID is not recommended. Consider appropriate washout times when switching from corticosteroid use or from one NSAID to another in dogs. The use of concomitantly protein-bound drugs with METACAM Oral Suspension has not been studied in dogs. Commonly used protein-bound drugs include cardiac, anticonvulsant and behavioral medications. The influence of concomitant drugs that may inhibit metabolism of METACAM Oral Suspension has not been evaluated. Drug compatibility should be monitored in patients requiring adjunctive therapy.

Adverse Reactions: Field safety was evaluated in 306 dogs.[1] Based on the results of two studies, GI abnormalities (vomiting, soft stools, diarrhea, and inappetance) were the most common adverse reactions associated with the administration of meloxicam.

The following adverse events are based on post-approval adverse drug experience reporting. Not all adverse reactions are reported to FDA/CVM. It is not always possible to reliably estimate the adverse event frequency or establish a causal relationship to product exposure using these data. The following adverse events are listed in decreasing order of frequency by body system.

Gastrointestinal: vomiting, anorexia, diarrhea, melena, gastrointestinal ulceration
Urinary: azotemia, elevated creatinine, renal failure
Neurological/Behavioral: lethargy, depression
Hepatic: elevated liver enzymes
Dermatologic: pruritus

Death has been reported as an outcome of the adverse events listed above. **Acute renal failure and death have been associated with use of meloxicam in cats.**

Information for Dog Owners: METACAM, like other drugs of its class, is not free from adverse reactions. Owners should be advised of the potential for adverse reactions and be informed of the clinical signs associated with drug intolerance. Adverse reactions may include vomiting, diarrhea, decreased appetite, dark or tarry stools, increased water consumption, increased urination, pale gums due to anemia, yellowing of gums, skin or white of the eye due to jaundice, lethargy, incoordination, seizure, or behavioral changes. **Serious adverse reactions associated with this drug class can occur without warning and in rare situations result in death (see Adverse Reactions). Owners should be advised to discontinue METACAM and contact their veterinarian immediately if signs of intolerance are observed.** The vast majority of patients with drug related adverse reactions have recovered when the signs are recognized, the drug is withdrawn, and veterinary care, if appropriate, is initiated. Owners should be advised of the importance of periodic follow up for all dogs during administration of any NSAID.

Effectiveness: The effectiveness of meloxicam was demonstrated in two field studies involving a total of 277 dogs representing various breeds, between six months and sixteen years of age, all diagnosed with osteoarthritis. Both of the placebo-controlled, masked studies were conducted for 14 days. All dogs received 0.2 mg/kg meloxicam on day 1. All dogs were maintained on 0.1 mg/kg oral meloxicam from days 2 through 14 of both studies. Parameters evaluated by veterinarians included lameness, weight-bearing, pain on palpation, and overall improvement. Parameters assessed by owners included mobility, ability to rise, limping, and overall improvement. In the first field study (n=109), dogs showed clinical improvement with statistical significance after 14 days of meloxicam treatment for all parameters. In the second field study (n=48), dogs receiving meloxicam showed a clinical improvement after 14 days of therapy for all parameters; however, statistical significance was demonstrated only for the overall investigator evaluation on day 7, and for the owner evaluation on day 14.[1]

Reference: 1. FOI for NADA 141-213 METACAM (meloxicam oral suspension).

Manufactured for:
Boehringer Ingelheim Vetmedica, Inc.
St. Joseph, MO 64506 U.S.A.

601401-08/601413-04/6015161-10/6015268-04
Revised 07/2016

18490
06/2018

Brief Summary
NADA 141-219, Approved by FDA

Boehringer Ingelheim

Metacam®

(meloxicam)
5 mg/mL Solution for Injection
Non-steroidal anti-inflammatory drug for use in dogs and cats only

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

Warning: Repeated use of meloxicam in cats has been associated with acute renal failure and death. Do not administer additional injectable or oral meloxicam to cats. See Contraindications, Warnings, and Precautions for detailed information.

Description: Meloxicam is a non-steroidal anti-inflammatory drug (NSAID) of the oxicam class. Each mL of this sterile product for injection contains meloxicam 5.0 mg, alcohol 15%, glycofurol 10%, poloxamer 188 5%, sodium chloride 0.6%, glycine 0.5% and meglumine 0.3%, in water for injection, pH adjusted with sodium hydroxide and hydrochloric acid.

Indications:
Dogs: METACAM (meloxicam) 5 mg/mL Solution for Injection is indicated in dogs for the control of pain and inflammation associated with osteoarthritis.

Contraindications: Dogs with known hypersensitivity to meloxicam should not receive METACAM 5 mg/mL Solution for Injection.

Warnings: Not for use in humans. Keep this and all medications out of reach of children. Consult a physician in case of accidental ingestion by humans. For IV or SQ injectable use in dogs. All dogs should undergo a thorough history and physical examination before administering any NSAID. Appropriate laboratory testing to establish hematological and serum biochemical baseline data is recommended prior to, and periodically during use of any NSAID in dogs.

Owner should be advised to observe their dogs for signs of potential drug toxicity.

Precautions: The safe use of METACAM 5 mg/mL Solution for Injection in dogs younger than 6 months of age, dogs used for breeding, or in pregnant or lactating bitches has not been evaluated. Meloxicam is not recommended for use in dogs with bleeding disorders, as safety has not been established in dogs with these disorders. Safety has not been established for intramuscular (IM) administration in dogs. When administering METACAM 5 mg/mL Solution for Injection, use a syringe of appropriate size to ensure precise dosing. As a class, cyclo-oxygenase inhibitory NSAIDs may be associated with gastrointestinal, renal and hepatic toxicity. Sensitivity to drug-associated adverse events varies with the individual patient. Dogs that have experienced adverse reactions from one NSAID may experience adverse reactions from another NSAID. Patients at greatest risk for renal toxicity are those that are dehydrated, on concomitant diuretic therapy, or those with existing renal, cardiovascular, and/or hepatic dysfunction. Concurrent administration of potentially nephrotoxic drugs should be carefully approached. NSAIDs may inhibit the prostaglandins that maintain normal homeostatic function. Such anti-prostaglandin effects may result in clinically significant disease in patients with underlying or preexisting disease that has not been previously diagnosed. Since NSAIDs possess the potential to induce gastrointestinal ulcerations and/or perforations, concomitant use with other anti-inflammatory drugs, such as NSAIDs or corticosteroids, should be avoided. If additional pain medication is needed after the administration of the total daily dose of METACAM Oral Suspension, a non-NSAID or noncorticosteriod class of analgesia should be considered. The use of another NSAID is not recommended. Consider appropriate washout times when switching from corticosteroid use or from one NSAID to another in dogs. The use of concomitantly protein-bound drugs with METACAM 5 mg/mL Solution for Injection has not been studied in dogs. Commonly used protein-bound drugs include cardiac, anticonvulsant and behavioral medications. The influence of concomitant drugs that may inhibit metabolism of METACAM 5 mg/mL Solution for Injection has not been evaluated. Drug compatibility should be monitored in patients requiring adjunctive therapy. The effect of cyclo-oxygenase inhibition and the potential for thromboembolic occurrence or a hypercoagulable state has not been studied.

Adverse Reactions:
Dogs: A field study involving 224 dogs was conducted.[1] Based on the results of this study, GI abnormalities (vomiting, soft stools, diarrhea, and inappetance) were the most common adverse reactions associated with the administration of meloxicam.

The following adverse reactions are based on post-approval adverse drug event reporting. The categories are listed in decreasing order of frequency by body system:

Gastrointestinal: *vomiting, diarrhea, melena, gastrointestinal ulceration*
Urinary: *azotemia, elevated creatinine, renal failure*
Neurological/Behavioral: *lethargy, depression*
Hepatic: *elevated liver enzymes*
Dermatologic: *pruritus*

Death has been reported as an outcome of the adverse events listed above. **Acute renal failure and death have been associated with the use of meloxicam in cats.**

Information For Dog Owners: Meloxicam, like other NSAIDs, is not free from adverse reactions. Owners should be advised of the potential for adverse reactions and be informed of the clinical signs associated with NSAID intolerance. Adverse reactions may include vomiting, diarrhea, lethargy, decreased appetite and behavioral changes. Dog owners should be advised when their pet has received a meloxicam injection. Dog owners should contact their veterinarian immediately if possible adverse reactions are observed, and dog owners should be advised to discontinue METACAM therapy.

Effectiveness:
Dogs: The effectiveness of METACAM 5 mg/mL Solution for Injection was demonstrated in a field study involving a total of 224 dogs representing various breeds, all diagnosed with osteoarthritis.[1] This placebo-controlled, masked study was conducted for 14 days. Dogs received a subcutaneous injection of 0.2 mg/kg METACAM 5 mg/mL Solution for Injection on day 1. The dogs were maintained on 0.1 mg/kg oral meloxicam from days 2 through 14. Variables evaluated by veterinarians included lameness, weight-bearing, pain on palpation, and overall improvement. Variables assessed by owners included mobility, ability to rise, limping, and overall improvement.

In this field study, dogs showed clinical improvement with statistical significance after 14 days of meloxicam treatment for all variables.

Reference: 1. FOI for NADA 141-219 METACAM (meloxicam) 5 mg/mL Solution for Injection.

Manufactured for:
Boehringer Ingelheim Vetmedica, Inc.
St. Joseph, MO 64506 U.S.A.

601307-07
Revised 08/2014

18490
06/2018

Previcox® (firocoxib)

CHEWABLE TABLETS

Brief Summary: Before using* PREVICOX, *please consult the product insert, a summary of which follows:

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

Indications: PREVICOX (firocoxib) Chewable Tablets are indicated for the control of pain and inflammation associated with osteoarthritis and for the control of postoperative pain and inflammation associated with soft-tissue and orthopedic surgery in dogs.

Contraindications: Dogs with known hypersensitivity to firocoxib should not receive PREVICOX.

Warnings: Not for use in humans. Keep this and all medications out of the reach of children. Consult a physician in case of accidental ingestion by humans.

For oral use in dogs only. Use of this product at doses above the recommended 2.27 mg/lb (5.0 mg/kg) in puppies less than seven months of age has been associated with serious adverse reactions, including death (see Animal Safety). Due to tablet sizes and scoring, dogs weighing less than 12.5 lb (5.7 kg) cannot be accurately dosed.

All dogs should undergo a thorough history and physical examination before the initiation of NSAID therapy. Appropriate laboratory testing to establish hematological and serum baseline data is recommended prior to and periodically during administration of any NSAID. ***Owners should be advised to observe for signs of potential drug toxicity (see Adverse Reactions and Animal Safety) and be given a Client Information Sheet about* PREVICOX *Chewable Tablets.***

For technical assistance or to report suspected adverse events, call 1-877-217-3543. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDAVETS or http://www.fda.gov/AnimalVeterinary/SafetyHealth

Precautions: This product cannot be accurately dosed in dogs less than 12.5 pounds in body weight. Consider appropriate washout times when switching from one NSAID to another or when switching from corticosteroid use to NSAID use.

As a class, cyclooxygenase inhibitory NSAIDs may be associated with renal, gastrointestinal and hepatic toxicity. Sensitivity to drug-associated adverse events varies with the individual patient. Dogs that have experienced adverse reactions from one NSAID may experience adverse reactions from another NSAID. Patients at greatest risk for adverse events are those that are dehydrated, on concomitant diuretic therapy, or those with existing renal, cardiovascular, and/or hepatic dysfunction. Concurrent administration of potentially nephrotoxic drugs should be carefully approached and monitored. NSAIDs may inhibit the prostaglandins that maintain normal homeostatic function. Such anti-prostaglandin effects may result in clinically significant disease in patients with underlying or pre-existing disease that has not been previously diagnosed. Since NSAIDs possess the potential to produce gastrointestinal ulceration and/or gastrointestinal perforation, concomitant use of PREVICOX Chewable Tablets with other anti-inflammatory drugs, such as NSAIDs or corticosteroids, should be avoided. The concomitant use of protein-bound drugs with PREVICOX Chewable Tablets has not been studied in dogs. Commonly used protein-bound drugs include cardiac, anticonvulsant, and behavioral medications. The influence of concomitant drugs that may inhibit the metabolism of PREVICOX Chewable Tablets has not been evaluated. Drug compatibility should be monitored in patients requiring adjunctive therapy. If additional pain medication is needed after the daily dose of PREVICOX, a non-NSAID class of analgesic may be necessary. Appropriate monitoring procedures should be employed during all surgical procedures. Anesthetic drugs may affect renal perfusion, approach concomitant use of anesthetics and NSAIDs cautiously. The use of parenteral fluids during surgery should be considered to decrease potential renal complications when using NSAIDs perioperatively. The safe use of PREVICOX Chewable Tablets in pregnant, lactating or breeding dogs has not been evaluated.

Adverse Reactions:

Osteoarthritis: In controlled field studies, 128 dogs (ages 11 months to 15 years) were evaluated for safety when given PREVICOX Chewable Tablets at a dose of 2.27mg/lb (5.0 mg/kg) orally once daily for 30 days. The following adverse reactions were observed. Dogs may have experienced more than one of the observed adverse reactions during the study.

Adverse Reactions Seen in U. S. Field Studies

Adverse Reactions	PREVICOX *(n=128)*	*Active Control (n=121)*
Vomiting	5	8
Diarrhea	1	10
Decreased Appetite or Anorexia	3	3
Lethargy	1	3
Pain	2	1
Somnolence	1	1
Hyperactivity	1	0

PREVICOX (firocoxib) Chewable Tablets were safely used during field studies concomitantly with other therapies, including vaccines, anthelmintics, and antibiotics.

Soft-tissue Surgery: In controlled field studies evaluating soft-tissue postoperative pain and inflammation, 258 dogs (ages 10.5 weeks to 16 years) were evaluated for safety when given PREVICOX Chewable Tablets at a dose of 2.27 mg/lb (5.0 mg/kg) orally approximately 2 hours prior to surgery and once daily thereafter for up to two days. The following adverse reactions were observed. Dogs may have experienced more than one of the observed reactions during the study.

Adverse Reactions Seen in the Soft-tissue Surgery Postoperative Pain Field Studies

Adverse Reactions	*Firocoxib Group (n=127)*	*Control Group* (n=131)*
Vomiting	5	6
Diarrhea	1	1
Bruising at Surgery Site	1	1
Respiratory Arrest	1	0
SQ Crepitus in Rear Leg and Flank	1	0
Swollen Paw	1	0

**Sham-dosed (pilled)*

Orthopedic Surgery: In a controlled field study evaluating orthopedic postoperative pain and inflammation, 226 dogs of various breeds, ranging in age from 1 to 11.9 years in the PREVICOX-treated groups and 0.7 to 17 years in the control group were evaluated for safety. Of the 226 dogs, 118 were given PREVICOX Chewable Tablets at a dose of 2.27 mg/lb (5.0 mg/kg) orally approximately 2 hours prior to surgery and once daily thereafter for a total of three days. The following adverse reactions were observed. Dogs may have experienced more than one of the observed reactions during the study.

Adverse Reactions Seen in the Orthopedic Surgery Postoperative Pain Field Study

Adverse Reactions	*Firocoxib Group (n=118)*	*Control Group* (n=108)*
Vomiting	1	0
Diarrhea	2**	1
Bruising at Surgery Site	2	3
Inappetence/ Decreased Appetite	1	2
Pyrexia	0	1
Incision Swelling, Redness	9	5
Oozing Incision	2	0

A case may be represented in more than one category.
*Sham-dosed (pilled).
**One dog had hemorrhagic gastroenteritis.

Post-Approval Experience (Rev. 2009): The following adverse reactions are based on post-approval adverse drug event reporting. The categories are listed in decreasing order of frequency by body system:

Gastrointestinal: *Vomiting, anorexia, diarrhea, melena, gastrointestinal perforation, hematemesis, hematachezia, weight loss, gastrointestinal ulceration, peritonitis, abdominal pain, hypersalivation, nausea*

Urinary: *Elevated BUN, elevated creatinine, polydypsia, polyuria, hematuria, urinary incontinence, proteinuria, kidney failure, azotemia, urinary tract infection*

Neurological/Behavioral/Special Sense: *Depression/lethargy, ataxia, seizures, nervousness, confusion, weakness, hyperactivity, tremor, paresis, head tilt, nystagmus, mydriasis, aggression, uveitis*

Hepatic: *Elevated ALP, elevated ALT, elevated bilirubin, decreased albumin, elevated AST, icterus, decreased or increased total protein and globulin, pancreatitis, ascites, liver failure, decreased BUN*

Hematological: *Anemia, neutrophilia, thrombocytopenia, neutropenia*

Cardiovascular/Respiratory: *Tachypnea, dyspnea, tachycardia*

Dermatologic/Immunologic: *Pruritis, fever, alopecia, moist dermatitis, autoimmune hemolytic anemia, facial/muzzle edema, urticaria*

In some situations, death has been reported as an outcome of the adverse events listed above.

For a complete listing of adverse reactions for firocoxib reported to the CVM see: http://www.fda.gov/downloads/AnimalVeterinary/SafetyHealth/ProductSafetyInformation/UCM055407.pdf

Information For Dog Owners: PREVICOX, like other drugs of its class, is not free from adverse reactions. Owners should be advised of the potential for adverse reactions and be informed of the clinical signs associated with drug intolerance. Adverse reactions may include vomiting, diarrhea, decreased appetite, dark or tarry stools, increased water consumption, increased urination, pale gums due to anemia, yellowing of gums, skin or white of the eye due to jaundice, lethargy, incoordination, seizure, or behavioral changes. **Serious adverse reactions associated with this drug class can occur without warning and in rare situations result in death (see Adverse Reactions). Owners should be advised to discontinue PREVICOX therapy and contact their veterinarian immediately if signs of intolerance are observed.** The vast majority of patients with drug-related adverse reactions have recovered when the signs are recognized, the drug is withdrawn, and veterinary care, if appropriate, is initiated. Owners should be advised of the importance of periodic follow up for all dogs during administration of any NSAID.

Effectiveness: Two hundred and forty-nine dogs of various breeds, ranging in age from 11 months to 20 years, and weighing 13 to 175 lbs, were randomly administered PREVICOX or an active control drug in two field studies. Dogs were assessed for lameness, pain on manipulation, range of motion, joint swelling, and overall improvement in a non-inferiority evaluation of PREVICOX compared with the active control. At the study's end, 87% of the owners rated PREVICOX-treated dogs as improved. Eighty-eight percent of dogs treated with PREVICOX were also judged improved by the veterinarians. Dogs treated with PREVICOX showed a level of improvement in veterinarian-assessed lameness, pain on palpation, range of motion, and owner-assessed improvement that was comparable to the active control. The level of improvement in PREVICOX-treated dogs in limb weight bearing on the force plate gait analysis assessment was comparable to the active control. In a separate field study, two hundred fifty-eight client-owned dogs of various breeds, ranging in age from 10.5 weeks to 16 years and weighing from 7 to 168 lbs, were randomly administered PREVICOX or a control (sham-dosed-pilled) for the control of postoperative pain and inflammation associated with soft-tissue surgical procedures such as abdominal surgery (e.g., ovariohysterectomy, abdominal cryptorchidectomy, splenectomy, cystotomy) or major external surgeries (e.g., mastectomy, skin tumor removal ≤8 cm). The study demonstrated that PREVICOX-treated dogs had significantly lower need for rescue medication than the control (sham-dosed-pilled) in controlling postoperative pain and inflammation associated with soft-surgery. A multi-center field study with 226 client-owned dogs of various breeds, and ranging in age from 1 to 11.9 years in the PREVICOX-treated groups and 0.7 to 17 years in the control group was conducted. Dogs were randomly assigned to either the PREVICOX or the control (sham-dosed-pilled) group for the control of postoperative pain and inflammation associated with orthopedic surgery. Surgery to repair a ruptured cruciate ligament included the following stabilization procedures: fabellar suture and/or imbrication, fibular head transposition, tibial plateau leveling osteotomy (TPLO), and 'over the top' technique. The study (n = 220 for effectiveness) demonstrated that PREVICOX-treated dogs had significantly lower need for rescue medication than the control (sham-dosed-pilled) in controlling postoperative pain and inflammation associated with orthopedic surgery.

Animal Safety: In a targeted animal safety study, firocoxib was administered orally to healthy adult Beagle dogs (eight dogs per group) at 5, 15, and 25 mg/kg (1, 3, and 5 times the recommended total daily dose) for 180 days. At the indicated dose of 5 mg/kg, there were no treatment-related adverse events. Decreased appetite, vomiting, and diarrhea were seen in dogs in all dose groups, including unmedicated controls, although vomiting and diarrhea were seen more often in dogs in the 5X dose group. One dog in the 3X dose group was diagnosed with juvenile polyarteritis of unknown etiology after exhibiting recurrent episodes of vomiting and diarrhea, lethargy, pain, anorexia, ataxia, proprioceptive deficits, decreased albumin levels, decreased and then elevated platelet counts, increased bleeding times, and elevated liver enzymes. On histopathologic examination, a mild ileal ulcer was found in one 5X dog. This dog also had a decreased serum albumin which returned to normal by study completion. One control and three 5X dogs had focal areas of inflammation in the pylorus or small intestine. Vacuolization without inflammatory cell infiltrates was noted in the thalamic region of the brain in three control, one 3X, and three 5X dogs. Mean ALP was within the normal range for all groups but was greater in the 3X and 5X dose groups than in the control group. Transient decreases in serum albumin were seen in multiple animals in the 3X and 5X dose groups, and in one control animal. In a separate safety study, firocoxib was administered orally to healthy juvenile (10-13 weeks of age) Beagle dogs at 5, 15, and 25 mg/kg (1, 3, and 5 times the recommended total daily dose) for 180 days. At the indicated (1X) dose of 5 mg/kg, on histopathologic examination, three out of six dogs had minimal periportal hepatic fatty change. On histopathologic examination, one control, one 1X, and two 5X dogs had diffuse slight hepatic fatty change. These animals showed no clinical signs and had no liver enzyme elevations. In the 3X dose group, one dog was euthanized because of poor clinical condition (Day 63). This dog also had a mildly decreased serum albumin. At study completion, out of five surviving and clinically normal 3X dogs, three had minimal periportal hepatic fatty change. Of twelve dogs in the 5X dose group, one died (Day 82) and three moribund dogs were euthanized (Days 38, 78, and 79) because of anorexia, poor weight gain, depression, and in one dog, vomiting. One of the euthanized dogs had ingested a rope toy. Two of these 5X dogs had mildly elevated liver enzymes. At necropsy all five of the dogs that died or were euthanized had moderate periportal or severe panzonal hepatic fatty change; two had duodenal ulceration; and two had pancreatic edema. Of two other clinically normal 5X dogs (out of four euthanized as comparators to the clinically affected dogs), one had slight and one had moderate periportal hepatic fatty change. Drug treatment was discontinued for four dogs in the 5X group. These dogs survived the remaining 14 weeks of the study. On average, the dogs in the 3X and 5X dose groups did not gain as much weight as control dogs. Rate of weight gain was measured (instead of weight loss) because these were young growing dogs. Thalamic vacuolation was seen in three of six dogs in the 3X dose group, five of twelve dogs in the 5X dose group, and to a lesser degree in two unmedicated controls. Diarrhea was seen in all dose groups, including unmedicated controls. In a separate dose tolerance safety study involving a total of six dogs (two control dogs and four treated dogs), firocoxib was administered to four healthy adult Beagle dogs at 50 mg/kg (ten times the recommended daily dose) for twenty-two days. All dogs survived to the end of the study. Three of the four treated dogs developed small intestinal erosion or ulceration. Treated dogs that developed small intestinal erosion or ulceration had a higher incidence of vomiting, diarrhea, and decreased food consumption than control dogs. One of these dogs had severe duodenal ulceration, with hepatic fatty change and associated vomiting, diarrhea, anorexia, weight loss, ketonuria, and mild elevations in AST and ALT. All four treated dogs exhibited progressively decreasing serum albumin that, with the exception of one dog that developed hypoalbuminemia, remained within normal range. Mild weight loss also occurred in the treated group. One of the two control dogs and three of the four treated dogs exhibited transient increases in ALP that remained within normal range.

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QUIZ CORNER

QUIZ YOURSELF

on this issue's features

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1 **CASE IN POINT** PAGE 6

Which of the following is *not* a basic principle of treatment of physeal fractures?

A. Anatomic reduction
B. Immobilization of the limb
C. Stable fixation
D. Preservation of blood supply

2 **TOP 5** PAGE 14

Pentoxifylline is often the treatment of choice for which of the following disorders that affect the pinnae?

A. Vasculitis
B. Ceruminous cystadenomatosis
C. Scabies
D. Ear margin seborrhea

3 **TOP 5** PAGE 26

An application regimen of _____ minutes per session, with an interval of 6 hours between sessions, is recommended when using cryotherapy for rehabilitation after an orthopedic procedure.

A. 1 to 10
B. 10 to 30
C. 30 to 60
D. 60 to 90

4 **CONSULT THE EXPERT** PAGE 65

When performing an ophthalmologic examination using smartphone technology, enabling the _____ feature in the camera's video mode can help avoid shadowing and underexposure.

Answer Key:
1: B 2: A 3: B 4: Continuous flash

LOOK FOR THESE ARTICLES IN FUTURE ISSUES

- Feline Orofacial Pain Syndrome Case
- Compulsive Disorders in Dogs
- Step-by-Step: Sialoadenectomy
- Septic Shock & Critical Illness-Related Corticosteroid Insufficiency
- Procedure Overview: Exploratory Celiotomy
- Opinion: Treatment for Mental Health

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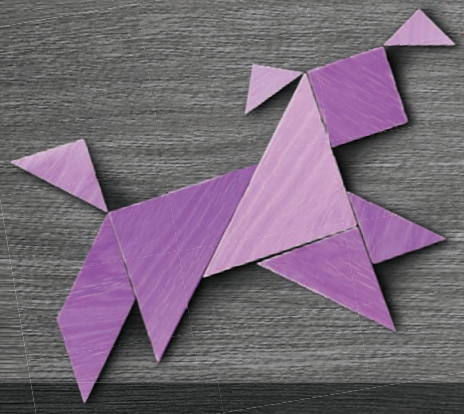

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See pages 82 and 83 for product information summary.

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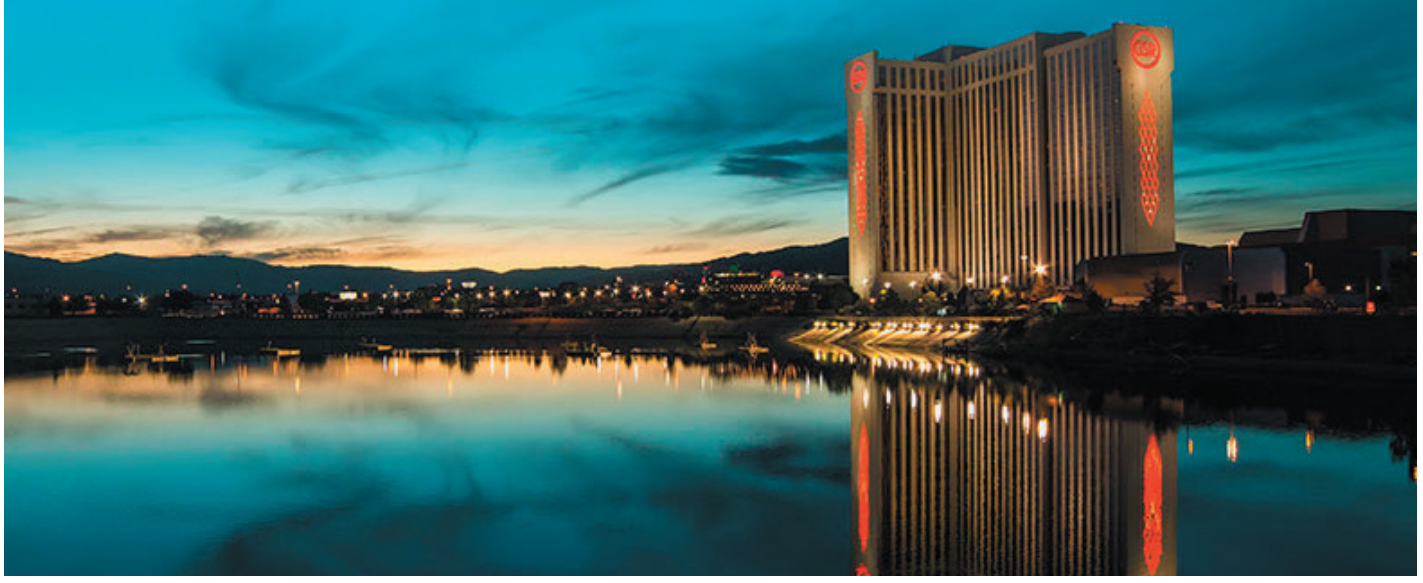

CLINICAL THEATER 1
TAHOE ROOM

8.00-8:50
Cat Corneas: FHV-1 & More

Thomas Chen
DVM, MS, DACVO
Clinical Assistant Professor, Small Animal Clinical Sciences
University of Tennessee

9.00-9:50
No Hydro? No Problem! Alternatives for Perioperative Pain Management

Khursheed Mama
DVM, DACVAA
Professor, Anesthesiology
Colorado State University

10:30-11:20
Tips & Tricks for Oral & Dental Emergencies in General Practice

Speaker details to come.

11:30-12:20
Start Now! Tibial & Radial Fracture Repair in Dogs in Daily Practice

Denis Marcellin-Little
DEDV, DACVS, DECVS, DACVSMR
Professor, Surgical and Radiological Sciences
University of California, Davis

1:20-2:10
Clinical Pathology Bootcamp: Immunology Under the Microscope

Speaker details to come.

17:00-17:50
Crazy Cats: Neurologic or Normal?

Rebecca Windsor
DVM, DACVIM (Neurology/ Neurosurgery)
Veterinary Specialist
Wheat Ridge Animal Hospital

CLINICAL THEATER 2
CARSON 1-2

8:50-9:40
"It's Okay… Be Nice…" Canine Aggression During Veterinary Visits

Wailani Sung
MS, PhD, DVM, DACVB
Staff Veterinarian
Mission Campus, San Francisco SPCA

10:30-11:20
Survival Guide to Managing Chronic Ophthalmic Conditions

Thomas Chen
DVM, MS, DACVO
Clinical Assistant Professor, Small Animal Clinical Sciences
University of Tennessee

11:30-12:20
Haven't Got Time for the Pain: Prevention & Treatment of Dental Extraction Complications

Speaker details to come.

13:30-14:20
It's Complicated: Anesthetizing Patients With Heart Disease

Khursheed Mama
DVM, DACVAA
Professor, Anesthesiology
Colorado State University

16:10-17:00
Start Now! Veterinary Rehabilitation for Common Orthopedic Conditions

Denis Marcellin-Little
DEDV, DACVS, DECVS, DACVSMR
Professor, Surgical and Radiological Sciences
University of California, Davis

For the most up-to-date program, please visit wildwest.vetshow.com/program

CLINICAL THEATER 3
CARSON 3-4

8:50-9:40
Follow Your Heart: The Essential Cardiology Examination

Kursten Pierce
DVM, DACVIM (Cardiology)
Veterinary Specialist
James L. Voss Veterinary Teaching Hospital, Colorado State University

10:30-11:20
Parasites in Your Pocket (Pets): Companion Mammal Parasitology

Dan Johnson
DVM, DABVP (Exotics)
Founder
Avian and Exotic Animal Care Veterinary Hospital

11:30-12:20
Infectious Diseases of Companion Mammals

Dan Johnson
DVM, DABVP (Exotics)
Founder
Avian and Exotic Animal Care Veterinary Hospital

13:30-14:20
Fiery Felines: How to Handle Your Aggressive Feline Patients

Wailani Sung
MS, PhD, DVM, DACVB
Staff Veterinarian
Mission Campus, San Francisco SPCA

14:30-15:20
What's Next in Adnexal Procedures?

Thomas Chen
DVM, MS, DACVO
Clinical Assistant Professor, Small Animal Clinical Sciences
University of Tennessee

16:10-17:00
Come Fly With Me: Avian Parasitology

Dan Johnson
DVM, DABVP (Exotics)
Founder
Avian and Exotic Animal Care Veterinary Hospital

Program subject to change.

BUSINESS THEATER
CRYSTAL 1-2

8:50-9:40
Recruitment Strategies

Louise Dunn
Founder and CEO
Snowgoose Veterinary Management Consulting

10:30-11:20
Preventive Care Visits

Dr. Peter Brown
DVM

11:30-12:20
Top Tips for Employee Retention

Louise Dunn
Founder and CEO
Snowgoose Veterinary Management Consulting

14:30-15:20
Risky Personnel Practices You Are Doing Every Day

Louise Dunn
Founder and CEO
Snowgoose Veterinary Management Consulting

16:10-17:00
SESSION DELIVERED BY
TOTAL PRACTICE SOLUTIONS GROUP
Veterinary Practice Sales & Appraisal

Karl Salzsieder
DVM, JD, CVA
Valuation Analyst
Total Practice Solutions Group

VETERINARY NURSING THEATER
CRYSTAL 3-4

10:30-11:20
Keep Your Cool: Handling the Top 3 Emergencies in Practice

Courtney Waxman
CVT, VTS (ECC)
Instructional Technologist
Purdue University

11:30-12:20
The Role of Technicians in Veterinary Behavioral Medicine

Monique Feyrecilde
BA, LVT, VTS (Behavior)
Founder
Teaching Animals

13:30-14:20
Desert Dangers: Heatstroke

Courtney Waxman
CVT, VTS (ECC)
Instructional Technologist
Purdue University

14:30-15:20
Bites & Scratches & Bruises, No More! Fear-Free Animal Handling

Monique Feyrecilde
BA, LVT, VTS (Behavior)
Founder
Teaching Animals

APHIS, EQUINE, & FARM
CRYSTAL 5

9:10-10:00
Module 5:
Vesicular Diseases

10:20-11:10
Module 30:
The Role of Veterinarians in Honey Bee Health

11:30-12:20
Module 29:
Veterinary Feed Directive

13:00-13:50
Module 23:
Antibiotic Use in Animals

14:10-15:00
Module 9:
Interstate & International Health Certificates for Category I Animals

15:20-16:10
Module 11:
Sheep & Goat Diseases & Health Certificates

Speaker details to come.

SESSIONS SUPPORTED BY APHIS

CLINICAL THEATER 1
TAHOE ROOM

7:00-7:50
Top 3 Neurologic Conditions of Pediatric & Geriatric Companion Animals

Rebecca Windsor
DVM, DACVIM (Neurology/ Neurosurgery)
Veterinary Specialist
Wheat Ridge Animal Hospital

8:00-8:50
Be Still My Beating Heart: Diagnosis & Management of Common Cardiac Arrhythmias

Kursten Pierce
DVM, DACVIM (Cardiology)
Veterinary Specialist
James L. Voss Veterinary Teaching Hospital, Colorado State University

9:00-9:50
What Lies Beneath: Dental Radiology Survival Guide

Speaker details to come.

10:30-11:20
Managing Limb Deformities

Denis Marcellin-Little
DEDV, DACVS, DECVS, DACVSMR
Professor, Surgical and Radiological Sciences
University of California, Davis

11:30-12:20
Choosing the right therapies for fear and anxiety in small animal patients

SESSION SUPPORTED BY PURINA

Julia Albright
DVM, MA, DACVB
Associate Professor, Small Animal Clinical Sciences
University of Tennessee

13:20-14:10
Tips & Clinical Pearls for Working with Community Pharmacists

SESSION SUPPORTED BY plumb's veterinary drugs

Elaine Blythe PharmD
Associate Professor, Veterinary Pharmacology
St. Matthews University School of Veterinary Medicine

14:20-15:10
Stop Bugging Me: The Role of the Vector in Immune-Mediated Hemolytic Anemia

Linda Kidd
DVM, PhD, DACVIM
Associate Professor, Small Animal Internal Medicine
Western University of Health Sciences

17:00-17:50
Can't Find a Vein? Alternate Routes for Euthanasia

Mary Gardner
DVM
Cofounder and CTO
Lap of Love Veterinary Hospice

CLINICAL THEATER 2
CARSON 1-2

10:30-11:20
Better Living Through Chemistry: Sedation Protocols for Every Patient

Khursheed Mama
DVM, DACVAA
Professor, Anesthesiology
Colorado State University

11:30-12:20
Clinical Pathology in the ER: When You Need Results Fast

Speaker details to come.

13:30-14:20
Beyond Opioids: Medical Massage for Pain Management

Narda Robinson
DO, DVM, MS, FAAMA
President and CEO
CuraCore Integrative Medicine and Education Center

14:30-15:20
Is That Normal for an Old Dog (or Cat)? Geriatric Variants in Radiology

Anthony Pease
DVM, MS, DACVR
Chief Veterinary Medical Officer
WVC

16:10-17:00
The Essential Guide to GI Obstruction: Diagnosis & Treatment

Bonnie Campbell
DVM, PhD, DACVS
Clinical Associate Professor
Washington State University

CLINICAL THEATER 1
TAHOE ROOM

18:00-19:40
Anatomy of a Complaint

Louis Ling, Esq., Board Counsel, Nevada Board of Veterinary Examiners

Patricia Handal, Board Investigator

Christina Johnson, Hospital Inspector

Ron Sandoval, **DVM**, Board Vice-President

Richard Simmonds, **DVM**, **MS**, **DACLAM**

Jennifer Pedigo, Executive Director

CLINICAL THEATER 3
CARSON 3-4

6:30-7:20

SESSION DELIVERED BY TOTAL PRACTICE SOLUTIONS GROUP

Karl Salzsieder
DVM, JD, CVA
Valuation Analyst
Total Practice Solutions Group

8:50-9:40
Beyond Opioids: Acupuncture for Pain Management

Narda Robinson
DO, DVM, MS, FAAMA
President and CEO
CuraCore Integrative Medicine and Education Center

10:30-11:20
Beyond Opioids: Laser Therapy for Pain Management

SESSION SUPPORTED BY COMPANION ANIMAL HEALTH

Speaker details to come.

11:30-12:20
Vector-Borne Disease Screening Using Available Diagnostic Panels: What Am I Missing?

Linda Kidd
DVM, PhD, DACVIM
Associate Professor, Small Animal Internal Medicine
Western University of Health Sciences

13:30-14:20
Neuropathic Pain: How to Diagnose & Manage

Rebecca Windsor
DVM, DACVIM (Neurology/ Neurosurgery)
Veterinary Specialist
Wheat Ridge Animal Hospital

14:30-15:20
Beyond Opioids: Veterinary Botanicals for Pain Management

Narda Robinson
DO, DVM, MS, FAAMA
President and CEO
CuraCore Integrative Medicine and Education Center

15:20-16:10
Is That Normal for a Bulldog? Breed Variations in Radiology

Anthony Pease
DVM, MS, DACVR
Chief Veterinary Medical Officer
WVC

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BUSINESS THEATER
CRYSTAL 1-2

8:50-9:40
Caregiver Burden & Relief: When Loving Hurts

Mary Gardner
DVM
Cofounder and CTO
Lap of Love Veterinary Hospice

11:30-12:20
Driving Financial Success

Karen Felsted
CPA, MS, DVM, CVPM, CVA
Founder and President
PantheraT

13:30-14:20
Workplace Happiness: Is It Possible?

Mary Gardner
DVM
Cofounder and CTO
Lap of Love Veterinary Hospice

14:30-15:20
Using Effective Pricing Strategies

Karen Felsted
CPA, MS, DVM, CVPM, CVA
Founder and President
PantheraT

16:10-17:00
Get Your Veterinary Groove Back

Mary Gardner
DVM
Cofounder and CTO
Lap of Love Veterinary Hospice

VETERINARY NURSING THEATER
CRYSTAL 3-4

8:50-9:40
Minutes Count: Traumatic Brain Injury

Courtney Waxman
CVT, VTS (ECC)
Instructional Technologist
Purdue University

10:30-11:20
Behavior Essentials: Preventive Care for Puppies & Kittens

Monique Feyrecilde
BA, LVT, VTS (Behavior)
Founder
Teaching Animals

11:30-12:20
The Perils of Parasites: How to Protect More Patients

Beckie Mossor
RVT
Director of Operations
3K9 Working Dogs, Inc

13:30-14:20
Dr. Dolittle Is on Duty! Communicating With Animals the Fear-Free Way

Monique Feyrecilde
BA, LVT, VTS (Behavior)
Founder
Teaching Animals

14:30-15:20
Desert Dangers: Rattlesnake Envenomation

Courtney Waxman
CVT, VTS (ECC)
Instructional Technologist
Purdue University

16:10-17:00
You Can't Ask That: Understanding Service Dog Laws & Having Conversations About Them

Beckie Mossor
RVT
Director of Operations
3K9 Working Dogs, Inc

APHIS, EQUINE, & FARM
CRYSTAL 5

8:30-9:20
Module 19: Animal Emergency Response

9:40-10:30
Module 12: Animal Disease Traceability

Speaker details to come.

SESSIONS SUPPORTED BY APHIS

10:50-11:40
Equine Ophthalmology: The Essential Eye Examination

Nicole Scherrer
DVM
Clinical Assistant Professor, Ophthalmology
New Bolton Center, University of Pennsylvania

13:00-13:50
The Small Ruminant Physical Examination Made Easy

Meredyth Jones
DVM, MS, DACVIM
Associate Professor
Oklahoma State University

14:10-15:00
Equine Corneal Disease: Ulceration & More

Nicole Scherrer
DVM
Clinical Assistant Professor, Ophthalmology
New Bolton Center, University of Pennsylvania

15:20-16:10
Parasites in Small Ruminants: What You Need to Know

Meredyth Jones
DVM, MS, DACVIM
Associate Professor
Oklahoma State University

16:30-17:20
Guide to Equine Field Anesthesia

Dr. Lynn Martin
DVM, MPH, DACVIM (LAIM),
Post-Doctoral Fellow, College of Veterinary Medicine
Veterinary Health Center, University of Missouri

Program subject to change.

CLINICAL THEATER 1
TAHOE ROOM

8:00-8:50
Strategies for Successful Management of Complicated Wounds

Bonnie Campbell
DVM, PhD, DACVS
Clinical Associate Professor
Washington State University

9:00-9:50
Cancer Palliation: Oral Therapies & Beyond

Jennifer Willcox
DVM, DACVIM (Oncology)
Assistant Professor, Clinical Oncology
University of California, Davis

10:30-11:20
On the Mind: Survival Guide to Traumatic Brain Injury

Raegan Wells
DVM, MS, DACVECC
Medical Director
Phoenix Veterinary Referral and Emergency

11:30-12:20
In-House Compounding: Do's & Don'ts in General Practice

Lauren Eichstadt Forsythe
PharmD, DICVP, FSVHP
Pharmacy Director
University of Illinois College of Veterinary Medicine

13:20-14:10
Veterinary Hospice & Palliative Care From the Trenches

Mary Gardner
DVM
Cofounder and CTO
Lap of Love Veterinary Hospice

14:20-15:10
Diversion Concerns in Veterinary Practice

Paul Edwards
JD
General Counsel
Nevada State Board of Pharmacy

16:00-16:50
Dermatology or Ophthalmology? The Eyelid Margin Wars

Alexander Werner
VMD, DACVD
Veterinary Specialist
Animal Dermatology Center

CLINICAL THEATER 2
CARSON 1-2

10:30-11:20
This patient is out of control! - The complicated diabetic made easy

Peter Chapman
BVetMed (Hons), DECVIM-CA, DACVIM, MRCVS
Internal Medicine Specialist
Veterinary Specialty and Emergency Center—Blue Pearl Philadelphia

11:30-12:20
Assessing Quality of Life

Mary Gardner
DVM
Cofounder and CTO
Lap of Love Veterinary Hospice

13:30-14:20
Top 5 Emergency Room Procedures You Can Use in General Practice

Raegan Wells
DVM, MS, DACVECC
Medical Director
Phoenix Veterinary Referral and Emergency

15:20-16:10
Queen of Denial: How Cats Show (& Hide) Pain & What to Do About It

Margie Scherk
DVM, DABVP (Feline Practice)
Veterinary Specialist
Cat Healthy

CLINICAL THEATER 3
CARSON 3-4

10:30-11:20
Navigating the Muddy Waters of Pharmacy: Improving Communication & Reducing Error

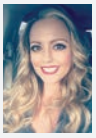
Lauren Eichstadt Forsythe
PharmD, DICVP, FSVHP
Pharmacy Director
University of Illinois College of Veterinary Medicine

Katie Boatright
VMD
Associate Veterinarian
Butler Veterinary Associates

13:30-14:20
Mast Cell Tumors, Melanoma, & Beyond: Clinical Approach to Cutaneous Masses

Jennifer Willcox
DVM, DACVIM (Oncology)
Assistant Professor, Clinical Oncology
University of California, Davis

14:30-15:20
Lessons From the Street: Opioid Diversion in the Veterinary Clinic



Austin Broome-Phillips
Detective
Reno Police Department Street Enforcement Team

16:10-17:00
Chronic vomiting - As much information as you can stomach

Peter Chapman
BVetMed (Hons), DECVIM-CA, DACVIM, MRCVS
Internal Medicine Specialist
Veterinary Specialty and Emergency Center—Blue Pearl Philadelphia

Program subject to change.

BUSINESS THEATER
CRYSTAL 1-2

8:50-9:40
Top Tips to Stay Sane

Mary Gardner
DVM
Cofounder and CTO
Lap of Love Veterinary Hospice

Eric Garcia
CEO
Simply Done Tech Solutions

Megan Brashear
BS, CVT, VTS (ECC)
Specialty Technician Trainer
VCA Northwest Veterinary Specialists

10:30-11:20
What to Do with Out-of-Control Inventory Costs

Karen Felsted
CPA, MS, DVM, CVPM, CVA
Founder and President
PantheraT

11:30-12:20
Why Are Performance Reviews So Overwhelming?

Megan Brashear
BS, CVT, VTS (ECC)
Specialty Technician Trainer
VCA Northwest Veterinary Specialists

14:30-15:20
Translate Management Decisions into Dollars & Cents

Karen Felsted
CPA, MS, DVM, CVPM, CVA
Founder and President
PantheraT

16:10-17:00
Why Do They Do That? Generational Conflicts in Your Practice

Megan Brashear
BS, CVT, VTS (ECC)
Specialty Technician Trainer
VCA Northwest Veterinary Specialists

Eric Garcia
CEO
Simply Done Tech Solutions

For the most up-to-date program, please visit wildwest.vetshow.com/program

VETERINARY NURSING THEATER
CRYSTAL 3-4

8:50-9:40
Stayin' Alive: The RECOVER Guidelines

Jo Woodison
RVT
Representative
California Veterinary Medical Association

10:30-11:20
Block Pain Before It Starts: Local & Regional Blocks in Clinical Practice

Darci Palmer
BS, LVT, VTS (Anesthesia & Analgesia)
Veterinary Anesthetist
Southeastern Veterinary Surgery Center

11:30-12:20
Self-Care: Why There Needs to Be an 'I' in 'Team'

Jade Velasquez
LVT
Past-President
Washington State Association of Veterinary Technicians

13:30-14:20
It's Not Over Yet: Managing Anesthesia Recovery

Darci Palmer
BS, LVT, VTS (Anesthesia & Analgesia)
Veterinary Anesthetist
Southeastern Veterinary Surgery Center

14:30-15:20
Compassion Fatigue Versus Burnout

Jade Velasquez
LVT
Past-President
Washington State Association of Veterinary Technicians

16:10-17:00
The Do's & Don'ts of Blood Transfusions

Jo Woodison
RVT
Representative
California Veterinary Medical Association

APHIS, EQUINE, & FARM
CRYSTAL 5

8:30-9:20
Complications of Equine Field Surgery

Shane Miller
DVM, DACVS
Equine Surgeon
Comstock Equine Hospital

9:40-10:30
Blood Work in Small Ruminants: What to Run & How to Interpret

Meredyth Jones
DVM, MS, DACVIM
Associate Professor
Oklahoma State University

10:50-11:40
Special Considerations for Donkey and Mule Medicine

Dr. Lynn Martin
DVM, MPH, DACVIM (LAIM),
Post-Doctoral Fellow, College of Veterinary Medicine Veterinary Health Center, University of Missouri

13:00-13:50
Equine Lameness: Early Intervention

Shane Miller
DVM, DACVS
Equine Surgeon
Comstock Equine Hospital

14:10-15:00
Drug Protocols in Small Ruminants

Meredyth Jones
DVM, MS, DACVIM
Associate Professor
Oklahoma State University

15:20-16:10
Guide to Equine Field Neurologic Examination

Dr. Lynn Martin
DVM, MPH, DACVIM (LAIM),
Post-Doctoral Fellow, College of Veterinary Medicine Veterinary Health Center, University of Missouri

16:30-17:20
Equine Regenerative Medicine Made Easy

Shane Miller
DVM, DACVS
Equine Surgeon
Comstock Equine Hospital

CLINICAL THEATER 1
TAHOE ROOM

8:00-9:15
What's New? Emerging Issues in Small Animal Toxicology

Raegan Wells
DVM, MS, DACVECC
Medical Director
Phoenix Veterinary Referral and Emergency

9:35-10:25
Food Allergy: Dr. Google Debunked

Alexander Werner
VMD, DACVD
Veterinary Specialist
Animal Dermatology Center

10:40-12:10
Hyperthyroidism & Beyond: Feline Endocrine Case Studies

Margie Scherk
DVM, DABVP (Feline Practice)
Veterinary Specialist
Cat Healthy

CLINICAL THEATER 2
CARSON 1-2

8:00-9:15
Picky Kitty: Feeding the Inappetent or Anorectic Cat

Margie Scherk
DVM, DABVP (Feline Practice)
Veterinary Specialist
Cat Healthy

9:35-10:25
What's New With Canine Hyperdrenocorticism - Crush the Cush!

Peter Chapman
BVetMed (Hons), DECVIM-CA, DACVIM, MRCVS
Internal Medicine Specialist
Veterinary Specialty and Emergency Center—Blue Pearl Philadelphia

10:40-12:10
Cutaneous Adverse Drug Reactions: Blame the Drug, Not Your Choice!

Alexander Werner
VMD, DACVD
Veterinary Specialist
Animal Dermatology Center

BUSINESS THEATER
CRYSTAL 1-2

8:50-9:40
Getting Your Team on Board With Change: Hospital Protocols

Megan Brashear
BS, CVT, VTS (ECC)
Specialty Technician Trainer
VCA Northwest Veterinary Specialists

10:30-11:20
Top Marketing Mistakes & How You Can Fix Them

Eric Garcia
CEO
Simply Done Tech Solutions

11:30-12:20
Top Communication Mistakes Online & Off

Megan Brashear
BS, CVT, VTS (ECC)
Specialty Technician Trainer
VCA Northwest Veterinary Specialists

Eric Garcia
CEO
Simply Done Tech Solutions

VETERINARY NURSING THEATER
CRYSTAL 3-4

8:00-9:30
Beyond Opioids: Balanced Anesthesia Meets Multimodal Analgesia—Developing a Patient-Specific Drug Protocol

Darci Palmer
BS, LVT, VTS (Anesthesia & Analgesia)
Veterinary Anesthetist
Southeastern Veterinary Surgery Center

9:35-10:25
Just Breathe: Respiratory Emergencies

Jo Woodison
RVT
Representative
California Veterinary Medical Association

10:40-12:10
Oh, Baby! Anesthesia & Analgesia Management for C-Sections & Neonatal Care

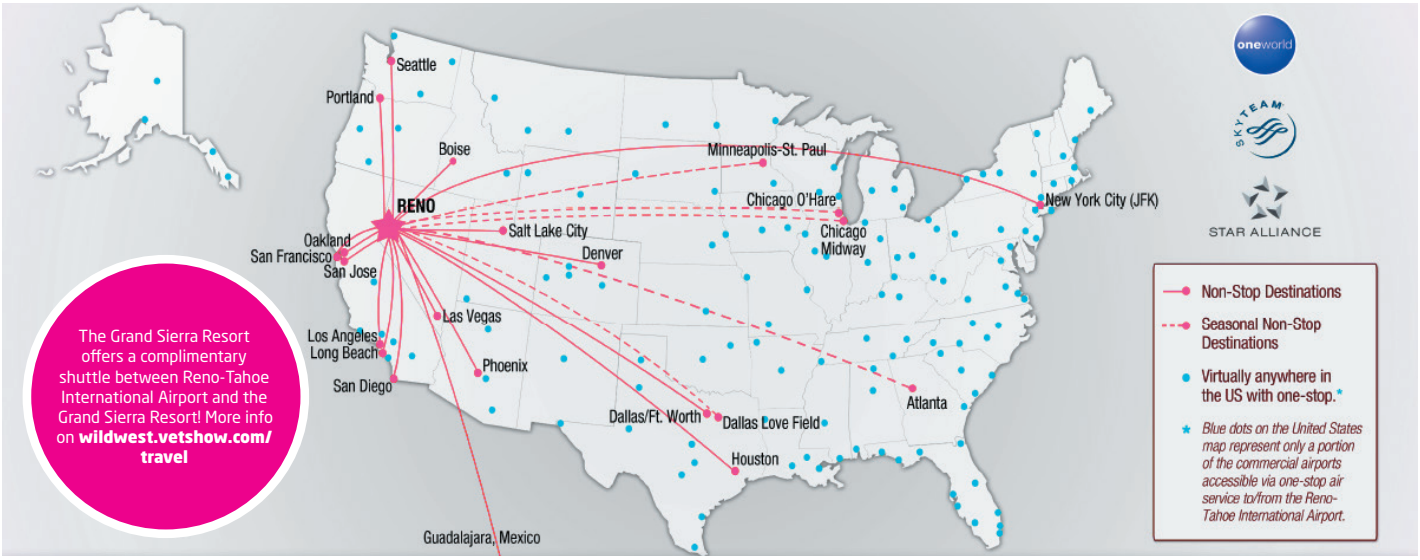
Darci Palmer
BS, LVT, VTS (Anesthesia & Analgesia)
Veterinary Anesthetist
Southeastern Veterinary Surgery Center

Program subject to change.

Many roads lead to Wild West Vet! Are you flying? Visit wildwest.vetshow.com/travel to view our special deals with Delta Airlines and United Airlines as Wild West Vet attendees get discounted plane tickets.

DELTA AIR LINES

United Airlines



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Earn **16 hours** of CE
Join **3,000** attendees
Meet with **320+** exhibitors

Earn **15 hours** of CE
Join **1,300** attendees
Meet with **160+** exhibitors

Can't make it to Wild West Vet?

Have a look at our 4 other US-based Vet Shows!

Earn **24 hours** of CE
Join **1,800** attendees
Meet with **200+** exhibitors

Earn **15 hours** of CE
Join **1,300** attendees
Meet with **160+** exhibitors

WILD WEST VET

RENO, NEVADA • OCTOBER 23-26, 2019

WILDWEST.VETSHOW.COM

Get Your Hands Dirty

Do you want to elevate your CE experience and take learning to the next level? We recommend attending one (or more!) of the small-scale labs and workshops offered at Wild West Vet. The intimate class setting provides the perfect climate to ask questions, get feedback, and partake in the crucial experience needed to master your newfound skills.

Fees and availability vary between classes, so take a look at the most up-to-date information at **wildwest.vetshow.com**.

Beginner Ultrasound Laboratory

Speaker to be confirmed

Friday, October 25, 2019

9:00 AM - 12:00 PM

Nevada Humane Society

A shuttle will be provided.
Open to all attendees.

This lab is geared towards finding the "Big 5." Hands-on training with experienced sonographers will give you the confidence to not only find the organs but also see each organ completely.

Sign up today for the opportunity to scan different animals with different instructors to gain experience with the machines and probes.

CE CREDITS 3.0 | COST $599 | CAPACITY 20

Intermediate / Advanced Ultrasound Laboratory

Speaker to be confirmed

Friday, October 25, 2019

1:00 PM - 4:00 PM

Nevada Humane Society

A shuttle will be provided.
Open to all attendees.

This lab is geared towards finding the smaller structures within the abdomen. Normal anatomical structures will be identified to facilitate finding the smaller structures such as lymph nodes and pancreas.

Take this opportunity to gain familiarity with the machines and probes.

CE CREDITS 3.0 | COST $599 | CAPACITY 20

Surgeries of the Equine Eyelid Lab

Nicole Scherrer, DVM

Wednesday, October 23, 2019

1:00 PM - 4:00 PM

Limited Enrollment Sessions Theater

Open to veterinarians only.

Perfect your routine eyelid surgeries including entropion repair, eyelid laceration repair, and eyelid mass removal. Learn when to lubricate the eye versus opting for surgical correction with entropion. Techniques for repairing complicated eyelid lacerations and options for eyelid margin mass removal will also be covered.

CE CREDITS 3.0 | COST $199 | CAPACITY 15

In the Spotlight

We asked some of our featured Wild West Vet speakers what they are most looking forward to, and their answers range from visiting Reno to interacting with attendees and meeting other speakers. See what else they're excited about!

"Having spent many years in Northern California both at UC Davis as a vet student and Neurology/Neurosurgery resident, the Reno/Tahoe area feels like a trip back home to me."

Rebecca Windsor, DVM, DACVIM (Neurology/Neurosurgery)
Veterinary Neurologist,
Wheat Ridge Animal Hospital

"The lineup of other awesome speakers! I can't wait to sit in their sessions and learn!"

Mary Gardner, DVM
CTO and Co-Founder,
Lap of Love Veterinary Hospice

"I am looking most forward to interacting with the attendees and helping to address their needs in practice. I keep my sessions informal and like to host lots of discussion."

Meredyth Jones, DVM, MS, DACVIM
Associate Professor - Food Animal Medicine and Surgery,
Oklahoma State University/Large Animal Consulting & Education

"As a first-time speaker for this conference, I'm looking forward to everything! It's always fun to connect with people and lecture on topics I'm passionate about."

Courtney Waxman, CVT, RVT, VTS (ECC)
Instructional Technologist,
Purdue University

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WILD WEST VET

Speaker Highlights

Nursing

Monique Feyrecilde

BA, LVT, VTS (Behavior)

Veterinary Technician
Mercer Island Veterinary Clinic & Teaching Animals

Monique Feyrecilde (pronounced Fair-child) is a licensed veterinary technician, specialized in behavior. Co-author of the book, Cooperative Veterinary Care released in 2018, Monique enjoys teaching groups from 2 to 2,000. Providing practical solutions you can implement today, Monique also owns a consulting business called Teaching Animals.

FEATURED SESSION:
ANXIOUS PETS & THE VETERINARIAN: SUPERIOR CARE FOR CLIENTS & PATIENTS

Beckie Mossor

RVT

Co-Founder
Veterinary Advancements

Beckie Mossor is a co-founder of Veterinary Advancements (a consulting and association management firm) volunteer VP of Operations with 3K9 Working Dogs, Co-Host of the podcast Veterinary Viewfinder, and a Professional Responder with the ASPCA Field Investigations and Response Team.

FEATURED SESSION:
YOU CAN'T ASK THAT: UNDERSTANDING SERVICE DOG LAWS & HAVING CONVERSATIONS ABOUT THEM

Darci Palmer

BS, LVT, VTS (Anesthesia & Analgesia)

Anesthesia Veterinary Technician
Southeastern Veterinary Surgery Center

In addition to her job, Darci Palmer currently holds the executive secretary position for the Academy of Veterinary Technicians in Anesthesia and Analgesia (AVTAA). She also serves on the Committee of Veterinary Technician Specialists (CVTS). Darci is a board moderator and Continuing Education (CE) instructor for the Veterinary Support Personnel Network (VSPN) and has lectured at several veterinary conferences.

FEATURED SESSION:
OH, BABY! ANESTHESIA & ANALGESIA MANAGEMENT FOR C-SECTIONS & NEONATAL CARE

Jade Velasquez

LVT

Practice Manager
Brookside Veterinary Hospital

Jade Velasquez has been the President Elect, President and Past President of WSAVT. She also is the NAVTA PR committee chair and sits on the NAVTA membership committee. In addition, she uses her writing and speaking to reach veterinary professionals with her unique view on veterinary medicine. She's a regular contributor to the NAVTA Journal and guest author at DrAndyRoark.com.

FEATURED SESSION:
COMPASSION FATIGUE VERSUS BURNOUT

Equine and Farm

Nikki Scherrer

DVM

Assistant Professor of Ophthalmology
New Bolton Center, University of Pennsylvania

Dr. Scherrer received a bachelor's degree in biochemistry and graduated summa cum laude at DePauw University in Greencastle, IN. She attended Purdue University, in West Lafayette, Indiana, where she earned a doctorate degree from the Purdue University School of Veterinary Medicine. After graduation she started an internship at Rood and Riddle Equine Hospital. She then started at University of Pennsylvania's New Bolton Center, where she advanced from an intern, to a resident to her current job.

FEATURED SESSION:
SURGERIES OF THE EQUINE EYELID WETLAB ***(SEE PAGE 12 FOR MORE INFORMATION)***

Shane Miller

DVM, DACVS

Equine Surgeon
Comstock Equine Hospital

Dr. Miller became board certified in equine surgery from the American College of Veterinary Surgeons in 1998. While at Littleton Equine Medical Center, he served as CEO and Chief of Surgery. Dr. Miller's professional interests lie in soft tissue and orthopedic surgeries with an emphasis in arthroscopy, laparoscopy and fracture repair. He also has a clinical interest in lameness and prepurchase exams.

FEATURED SESSION:
EQUINE LAMENESS: EARLY INTERVENTION

WILD WEST VET Speaker Highlights

Business

Louise Dunn

Founder and CEO
Snowgoose Veterinary Management Consulting

Louise Dunn is a renowned award-winning speaker, writer and consultant. She brings over 40 years of in the trenches experience and her business education to veterinary management. Most recently Louise Dunn received many awards including the WVC Educator of the Year and VetPartner's The Life Time achievement Award in January 2016.

FEATURED SESSION:
TOP TIPS FOR EMPLOYEE RETENTION

Megan Brashear
RVT, VTS (ECC)

Small Animal Veterinary Nursing Manager
Purdue University Veterinary Teaching Hospital

After graduating with a BS in Veterinary Technology in 2000, Megan Brashear has worked in emergency/critical care and then earned her Veterinary Technician Specialty in Emergency/Critical Care in 2004.

FEATURED SESSION:
TOP COMMUNICATION MISTAKES ONLINE & OFF

Eric Garcia

Digital Strategist/CEO
Simply Done Tech Solutions

When it comes to helping veterinary practices streamline their technology and attract and retain clients, Eric Garcia has a proven track record of educating the industry and producing results. Eric is an IT and Digital Marketing consultant working exclusively with veterinary practices. In addition to a long list of satisfied clients, Garcia's work has been recognized throughout the industry.

FEATURED SESSION:
TOP MARKETING MISTAKES & HOW YOU CAN FIX THEM

Karen Felsted
CPA, MS, DVM, CVPM, CVA,

President
PantheraT Veterinary Management Consulting

Dr. Felsted is a CPA as well as a veterinarian and has spent the last 20 years working as a financial and operational consultant to veterinary practices and the animal health industry. She is also the past CEO of the National Commission on Veterinary Economic Issues. She is a well-known speaker and author and an active member of VetPartners and a member of the Veterinary Economics' Editorial Advisory Board.

FEATURED SESSION:
USING EFFECTIVE PRICING STRATEGIE

Small Animal

Linda Kidd
DVM, PhD, DACVIM

Associate Professor, Small Animal Internal Medicine
Western University of Health Sciences

Dr. Kidd received her DVM and specialty training in small animal medicine from the University of Wisconsin-Madison, a PhD in Immunology from North Carolina State University and she completed a post- doctoral fellowship at The Scripps Research Institute in La Jolla, CA.

FEATURED SESSION:
STOP BUGGING ME: THE ROLE OF THE VECTOR IN IMMUNE-MEDIATED HEMOLYTIC ANEMIA

Peter Chapman
BVetMed, DECVIM-CA, DACVIM, MRCVS

Internal Medicine Specialist
Veterinary Specialty and Emergency Center—Blue Pearl Philadelphia

Dr. Chapman is interested in all aspects of internal medicine - especially endocrine and hematologic disease. In addition to his clinical duties, he is on the examination committee of the ECVIM, director of the residency program at VSEC and has published extensively on various internal medicine topics.

FEATURED SESSION:
CHRONIC VOMITING - AS MUCH INFORMATION AS YOU CAN STOMACH

Margie Scherk
DVM, DABVP (Feline)

Consultant, Educator
catsINK

Margie Scherk published several clinical trials whilst practicing in the Cats Only Veterinary Clinic that she opened in Vancouver in 1986. She has written numerous book chapters and is an active international speaker as well as enjoying teaching on-line. Margie Scherk is Co-editor of the Journal of Feline Medicine and Surgery. She has served extensively in the American Association of Feline Practitioners as well other veterinary organizations.

FEATURED SESSION:
QUEEN OF DENIAL: HOW CATS SHOW (& HIDE) PAIN & WHAT TO DO ABOUT IT

Kursten Pierce
DVM, DACVIM (Cardiology)

Cardiologist
Colorado State University

Kursten Pierce is currently pursuing a fellowship in interventional cardiology and previously taught at Cummings School of Veterinary Medicine at Tufts University, where she also completed a cardiology residency. Dr. Pierce has authored several book chapters and articles.

FEATURED SESSION:
BE STILL MY BEATING HEART: DIAGNOSIS & MANAGEMENT OF THE MOST COMMON CARDIAC ARRHYTHMIAS OF DOGS & CATS

WILD WEST VET

RENO, NEVADA • OCTOBER 23-26, 2019

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Walk on the wild side

Beauty as far as the eye can see, and right at your fingertips in Reno Tahoe. If you're willing to make the trek, you can stumble upon some of Mother Nature's greatest works. Satisfy your inner wanderer when you hike one of the region's stunning trails.

Come along for the ride

If you're more of a two-wheel than a two-feet kind of adventurer, fear not. Reno Tahoe is made for the free spirited, who come alive with their hair blowing in the wind, and feet flying in the pedals. Cycling and mountain biking enthusiasts: come one come all.

Eat like a local

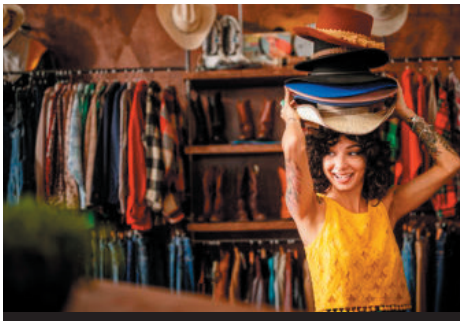
The most important meal of the day is... all of them! As a team of foodies, we understand the appeal of every meal. Reno offers everything from light bites to full feasts, meaning you are in for a treat. From savory to sweet, and everything in between, the Biggest Little City will leave you fueled for your adventures.

Seize the night

After a day of CE, it is nice to unwind with some extracurricular activities. This city may see 300+ days of sunshine, but when the moon shines, this city really impresses. From breweries to wine walks to live music venues, there is never a shortage of entertainment.

Go bold or go home

Reno thrives on being bold. This culturally vibrant region draws in artists from around the world and gives them a platform for their work. The city is especially known for its public art, so keep an eye out when you are strolling down the street!



Shop 'til you drop

Whether you are in the market for souvenirs, or looking to partake in an extreme makeover: Reno edition, you'll find what you need here. With the countless boutiques and shopping malls, you will certainly be able to leave with something special for those waiting at home—and yourself!

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