Opinion: Clinical Reasoning
Red Blood Cell Evaluation in Blood Films
Pectus Excavatum in Kittens
Complications from Mouth Gags
Pulse Alterations: A Diagnostic Algorithm
Mirtazapine Overview
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My world just isn’t the same when I have ticks and fleas. Prescribe me Credelio® (lotilaner)—a small, tasty chewable that acts fast¹ to protect puppies and dogs* like me all month long.

*Puppies and dogs 8 weeks of age and older and 4.4 pounds and greater.

**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. For product information, including complete safety information, see reverse side.


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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.

Clinical Pharmacology:

Following oral administration of 43 mg/kg (approximately 1X the maximum labeled dose), peak lotilaner concentrations were achieved between 6 hours and 3 days in dogs 2 months of age and between 1 and 7 days in dogs 10 months of age. Dogs 2 months of age had a shorter elimination half-life (average of 9.6 days) than at 10 months of age (average of 28.4 days). Due to reduced drug bioavailability in the fasted state, CREDELIO must be administered with a meal or within 30 minutes after feeding.

Mode of Action:
Lotilaner is an ectoparasiticide belonging to the isoxazoline group. Lotilaner inhibits insect and acarine gamma-aminobutyric acid (GABA)-gated chloride channels. This inhibition blocks the transfer of chloride ions across cell membranes, which results in uncontrolled neuromuscular activity leading to death of insects and acarines. The selective toxicity of lotilaner between insects and acarines and mammals may be inferred by the differential sensitivity of the insects and acarines’ GABA receptors versus mammalian GABA receptors.

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/photodermatitis 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.

Palatability: In the U.S. field study, which included 587 doses administered to 198 dogs, 80.4% of dogs voluntarily consumed CREDELIO when offered by hand or in an empty bowl, an additional 13.6% consumed CREDELIO when offered with food, and 6.0% required placement of the chewable tablet in the back of the dog’s mouth.

Animal Safety:
In a margin of safety study, CREDELIO was administered orally to 24 (8 dogs/group) 8-week-old Beagle puppies at doses of 43 mg/kg, 129 mg/kg, and 215 mg/kg (approximately 1, 3, and 5X the maximum labeled dose, respectively) every 29 days for eight consecutive doses. The 8 dogs in the control group (OX) were untreated. There were no clinically-relevant, treatment-related effects on clinical observations, physical and neurological examinations, body weights, food consumption, electrocardiograms, clinical pathology (hematology, clinical chemistries, coagulation profiles and urinalysis), gross pathology, histopathology, or organ weights. Blood concentrations of lotilaner confirmed systemic exposure of all treated dogs, although the exposure was less than dose proportional at 5X.

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

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.

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In an 8-week study of 160 client-owned dogs, oral PEA-um was shown to be beneficial for skin health associated with seasonal allergies.1 Concurrent use of Redonyl Ultra and topical therapies for the skin, including shampoos, mousse, conditioners, sprays and wipes, can help support the health of your canine patients’ skin. For skin issues with wide ranging causes, a multi-modal approach is often recommended. Add Redonyl Ultra to your current dermatology protocol to see the benefits.

When skin health is compromised, the exact cause can often be difficult to determine. Supporting the skin, regardless of the cause, is essential in keeping your canine patients and their owners happy and comfortable.
**FOR ORAL USE IN DOGS ONLY**

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

**Description:** SIMPARICA is a flavored, chewable tablet for administration to dogs over 6 months of age according to their weight. Each tablet is formulated to provide a minimum sarolaner dosage of 0.91 mg/lb (2 mg/kg) body weight.

Sarolaner is a member of the isoxazoline class of parasiticides and the chemical name is 1-(S)-(5S,5,5'- Dichloro-4-fluorophenyl)-5-(trifluoromethyl))-4,5-dihydroinosazol-3-yi)-2-(methylsulfonyl)ethanone. SIMPARICA contains the S-enantiomer of sarolaner.

The chemical structure of the S-enantiomer of sarolaner is:

![Chemical structure](https://via.placeholder.com/150)

**Indications:** SIMPARICA kills adult fleas, and is indicated for the treatment and prevention of flea infestations (Ctenocephalides felis), and the treatment and control of tick infestations (Amblyomma americanum (lone star tick), Amblyomma maculatum (Gulf Coast tick), Dermacentor variabilis (American dog tick), Ixodes scapularis (black-legged tick), and Rhipicephalus sanguineus (brown dog tick)) for one month in dogs 6 months of age or older and weighing 2.8 pounds or greater.

**Dosage and Administration:** SIMPARICA is given orally once a month at the recommended minimum dosage of 0.91 mg/lb (2 mg/kg).

**Dosage Schedule:**

<table>
<thead>
<tr>
<th>Body Weight</th>
<th>SAROLANER per Tablet (mg)</th>
<th>Number of Tablets Administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.8 to 5.5 lbs</td>
<td>5</td>
<td>One</td>
</tr>
<tr>
<td>5.6 to 11.0 lbs</td>
<td>10</td>
<td>One</td>
</tr>
<tr>
<td>11.1 to 22.0 lbs</td>
<td>20</td>
<td>One</td>
</tr>
<tr>
<td>22.1 to 44.0 lbs</td>
<td>40</td>
<td>One</td>
</tr>
<tr>
<td>44.1 to 88.0 lbs</td>
<td>80</td>
<td>One</td>
</tr>
<tr>
<td>88.1 to 132.0 lbs</td>
<td>120</td>
<td>One</td>
</tr>
<tr>
<td>&gt;132.1 lbs</td>
<td>Administer the appropriate combination of tablets</td>
<td></td>
</tr>
</tbody>
</table>

SIMPARICA can be offered by hand, in the food, or administered like other tablet medications. Care should be taken that the dog consumes the complete dose, and treated animals should be observed for a few minutes to ensure that part of the dose is not lost or refused. If a dose is missed, administer SIMPARICA and resume a monthly dosing schedule.

**Flea Treatment and Prevention:** Treatment with SIMPARICA may begin at any time of the year. In areas where fleas are common year-round, monthly treatment with SIMPARICA can continue the entire year without interruption.

To minimize the likelihood of re-infestation, it is important to treat all dogs and cats within a household with an approved flea control product.

**Tick Treatment and Control:** Treatment with SIMPARICA can begin at any time of the year (see Effectiveness).

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

**Warnings:** Not for use in humans. Keep this and all drugs out of reach of children and pets. For use in dogs only. Do not use SIMPARICA in cats.

**Precautions:** SIMPARICA may cause abnormal neurologic signs such as tremors, decreased conscious proprioception, ataxia, decreased or absent menace, and/or seizures (see Animal Safety). The safe use of SIMPARICA has not been evaluated in breeding, pregnant, or lactating dogs.

**Adverse Reactions:** SIMPARICA was administered in a well-controlled US field study, which included a total of 479 dogs (215 dogs treated with SIMPARICA and 164 dogs treated with active control once monthly for three treatments). Over the 90-day study period, all observations of potential adverse reactions were recorded.

Table 1. Dogs with adverse reactions

<table>
<thead>
<tr>
<th>Adverse reaction</th>
<th>simparica</th>
<th>simparica</th>
<th>active control</th>
<th>active control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>39 (n = 115)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Vomiting</td>
<td>3</td>
<td>0.3%</td>
<td>9</td>
<td>1.20%</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>2</td>
<td>0.63%</td>
<td>2</td>
<td>1.20%</td>
</tr>
<tr>
<td>Lethargy</td>
<td>1</td>
<td>0.32%</td>
<td>2</td>
<td>1.20%</td>
</tr>
<tr>
<td>Inappetence</td>
<td>0</td>
<td>0%</td>
<td>3</td>
<td>1.80%</td>
</tr>
</tbody>
</table>

Additionally, one female dog aged 8.6 years exhibited lethargy, ataxia while posturing to eliminate, elevated third eyelid, and inappetence one day after receiving SIMPARICA concurrently with a heartworm preventative (ivermectin/pyrantel pamoate). The signs resolved one day later. After the day 14 visit, the owner elected to withdraw the dog from the study. For a copy of the Safety Data Sheet (SDS) or to report adverse reactions call Zoetis Inc. at 1-888-963-9471. Additional information can be found at www.SIMPARICA.com. 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.

**Clinical Pharmacology:** Sarolaner is rapidly and well absorbed following oral administration of SIMPARICA. In a study of 12 Beagle dogs the mean maximum plasma concentration (Cmax) was 1100 ng/ml and the mean time to maximum concentration (tmax) occurred at 3 hours following a single oral dose of 2 mg/kg to fasted animals. The mean oral bioavailability was 86% and 107% in fasted and fed dogs, respectively. The mean oral T1/2 values for fasted and fed animals was 10 and 12 days respectively.

Sarolaner is distributed widely; the mean volume of distribution (Vss) was 2.81 L/kg bodyweight following a 2 mg/kg intravenous dose of sarolaner. Sarolaner is highly bound (≥99.3%) to plasma proteins. The metabolism of sarolaner appears to be minimal in the dog. The primary route of sarolaner elimination from dogs is biliary excretion with elimination via the feces.

Following repeat administration of SIMPARICA once every 28 days for 10 doses to Beagle dogs at 1X, 3X, and 5X the maximum intended clinical dose of 4 mg/kg, steady-state plasma concentrations were reached after the 6th dose. Following treatment at 1X, 3X, and 5X the maximum intended clinical dose of 4 mg/kg, sarolaner systemic exposure was dose proportional over the range 1X to 5X.

**Mode of Action:** The active substance of SIMPARICA, sarolaner, is an acaricide and insecticide belonging to the isoxazoline group. Sarolaner inhibits the function of the neurotransmitter gamma aminobutyric acid (GABA) receptor and glutamate receptor, and works at the neuromuscular junction of insects. This results in uncontrolled neuromuscular activity leading to death in insects or aracines.

**Effectiveness:** In a well-controlled laboratory study, SIMPARICA began to kill flea 3 hours after initial administration and reduced the number of live fleas by ≥96.2% within 8 hours after flea infestation through Day 35.

In a separate well-controlled laboratory study, SIMPARICA demonstrated 100% effectiveness against adult fleas within 24 hours following treatment and maintained 100% effectiveness against weekly re-infestations for 35 days.

In a study to explore flea egg production and viability, SIMPARICA killed fleas before they could lay eggs for 35 days. In a study to simulate a flea-infested home environment, with flea infestations established prior to the start of treatment and re-infestations on Days 7.37 and 67, SIMPARICA administered monthly for three months demonstrated >95.6% reduction in adult fleas within 14 days after treatment and reached 100% on Day 60.

In well-controlled laboratory studies, SIMPARICA demonstrated ≥99% effectiveness against an initial infestation of Amblyomma americanum, Amblyomma maculatum, Dermacentor variabilis, Ixodes scapularis, and Rhipicephalus sanguineus 48 hours post-administration and maintained ≥96% effectiveness 48 hours post re-infestation for 30 days.

In a well-controlled 90-day US field study conducted in households with existing flea infestations of varying severity, the effectiveness of SIMPARICA against fleas on Day 30, 60 and 90 visits compared to baseline was 99.4%, 99.8%, and 100%, respectively. Dogs with signs of flea allergy dermatitis showed improvement in erythema, papules, scaling, alopecia, dermatis/pseudomembrains and pruritus as a direct result of eliminating fleas.

**Animal Safety:** In a margin of safety study, SIMPARICA was administered orally to 8-week-old Beagle puppies at doses of 0, 1X, 3X, and 5X the maximum recommended dose (4 mg/kg) at 28-day intervals for 10 days (8 dogs per group). The control group received placebo tablets. Neurologic signs were observed in the 1X group. In the 3X group, one male dog exhibited tremors and ataxia post-dose on Day 0; one female dog exhibited tremors on Days 1, 2, 3, 5, and 7; and one female dog exhibited tremors on Day 1. In the 3X group, one female dog had a seizure on Day 6 (5 days after third dose); one female dog had tremors post-dose on Day 2 and abnormal head coordination after dosing on Day 140; and one female dog exhibited seizures associated with the second and fourth doses and tremors associated with the second and third doses. All dogs recovered without treatment. Except for the observation of abnormal head coordination in one dog in the 5X group two hours after dosing on Day 140 (dose 6). There were no treatment-related neurological signs observed once the dogs reached the age of 6 months.

In a separate exploratory pharmacokinetic study, one female dog dosed at 12 mg/kg (3X the maximum recommended dose) exhibited lethargy, anorexia, and multiple neurological signs including ataxia, tremors, disorientation, hypersalivation, diminished proprioception, and absent menace, approximately 2 days after a third monthly dose. The dog was not treated, and was ultimately euthanized. The first two doses resulted in plasma concentrations that were consistent with those of the other dogs in the treatment group. Starting at 7 hours after the third dose, there was a rapid 2.5 fold increase in plasma concentrations within 41 hours, resulting in Cmax, more than 7-fold higher than the mean Cmax at the maximum recommended use dose. No cause for the sudden increase in sarolaner plasma concentrations was identified.

**Storage Information:** Store at or below 30°C (86°F) with excursions permitted up to 40°C (104°F).

**How Supplied:** SIMPARICA (sarolaner) Chews are available in six flavored tablet sizes: 5, 10, 20, 40, 80, and 120 mg. Each tablet size is available in color-coded packages of one, three, or six tablets.

NADA #141-452, Approved by FDA

**Distributed by:** Zoetis Inc.

Kalamazoo, MI 49007

Made in Switzerland

Revised: July 2016

50070900A&P

**Additional Information:**

- SIMPARICA is given orally once a month at the recommended minimum dosage of 0.91 mg/lb (2 mg/kg).
- SIMPARICA contains the S-enantiomer of sarolaner.
- SIMPARICA is distributed by Zoetis Inc., Kalamazoo, MI, distributed in the USA, and Made in Switzerland.
You have not been a veterinarian long enough if you have never:

“Had to tell an owner, ‘That is a nipple, not a tick/mass ...’”—Leah M

147 45 😊

“Spent 15 minutes looking for the uterus inside a cat’s abdomen, only to realize the cat had testicles.”—Erika V

69 31 😊 1 😞

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25% Dr. First name

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2 😊

“Does anyone feel like they need to insist on using the doctor title with owners so they will respect your opinion? Asking for a friend who graduates in 4 months ... The friend is me; I’m the friend.”—Cayley B

2 😊

“They sound weird.”—Rosa V

53 11 😊 3 😞

“Please do not call me Doctor. Just Saskia is fine. In Australia, we are a bit more casual, and Doctor sounds weird.”—Saskia V

2 😊

“Dr. Kate, but the most important thing for me is respect.”—Kathleen T

1 😊

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Premium protection without the premium price—with our rebate offers and affordable price, you can compete against OTC brands and bring flea and tick protection back into your practice.

IMPORTANT SAFETY INFORMATION: Simparica is for use only in dogs, 6 months of age and older. Simparica may cause abnormal neurologic signs such as tremors, decreased conscious proprioception, ataxia, decreased or absent menace, and/or seizures. Simparica has not been evaluated in dogs that are pregnant, breeding or lactating. Simparica has been safely used in dogs treated with commonly prescribed vaccines, parasiticides and other medications. The most frequently reported adverse reactions were vomiting and diarrhea. See full Prescribing Information on the back of this page and at www.zoetisUS.com/SimparicaPI.

*Studies show Simparica starts killing ticks in 8 hours and is ≥96.9% effective for 35 days against weekly reinfections of Ixodes scapularis, Amblyomma americanum, Amblyomma maculatum, Dermacentor variabilis, and Rhipicephalus sanguineus.1,2

Learn more about Simparica.
Contact Zoetis Customer Service at 1-888-ZOETIS-1 or 1-888-963-8471.


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See page 4 for product information summary.
CONSULT THE EXPERT
Interpretation of Culture & Susceptibility Reports
Patricia Dowling, DVM, MSc, DACVIM (Large Animal), DACVCP

PG 14

ON THE COVER

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Clinical Reasoning
Jill Maddison, BVSc, DipVetClinStud, PhD, SFHEA, MRCVS
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Dr. Anthony Caiafa
BVSc BDSc MACVSc (SA Surgery and Veterinary Dentistry)
WHITNEY DEGROOT, DVM, is currently completing a small animal surgical residency at University of Tennessee. She earned her DVM from University of Guelph, where she also completed a small animal medicine and surgery internship. She also completed a surgical internship at Veterinary Emergency Clinic in Toronto, Canada.

PROCEDURES PRO PAGE 57

PATRICIA DOWLING, DVM, MSc, DACVIM (Large Animal), DACVCP, is a professor of veterinary clinical pharmacology at Western College of Veterinary Medicine and is the founder and codirector of the Canadian Global Food Animal Residue Avoidance Databank. She is also a drug therapy consultant and conducts research on pharmacokinetics.

CONSULT THE EXPERT PAGE 14

JUSTIN FRASER, BSc, is a veterinary student at University of Tennessee, where he earned his bachelor’s degree in animal science. He plans to pursue a career in veterinary cardiology.

CASE ROUTES PAGE 65

JILL MADISON, BVSc, DipVetClinStud, PhD, SFHEA, MRCVS, is a professor of general practice, the director of professional development, and the BVetMed and CertAVP course director at Royal Veterinary College. She is also a coordinator for London Vet Show and is a consultant at a local veterinary practice and at Beaumont Sainsbury Animal Hospital in London. Dr. Maddison is the senior editor of the second edition of Small Animal Clinical Pharmacology and the senior editor of Clinical Reasoning in Small Animal Practice. She has lectured worldwide on clinical problem-solving, small animal internal medicine, and clinical pharmacology.

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ELISA MAZZAFERRO, DVM, MS, PhD, DACVECC, is a staff criticalist at Cornell University Veterinary Specialists and an adjunct associate clinical professor of emergency medicine and critical care at Cornell University. Dr. Mazzaferro completed an internship at Veterinary Institute of Trauma, Emergency and Critical Care in Wisconsin and a residency in emergency medicine and critical care at Colorado State University, where she also earned her PhD. Dr. Mazzaferro has served as the director of emergency services at a multispecialty practice in Colorado and as the immediate past president of the American College of Veterinary Emergency and Critical Care. She has authored 4 books as well as numerous chapters and articles on emergency medicine and critical care, and she lectures nationally and internationally.

DIAGNOSTIC TREE PAGE 20

SHELLY J. OLIN, DVM, DACVIM (SAIM), is an assistant professor at University of Tennessee, where she completed an internal medicine residency. Dr. Olin earned her DVM from and completed a rotating internship in small animal medicine and surgery at University of Georgia. She has also worked as an emergency veterinarian in Atlanta, Georgia. Her clinical interests are endocrinology, interventional procedures, and teaching.

CASE ROUTES PAGE 65

LISA M. POHLMAN, DVM, MS, DACVP, is an associate professor at Kansas State University. She earned her DVM from University of Guelph and, after 3 years in small animal practice, completed a residency and earned her master’s degree in clinical pathology from Auburn University. Dr. Pohlman is an active teacher and mentor of veterinary students, interns, residents, and graduate students and enjoys providing CE in clinical pathology through speaking engagements, online courses, and publications. She also serves as the medical director of the Riley County Humane Society in Manhattan, Kansas.

COMPARATIVE IMAGERY PAGE 26
HEARTGARD Plus Chewables, given orally using the recommended dose and regimen, are effective against the tissue larval stage of D. immitis for a month (30 days) after infection and, as a result, prevent the development of the adult heartworm stage. HEARTGARD Plus Chewables are also effective against canine roundworms (A. caninum, U. stenocephala, A. braziliense). Clients should be advised of measures to be taken to prevent reinfection with intestinal parasites.

Efficacy: HEARTGARD Plus Chewables, given orally using the recommended dose and regimen, are effective against the tissue larval stage of D. immitis for a month (30 days) after infection and, as a result, prevent the development of the adult heartworm stage. HEARTGARD Plus Chewables are also effective against canine roundworms (A. caninum, U. stenocephala, A. braziliense).

Acceptability: In acceptability and field trials, HEARTGARD Plus was shown to be an acceptable oral dosage form that was consumed at first offering by the majority of dogs. It is recommended that HEARTGARD Plus Chewables be administered at the following time points: at the time of diagnosis, prior to starting treatment with a heartwormicide. It is important to ensure that the dog consumes the entire chewable. In the event that the dog does not consume the entire chewable, it is recommended to monitor the dog for signs of toxicity. If signs of toxicity are observed, it is recommended to consult a veterinarian.

ADVERSE REACTIONS: In clinical field trials with HEARTGARD Plus, vomiting or diarrhea within 24 hours of dosing was rarely observed (1.1% of administered doses). The following adverse reactions have been reported following the use of HEARTGARD: Depression/diarrhea, vomiting, anorexia, diarrhea, myoglobinuria, ataxia, staggering, convulsions, and hypo- and hyperkalemia.

Safety: HEARTGARD Plus has been shown to be inapparent to HEARTGARD, with respect to the bioavailability of ivermectin. The dose regimen of HEARTGARD Plus and HEARTGARD are the same with regard to ivermectin (2.27 mg/kg). Studies with ivermectin indicate that certain dogs of the Collie breed are more sensitive to the effects of ivermectin administered at elevated dose levels than dogs of other breeds. In elevated doses, sensitive dogs showed adverse reactions which included mydriasis, depression, ataxia, tremors, drooling, paresis, recumbency, excitement, stupor, coma and death. HEARTGARD demonstrated increased signs of toxicity at 10 times the recommended dose 30 mg/kg in sensitive Collies. Results of these trials and bioequivalence studies, support the safety of HEARTGARD products in dogs, including Collies, when used as recommended.

HEARTGARD Plus has been shown to provide a wide margin of safety at the recommended dose level in dogs, including pregnant or nursing bitches, stud dogs and puppies aged 6 or more weeks. In clinical trials, many commonly used flea collars, dips, shampoos, anthelmintics, antibiotics, vaccines and steroid preparations have been administered with HEARTGARD Plus in a heartworm disease prevention program.

In one trial, where some pups had parvovirus, there was a marginal reduction in efficacy against intestinal nematodes, but no reduction in efficacy against intestinal nematodes, hookworms, or canine roundworms. The following adverse reactions have been reported following the use of HEARTGARD: Depression/diarrhea, vomiting, anorexia, diarrhea, myoglobinuria, ataxia, staggering, convulsions, and hypo- and hyperkalemia.
Anesthetic Management in a Hyperthyroid Cat

Berit Fischer, DVM, DACVAA, CCRP
Crown Veterinary Specialists
Lebanon, New Jersey

THE CASE
Buttercup, a 12-year-old spayed domestic shorthair cat, is presented for a preanesthetic examination prior to removal of a previously diagnosed, ulcerated basal cell carcinoma on the dorsal aspect of the neck measuring 1.0 × 1.0 × 0.5 cm.

Buttercup had been diagnosed with hyperthyroidism 4 months prior and was initially treated with methimazole; however, because of intolerable side effects (ie, pruritus, diarrhea), she was switched to a low-iodine prescription diet. Her owner reports that Buttercup has shown clinical improvement (ie, less polyuria/polydipsia and vomiting) since starting the low-iodine diet.

An echocardiogram performed when hyperthyroidism was first diagnosed showed mild eccentric hypertrophy of the left ventricle, thickening of the intraventricular septum, and benign right ventricular outflow tract obstruction.

CBC and serum chemistry profile results from 4 days before presentation are relatively unremarkable, other than a mildly elevated alanine transaminase of 185 U/L (reference range, 27-158 U/L) and blood glucose of 198 mg/dL (reference range, 72-175 mg/dL). Total thyroxine is still elevated at 5.5 µg/dL (reference range, 0.8-4.7 µg/dL) but is greatly improved from 4 months prior, when total thyroxine was 10.3 µg/dL.

On physical examination, the patient is thin (BCS, 3/9) and appears euhydrated. She is visibly nervous and resists restraint, behavior that is atypical from her previous visits. Temperature is 102.5°F (39.2°C), heart rate is 254 bpm, and respiratory rate is 51 breaths/min. A grade 2/6 systolic parasternal murmur and gallop rhythm are present with synchronous and bounding pulses. Lungs are clear on auscultation, but increased effort is noted. A thyroid slip is palpable. Average blood pressure* after 5 readings is 196/93 mm Hg (MAP, 127 mm Hg). The owner expresses concern that Buttercup has not been this agitated at home and became more upset in the waiting room when surrounded by dogs.

WHAT IS THE APPROPRIATE NEXT STEP?

*All blood pressure values are provided in a systolic/diastolic (mean arterial pressure [MAP]) format.
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- Treats and controls 3 species of hookworms
- Treats and controls 2 species of roundworms
- Owners prefer it
- Dogs love it
- Safe for puppies as young as 6 weeks of age

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 11 for product information summary.
CONSULT THE EXPERT

INTERPRETATION OF CULTURE & SUSCEPTIBILITY REPORTS

Patricia Dowling, DVM, MSc, DACVIM (Large Animal), DACVCP
University of Saskatchewan
Saskatchewan, Canada
Antimicrobial stewardship programs typically recommend culture and susceptibility testing to guide clinicians in choosing optimal antimicrobial therapy; however, the majority of antimicrobial selections are made empirically,\textsuperscript{1,2} rather than based on test results from individual patients. Antimicrobial selection guided by culture and susceptibility testing is conducted mostly for chronic or recurrent infections.\textsuperscript{3,4}
Culture and susceptibility reports are often underused by veterinary practitioners because of a number of limitations, including cost and the time delay between sampling and results. Even after results are obtained, clinicians may lack the information necessary to interpret the reports in a meaningful way.

**Culture & Susceptibility Reports**

A culture and susceptibility report from a microbiology laboratory identifies the bacterial pathogen and lists antimicrobials labeled with an S, R, or I, designating Susceptible, Resistant, or Intermediate, respectively. These labels indicate the likelihood of a clinical response to antimicrobial treatment. Categories are determined by clinical breakpoints (ie, values that express whether specific bacterial pathogens will respond to certain antimicrobials), which are determined for specific antimicrobial/bacteria combinations based on the minimum inhibitory concentration (MIC) and the designation S, R, or I that corresponds to a specific MIC value (see Determining Breakpoints). MIC values are based on populations of the specific bacteria, the pharmacodynamic data for a specific species, and evidence from clinical use in patients treated with that antimicrobial. The clinical use is specific to the dose regimen (ie, dose, route of administration, frequency of administration) and disease. If any aspect of the regimen is altered (eg, the drug is administered orally instead of by injection), the predictive values of the breakpoints are no longer reliable.

**Established Breakpoints**

The Clinical Laboratory Standards Institute (CLSI) sets the standards for conducting and interpreting veterinary antimicrobial susceptibility tests. Breakpoints have been set only for a limited number of antimicrobial/bacteria combinations in veterinary species. If veterinary breakpoints are not available, breakpoints derived from human data are often provided on the report; this practice, however, is controversial, with some veterinary microbiologists stating that interpretation from nonveterinary breakpoints should not be performed or should only be performed with extreme caution. The CLSI recommends that microbiology laboratories should inform clinicians of the breakpoint source (ie, human or veterinary), but such designations rarely appear on culture and susceptibility reports. Thus, the report must be used in conjunction with knowledge of the pharmacokinetics and pharmacodynamics of the antimicrobial and the pathophysiology of the disease to determine if a specific drug is a reasonable treatment option (see Breakpoint Sources & Resistance).

Diagnostic laboratories independently choose which bacterial isolates and which antimicrobial susceptibilities to report. Although laboratories recommend reporting only isolates that are clinically relevant, as
reporting clinically irrelevant isolates can lead to unnecessary antimicrobial use, this would require oversight by a veterinary microbiologist with an adequate clinical background; however, not all laboratories have the services of such specialists. It is also recommended that laboratories practice selective reporting (ie, all determined susceptibilities are not automatically reported), which helps prevent clinicians from choosing antimicrobials for cases in which they are not appropriate. For example, the susceptibility of an *Escherichia coli* isolate to nitrofurantoin should only be reported for isolates from an uncomplicated UTI, as UTI is the only clinical situation in which nitrofurantoin is an effective treatment. Susceptibilities for last resort drugs important in human medicine (eg, vancomycin, imipenem) should not be routinely reported.

**Resistance & Susceptibility**

It is important to recognize intrinsic resistance when interpreting culture and susceptibility reports. There are certain antimicrobial/bacteria combinations for which resistance should be assumed (eg, enterococci and cephalosporins). Some pathogens are intrinsically resistant to most major categories of antimicrobials. For example, *Pseudomonas aeruginosa* is a common secondary invader in cases of chronic otitis externa in dogs. Therefore, it is common to see resistance reported to all antimicrobials except aminoglycosides, fluoroquinolones, and antipseudomonal penicillins (eg, piperacillin). As another example, methicillin-resistant staphylococci should be reported as resistant to all penicillins and cephalosporins and imipenem; even if in vitro test results indicate susceptibility, the laboratory should report the result as resistant if there is a known intrinsic resistance. Results reported as susceptible should be questioned, as they are most likely the result of an identification or susceptibility testing error, indicating potential problems with the laboratory’s adherence to standard guidelines.

Unexpected resistance results (eg, penicillin-resistant streptococci) should also be identified and investigated (see **Breakpoint Sources & Resistance**). Although such results might be due to the emergence of antimicrobial resistance, it is more commonly the result of laboratory error.

Rather than listing drugs in alphabetical order, it is preferable for the reporting laboratory to list drugs in groups according to class and in order of appropriate first-line, second-line, and third-line treatment choices to support prudent antimicrobial use. Cross-resistance often occurs within classes of antimicrobials and may be more difficult for the clinician to visualize if drugs are listed in alphabetical order. This order may also prevent practitioners from simply choosing the first drug labeled “S” for therapy.

---

**BREAKPOINT SOURCES & RESISTANCE**

See page 18 for a preview of a table outlining breakpoint sources for and resistance to common antimicrobials. To view the full table, visit cliniciansbrief.com/interpretation-culture-susceptibility-reports

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**CLSI** = Clinical Laboratory Standards Institute  
**MIC** = minimum inhibitory concentration
### TABLE

**BREAKPOINT SOURCES FOR & RESISTANCE TO COMMON ANTIMICROBIALS**

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Breakpoint Source (Canine, Feline, Human)</th>
<th>Intrinsic Resistance</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CEPHALOSPORINS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cephalothin or Cefazolin</td>
<td>Canine: Escherichia coli, Pasteurella multocida, Staphylococcus aureus, S pseudintermedius, and ß-hemolytic Streptococcus spp in dermal, respiratory, soft tissue, and urinary tract infections Human: Enterobacteriaceae</td>
<td>Enterococcus spp, Proteus vulgaris, Serratia marcescens, Enterobacter spp, Pseudomonas aeruginosa</td>
<td>Generally indicates susceptibility to cephalaxin and cefadroxil Human breakpoints for cefalothin are used for other first-generation cephalosporins to treat Enterobacteriaceae infections, but cefazolin should be tested separately.</td>
</tr>
<tr>
<td>Cefotixin</td>
<td>Human: Staphylococcus spp</td>
<td>Enterococcus spp, P aeruginosa</td>
<td>A second-generation human-approved cephalosporin with excellent activity against anaerobes Cefotixin resistance is an indicator of methicillin-resistance in S aureus but is not reliable for S pseudintermedius; oxacillin resistance is the preferred indicator. Indicates ESBL-producing bacteria, which are susceptible to cefotixin but resistant to third-generation cephalosporins</td>
</tr>
<tr>
<td>Cefpodoxime</td>
<td>Canine: E coli, Proteus mirabilis, P multocida, S aureus, S pseudintermedius, and Streptococcus canis in wounds and abscesses</td>
<td>Enterococcus spp, P aeruginosa</td>
<td>Generally indicates susceptibility to third-generation cephalosporins, including cefovecin and ceftiofur Indicates ESBL-producing bacteria, which are often resistant to these cephalosporins but still susceptible to amoxicillin–clavulanic acid</td>
</tr>
</tbody>
</table>

---

**ESBL-producing bacteria = extended-spectrum ß-lactamase–producing bacteria**

---

### References


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### Suggested Reading

This dog you saved

Loves a boy
Who needs a friend
Who needs to learn to trust
Who will learn to love
Because of
This dog you saved

Our nutrition can change their health.
Your care changes lives.

Improving Lives Together
PULSE ALTERATIONS

Elisa Mazzaferro, DVM, MS, PhD, DACVECC
Cornell University Veterinary Specialists
Stamford, Connecticut

PALPABLE PULSE?

NO

INVESTIGATION
Auscult the heart; perform ECG

DIFFERENTIALS
- Palpable pulse?

DIFFERENTIALS
- Small amplitude of QRS complex; electrical alternans

INVESTIGATION
Perform TFAST

DIFFERENTIALS
- Thromboembolism
- Pericardial effusion
- Hypovolemia
- Hypothermia
- Hypothyroidism
- Depressed myocardial contractility
- Obesity

DIFFERENTIALS
- Fever
- Hyperthermia
- Increased sympathetic tone
- Myocardial dysfunction
- Hyperthyroidism (cats)
- Pheochromocytoma

DIFFERENTIALS
- Brachycardia
- Normal

DIFFERENTIALS
- Pericardial fluid

INVESTIGATION
Perform APFAST to check for abdominal effusion

DIFFERENTIALS
- Hypovolemia
- Hypothermia
- Hypothyroidism
- Depressed myocardial contractility

DIFFERENTIALS
- Sinus bradycardia
- Atroventricular block
- Hypothyroidism
- Hyperthermia
- Idioatrial/idoventricular rhythm
- Sinus arrest
- Hypoglycemia

DIFFERENTIALS
- Atrial tachycardia
- Sinus arrhythmia
- Premature ventricular contractions

INVESTIGATION
- CBC
- Serum chemistry profile
- Electrolyte/venous blood gas measurements
- +/- thyroid panel
- +/- abdominal ultrasonography
- +/- echocardiogram
DIAGNOSTIC TREE

CARDIOLOGY

PEER REVIEWED

YES

DIAGNOSTIC TREE

Cardiology

Perform ECG

INVESTIGATION

Tachycardia

Hyperdynamic

Normal

Hypodynamic

DIFFERENTIALS

Sinus tachycardia

Premature ventricular contractions

Ventricular tachycardia

Supraventricular tachycardia

Atrial fibrillation

DIFFERENTIALS

Fever/hyperthermia

Exercise

Stress/anxiety

Pain

Early sepsis/SIRS

Patent ductus arteriosus

Hyperthyroidism

Anemia

DIFFERENTIALS

Tachycardia

• Pain

• Anxiety

• Sepsis

• Dehydration

• Sinus arrhythmia

DIFFERENTIALS

Hypovolemia

Myocardial dysfunction

Hypothermia

Hypothyroidism

INVESTIGATION

ECG

CBC

Serum chemistry profile

Electrolyte/venous blood gas measurements

+/- thyroid panel

+/- abdominal ultrasonography

+/- echocardiogram

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Is Practice Ownership Right for You?

Practice ownership can be appealing to many veterinarians who would like to make leadership decisions about medical protocols and increase earning potential. Key skills that will help a practice owner succeed and more greatly enjoy this role are people management, medical management, and business management.

People management and leadership skills are paramount and include maintaining accountability, ensuring fair treatment of team members, satisfying team member needs, setting goals, providing positive reinforcement and incentives, and motivating the team. An unmotivated team can result in lowered productivity and efficiency and increased turnover and absenteeism. Pet owners often perceive when a team is not motivated and may seek veterinary services elsewhere as a result. The practice owner is also responsible for conflict mediation and resolution and must take an active role in identifying and compensating talented staff at all levels. A practice owner should create and enforce medical protocols that establish a standard of care. The practice team’s skills, attitudes, and knowledge base are a reflection of the owner.

Of the key skills, business management may be the most easily supplemented with help from outside consultants. Business management skills include fee setting, inventory control, cash control, checks and balances, budgeting, equipment purchasing and maintenance, and retirement strategies. Human resource skills are also needed for administration of benefits (eg, healthcare, retirement, team member discounts), and practice owners must maintain awareness of team members’ legal rights and responsibilities.

Improving skills in these areas can provide immeasurable benefits for the practice owner, team, pet owners, and patients. —McCormick D

Leveraging Pet Health Insurance to Increase the Bottom Line

A North American Pet Health Insurance Association (NAPHIA) study of pet owner spending found that dog owners with pet insurance spend 29% more on veterinary services than do those without pet insurance; cat owners with insurance spend 81% more than do those without insurance. Surveyed pet owners, especially first-time owners and those with new pets, were more likely to invest in insurance policies if the veterinary team actively recommended them. Other actions that made insurance purchases more likely included claim submissions on behalf of the pet owner, coverage of team members’ pets, informing pet owners of free coverage if available, and linking to insurance companies on the practice website.

NAPHIA recommends several steps to leverage pet insurance to improve the practice’s bottom line, including designating pet insurance liaisons, providing pet insurance policies to team members, focusing on one or 2 companies to recommend by providing brochures and linking to them on the practice website, and proactively educating pet owners about pet health insurance.—Dowdy T
Team Member Addiction

Addiction affecting team members in a veterinary practice can be particularly onerous. Because veterinary teams tend to have close relationships, acknowledging—and even addressing—the issue can be complicated. Studies have shown a correlation between stress and addiction. Whether the addiction is to a substance or to an activity, it will eventually adversely affect the individual. Because of the high-stress nature of the veterinary profession, its members are at greater than average risk for addiction.

There are many signs of substance abuse, and it is particularly important to watch for behavior changes. Comparing team members to each other is not an accurate basis for suspicion. Managers can base their discussion around legitimate performance concerns and potentially offer help. Any questioning should be done carefully and respectfully, as what seems suspicious might actually be a genuine issue or illness other than addiction. Help may be offered in various forms depending on the practice, but if help is declined, a manager should be able to take disciplinary action or terminate employment. There are certain legal protections for addicted individuals, but they do not include the right to use alcohol or drugs illegally or to be under the influence while working. It is important to document all conversations and accommodations offered and declined and to follow existing employment manual procedures.—Prendergast H

Technology & Elite Practices

Technology is a critical tool for veterinary practices that aim to improve efficiency, communication with pet owners, and patient care. Following are the top 10 technology trends used in progressive veterinary practices.

- Loyalty programs reward valuable pet owners with perks and can be managed using a mobile app.
- The practice-branded mobile app is a growing trend. Many pet owners spend hours on their smartphone, so allowing them to request prescription refills, schedule appointments, access pet records, and receive reminders and notifications about promotions is simply good business.
- Push notifications allow for messaging that is customized and therefore more likely to be noticed by pet owners.
- Social media can be used to build connectivity. Most practices have no shortage of pets with heartwarming stories to post.
- Video messaging (eg, Facebook Live, Bonjoro) can also help build connectivity.
- Software programs like Slide.ly and Biteable allow practice managers to make professional-quality commercials for the practice website and social media channels.
- Digital appointment booking allows busy pet owners to do business outside of appointment hours and from their smartphone.
- Data-driven compliance reporting by companies such as VetSuccess provide insight into lapsed visits and how to win back pet owners.
- Virtual meeting software makes meetings more productive and can even be used to communicate with pet owners.
- Team collaboration tools (eg, Slack) can be used to maintain communication within the veterinary team, host direct and group conversations, and manage scheduling.—Santi S
Assessing the Need for Team Members & Space

Phases of growth can be trying times for a practice, its team members, and pet owners; however, all businesses must grow to maintain sustainability. It is important to establish data points and metrics that can be used to measure growth and make decisions regarding changes in physical space and team member dynamics. For example, a metric such as paraprofessional hours per transaction may help determine whether each pet owner is receiving the time he or she needs or whether the practice is overstaffed. In addition, addressing the space needs of the practice can help maximize efficiency and profits. Designating examination rooms that can double as treatment rooms, eliminating unneeded items, or placing standing computer work stations in high-traffic areas are examples of maximizing physical space and efficiency. One way to maintain business during periods of growth is to cater to long-term, established clientele to make them feel valued. Pet owner surveys can also provide insight into customer service and satisfaction. Lastly, incentivizing team members to help meet newly established goals can help them play a role in overall practice growth.—Roasa L

References

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• Gives effective protection against highly infectious feline panleukopenia virus

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References:


Always read, understand and follow the label and use directions.

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Blood film evaluation is an important part of the routine CBC, as it often provides valuable diagnostic and prognostic information regarding the patient and the disorder being investigated. Ideally, a blood film should be evaluated as a part of every CBC.
Regular blood film evaluation can provide the practitioner with a breadth of experience, including a better understanding of normal variation among patients; an increased ability to recognize, and thus not overinterpret, the presence of common contaminants and artifacts that result from sample collection, preparation, and handling; an improved capacity to recognize morphologic abnormalities; and enhanced skill in determining when abnormal findings are clinically significant.

Even in cases when all CBC values are within the reference interval, abnormalities may be detected on the blood film. The following images and their interpretations focus on RBC morphology.

**MATCH THE IMAGES**
Match the images with the correct interpretation.

— Markedly regenerative anemia due to *Mycoplasma haemofelis* infection in a kitten
— Normal blood film from a cat
— Regenerative anemia with acanthocytes and schistocytes due to hemangiosarcoma in a dog
— Immune-mediated hemolytic anemia with marked evidence of regeneration in a dog
— Normal blood film from a dog

*Even in cases when all CBC values are within the reference interval, abnormalities may be detected on the blood film.*
PLATELET EVALUATION & INTERPRETATION

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LOOK FOR THIS RELATED ARTICLE IN A FUTURE ISSUE

- White Blood Cell Evaluation in Blood Films
ANSWER KEY

A  Immune-mediated hemolytic anemia with marked evidence of regeneration in a dog
The spherocytes (*black arrows*) are smaller and a darker shade of pink; they lack central pallor as compared with a normal erythrocyte (*blue arrow*). Regeneration is supported by the frequent, large polychromatophilic erythrocytes (*arrowheads*), which are analogous to reticulocytes.

B  Normal blood film from a dog
The normal erythrocytes (one represented by a *blue arrow*) in the monolayer are smaller than a neutrophil and have a small area of central pallor. Platelets (*black arrows*) and a segmented neutrophil (*arrowhead*) are also present.

C  Normal blood film from a cat
Normal feline erythrocytes (*blue arrows*) have little to no central pallor as compared with those in dogs.1 Platelets (one represented by a *black arrow*), an erythrocyte with a Howell-Jolly body (*pink arrow*), and a lymphocyte (*arrowhead*) can also be seen.
Markedly regenerative anemia due to *Mycoplasma haemofelis* infection in a kitten

This kitten was presented recumbent with a hematocrit of 4%, as evidenced by the paucity of erythrocytes seen here. Small cocci can be seen on the erythrocytes (blue arrows), and organisms can also be seen on the lighter-colored ghost cells (ie, erythrocytes that have lost their contents as a result of intravascular hemolysis, leaving only the membrane and the organisms attached to it; red arrows). Typically, extravascular hemolysis predominates in cases of *M haemofelis*; however, in the author’s experience, in severe cases, intravascular hemolysis (evidenced in this figure by the presence of ghost cells) may occur to a lesser degree if the immunoglobulins coating the RBCs are able to activate the complement system, which is an important part of the immune system. Its main function is to facilitate rapid and direct destruction of target cells or pathogens. Frequent large polychromatophilic erythrocytes (arrowheads) are evidence of regeneration. Platelets (black arrows), 2 neutrophils, and a lymphocyte (top center) can also be observed. This kitten was treated with a blood transfusion and doxycycline and recovered.

Regenerative anemia with acanthocytes and schistocytes due to hemangiosarcoma in a dog

When observed together, schistocytes (red arrows), acanthocytes (blue arrows), and large polychromatophilic erythrocytes (arrowheads) should raise concern for hemangiosarcoma. Acanthocytes can be difficult to differentiate from echinocytes (ie, crenated erythrocytes). Acanthocytes have more prominent, blunt projections that are wider and often appear paddle-like or have additional extensions at their end. Platelets (black arrows) can also be observed.

References


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3 Royal Canin Internal Study 2011. 4 Royal Canin Internal Study 2016.

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1Clinical trial on ULTAMINO® canine, 2011. Royal Canin data on file.
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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.

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Antiepileptic Drugs in Dogs

Heidi Barnes Heller, DVM, DACVIM (Neurology)
University of Wisconsin–Madison

In the Literature

FROM THE PAGE …

Dogs with structural epilepsy (ie, seizures that occur secondary to an identifiable intracranial cause [eg, inflammatory, neoplastic, or vascular disease]) pose a special concern for veterinarians. These dogs may be neurologically abnormal, with a high risk for progression or worsening of neurologic signs as disease worsens. Commonly accepted first-line antiepileptic drugs (eg, phenobarbital, potassium bromide) carry dose-dependent risks for sedation, ataxia, and weakness, all of which could result in true or apparent clinical progression in neurologically compromised dogs.1 Patients receiving newer anticonvulsant drugs (eg, levetiracetam) have a reportedly lower incidence of adverse effects as compared with those receiving potassium bromide and/or phenobarbital.2

This study evaluated seizure control and tolerability of levetiracetam monotherapy in 19 dogs diagnosed with structural epilepsy. Five of 6 dogs diagnosed with meningoencephalomyelitis of unknown origin (MUO) demonstrated improved seizure control on levetiracetam monotherapy, although phenobarbital was later added to one dog's treatment regimen. Four of 5 dogs diagnosed with seizures secondary to vascular disease were considered to have good seizure control with levetiracetam, whereas none of the 5 dogs diagnosed with neoplasia attained good seizure control with levetiracetam. Of the remaining dogs, one with congenital hydrocephalus attained good seizure control, whereas the 2 others (one with cortical dysplasia, one with traumatic brain injury) attained poor control.

Dogs with seizures that occur secondary to intracranial neoplasia and without definitive treatment (surgery or radiation therapy) often demonstrate progression resulting in death or euthanasia. Based on the data presented, levetiracetam should not be considered appropriate monotherapy for dogs with seizures that occur secondary to intracranial neoplasia. Levetiracetam may be considered appropriate for dogs with vascular disease or MUO; however, this needs further investigation in a large number of dogs with a standardized treatment protocol for the underlying disease. The lack of a standardized treatment protocol in this study was a major limitation. Managing a dog with structural epilepsy requires a balance of unwanted side effects, undesired progression of disease, quality-of-life goals for the dog, and owner financial limitations.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Levetiracetam may be useful as monotherapy for a select population of dogs with structural epilepsy, but close seizure monitoring is important.

2. If seizure control is not achieved, the addition of phenobarbital or potassium bromide should be considered.

References

Chronic Kidney Disease in Hyperthyroid Cats

Alex Gallagher, DVM, MS, DACVIM
University of Florida

In the Literature

FROM THE PAGE …

Hyperthyroidism is the most common endocrine disorder in cats, with prevalence ranging from 2% to 4%.1 Because of increases in glomerular filtration rate and decreased muscle mass, cats with hyperthyroidism may have masked concurrent chronic kidney disease (CKD) that does not become apparent until after treatment.2,3 It can be difficult to determine before therapy which cats may develop azotemia after restoration of the euthyroid state. A suitable biomarker has not been identified in prior reports.

In a previous study, lower plasma globulin concentrations were found to be a predictor of azotemia within 240 days of diagnosis of hyperthyroidism.4 In the present study, the investigators aimed to establish the repeatability of this finding and determine whether a particular globulin fraction, measured by protein electrophoresis, was associated with masked CKD. Fifty-six hyperthyroid cats and 26 healthy older cats were evaluated. Although differences were found between healthy and hyperthyroid cats in some variables, no differences were noted in concentrations of total globulin or any of its fractions between masked-azotemic and nonazotemic cats.

Because a reliable biomarker to determine masked kidney disease is not available, clinicians should thoroughly evaluate kidney function in cats before and after hyperthyroidism treatment. Thyroid function should also be assessed using thyroid-stimulating hormone and total thyroxine concentrations to avoid iatrogenic posttreatment hypothyroidism, as this can contribute to azotemia and reduced survival time.5,6

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Cats with hyperthyroidism should be screened at the time of diagnosis for evidence of CKD through evaluation of serum chemistry profile and urinalysis. Blood pressure should also be measured to assess for hypertension.

2. Because there is not a reliable biomarker to determine the presence of masked kidney disease, reassessment for kidney disease should be performed once the cat is euthyroid.

3. A hypothyroid state after treatment can contribute to the development of azotemia and result in reduced survival time.

References
3. “MY PET IS INDOORS.”
- Always? Pet owners may refer to small dogs as indoor animals, even if dogs go outside to urinate and defecate daily. Cat owners may not realize that the pet spends purring on the porch could be a source of exposure.
- Nature finds a way. Even if a pet is truly an indoor pet, once certain parasites such as the cat flea, brown dog tick, and many others are inside, they complete their full life cycle on the pet or in its immediate environment. Although the dog may be the brown dog tick’s preferred host, humans may also serve as potential hosts. Adults and nymphs preferentially drop off at night, and this may differentially deposit them in homes and human beds. Once they make their way inside, infestations quickly amplify. A single adult female flea will make 1300 eggs in her first 50 days on her host. After feeding, a single female brown dog tick can lay 4000 eggs to hatch indoors.

4. “I’VE BEEN TREATING MY PET.”
- Your pet is still exposed. Adult parasites may continue to emerge for at least another generation—even in the face of treatment—as not all life stages are susceptible to ectoparasiticides. Pets may also face a continual source of adult organisms if wild animals reside near outdoor spaces the pet frequents or indoors in crawl spaces or attics, leaving parasites behind.

The Misconceptions
1. “I’VE NEVER SEEN ANY BUGS.”
- Pets may clean many ectoparasites off—but not all of them. In a 7-day study, cats removed up to 45% of their original fleas; in a 22-day study, 78% were removed.
- Pests do not spend all of their time on your pet. Most stages of the flea and tick life cycle take place off the animal, in the environment.
- Ectoparasites are small and can be easy to miss. The size and translucency of many ectoparasites’ life stages render them invisible to the naked eye. Those that are visible are often tiny (Table). Parachutes also feed out of sight; for instance, the adult brown dog tick is most often found feeding preferentially in the ears or between the toes.

2. “MY OTHER PETS AREN’T AFFECTED.”
- Some pets are better groomers. Cats don’t all groom themselves equally well.
- Some pets show more signs. The pruritus of simple flea bite dermatitis may be much milder than the constellation of signs possible with true flea allergy dermatitis (FAD). Breed may also be a factor in parasite vulnerability.

3. “I’VE BEEN TREATING MY PET.”
- Treat all pets more thoroughly. Without guidance, pet owners may not treat all animals or the environment. Inappropriate application (flea collar too loose, putting topical medication on a wet pet) can prevent products from working effectively. Even with veterinary guidance, poor compliance due to forgetfulness is a common cause of treatment failure. For instance, although many pet owners may believe they should treat their pet with flea and tick preventive 12 months out of the year, estimated average prevention coverage based on flea and tick purchases is only 6.1 months.

Straightforward Treatment
Clearly, controlling ectoparasites can seem complicated to some pet owners. By offering convenient, veterinary-exclusive treatment options, the practice can provide successful control methods and clear up any client confusion, thereby helping patients, clients, and the practice’s bottom line.
Bravecto® is an excellent option that is easy to administer (palatable chewable for dogs, topical for dogs, topical for cats), starts working within hours, has a documented safety profile, and proven efficacy up to 12 weeks*.1-12 Not only do 9 out of 10 of pet owners prefer a 12-week flea and tick product to monthly prevention, but decreased frequency of administration increases adherence.8 This can contribute to improved care for pets and more doses sold. FAD patients especially benefit from extended duration of action; a field trial showed that Bravecto® significantly reduced clinical signs and eliminated flea infestations in dogs with FAD.10,11

Many clients easily misunderstand the basics of ectoparasite prevention. Counter their misconceptions and provide their pets with effective options that are simple for pet owners to stick to.

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

### TABLE

<table>
<thead>
<tr>
<th>Organism</th>
<th>Adult, Unfed Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ctenocephalides felis</td>
<td>1.5–3.2 mm³</td>
</tr>
<tr>
<td>Ixodes scapularis</td>
<td>2.0–2.5 mm²</td>
</tr>
<tr>
<td>Amblyomma americanum</td>
<td>3.4 mm⁴</td>
</tr>
<tr>
<td>Dermacentor variabilis</td>
<td>3.6–5.5 mm⁵</td>
</tr>
</tbody>
</table>

For comparison, a poppy seed is 1 mm in diameter.

### REFERENCES


Cyclophosphamide-Induced Sterile Hemorrhagic Cystitis

Timothy M. Fan, DVM, PhD, DACVIM (Oncology, Internal Medicine)
University of Illinois at Urbana–Champaign

In the Literature

FROM THE PAGE …
Systemic chemotherapy remains a cornerstone for treating companion animals with cancer. The manner by which antineoplastic drugs are administered can be categorized in 2 therapeutic strategies: maximum-tolerated dose or metronomic chemotherapy (ie, low-dose daily oral administration).1,2 Oral cyclophosphamide, either alone or in conjunction with NSAIDs (eg, piroxicam), is the most common cytotoxic agent used for metronomic chemotherapy in veterinary patients.3,4 Although metronomic cyclophosphamide administration does not typically cause myelosuppression or GI toxicities, the metabolism of cyclophosphamide still results in production of acrolein, a potent uroepithelial irritant with the potential to cause sterile hemorrhagic cystitis (SHC).5 Strategies for mitigating the development of SHC involve reducing acrolein contact time with uroepithelial cells via drug-induced polyuria and administering furosemide or prednisolone.6

This retrospective study examined the incidence of clinically relevant SHC in pet dogs receiving long-term (>6 months) metronomic cyclophosphamide therapy with or without concurrent oral furosemide. Over a span of 6 years at a single institute, 115 dogs meeting study inclusion criteria were categorized into 2 groups and evaluated for the development of clinically relevant SHC. Among the dogs, 25 cases of SHC were either diagnostically confirmed (via urinalysis, urine culture, ultrasonography) or clinically suspected (unresponsiveness to antibiotic), amounting to an incidence of 21.7%. Significantly, the incidence of SHC was reduced in dogs treated with concurrent furosemide therapy (10.2% [5/49 dogs]) as compared with that in dogs not treated with furosemide (30.3% [20/66 dogs]). Collectively, these findings suggest that coadministration of furosemide along with long-term metronomic cyclophosphamide therapy can reduce the incidence of clinical signs associated with SHC.

A FIGURE Visual (A) and chemical (B; ie, colorimetric) detection methods useful in complementing clinical signs (eg, hematuria, stranguria, pollakiuria) to support the presumed diagnosis of SHC. Visual assessments should be limited to detecting gross hematuria, whereas chemical detection (ie, urine dipstick) provides improved sensitivity for the identification of microscopic hematuria.
Key pearls to put into practice:

1. Oral metronomic cyclophosphamide therapy can result in uroepithelial irritation secondary to acrolein formation, even at low doses.

2. The overall incidence of SHC in pet dogs treated with metronomic cyclophosphamide is clinically relevant, with approximately 1 in 5 dogs being affected during long-term (>6 months) treatment.

3. Coadministration of furosemide (0.5-1.0 mg/kg q24h) with metronomic cyclophosphamide therapy can substantially reduce the likelihood of SHC-associated clinical signs (ie, hematuria, stranguria, pollakiuria).

References


Rapid Assessment with Physical Examination in Dyspneic Cats

Elke Rudloff, DVM, DACVECC
Lakeshore Veterinary Specialists
Glendale, Wisconsin

In the Literature

FROM THE PAGE …

The utility of clinical history and initial examination of cats presented with acute dyspnea (n = 108) to differentiate between cardiac and noncardiac causes were assessed in the present study. A study protocol was provided to participating clinicians to standardize the data collected. A triage algorithm was created using the data taken from the study participants’ clinical examination findings, which were highly specific for excluding or diagnosing cardiac dyspnea.

One of the main statistical parameters found to be associated with cardiac-related respiratory distress was tachycardia. Although this may be discordant with common clinical impressions. In addition, 10% (6/60) of the cats in the cardiac group were later definitively diagnosed with hyperthyroidism. It remains unclear whether all cats in the cardiac group were tested for hyperthyroidism and whether this might have affected the range and median heart rate used in building the algorithm.
The study essentially recommends that, if a cat with acute respiratory signs has a gallop rhythm and an increased heart rate or respiratory rate or hypothermia, furosemide should be administered before performing additional diagnostics. This approach seems benign, as long as the clinician also evaluates the respiratory pattern and auscultates the lungs and, if pleural effusion or pneumothorax is possible, performs an immediate thoracocentesis. Including instructions for sedation/anxiolysis in the study algorithm may also be worthwhile to reduce patient anxiety caused by dyspnea.

Of note, the term dyspnea, which in veterinary medicine refers to difficult or labored breathing, is a term derived from human medicine, in which it is used to describe a subjective, sensory experience of breathing discomfort; this is an experience rather than a clinical sign. Veterinarians should describe the clinical signs of respiratory distress (ie, respiratory rate, respiratory effort, breathing pattern, open-mouth breathing) to accurately convey what a nonverbal patient is showing rather than assume what it is feeling. A more valid measure of response to treatment can then be determined.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. A gallop rhythm and the presence of hypothermia or increased respiratory rate in a cat with acute respiratory difficulty should alert the veterinary team to the possibility of congestive heart failure.

2. Institution of therapy with furosemide before a definitive echocardiogram is obtained is reasonable when congestive heart failure is suspected.

References


A gallop rhythm and the presence of hypothermia or increased respiratory rate in a cat with acute respiratory difficulty should alert the veterinary team to the possibility of congestive heart failure.
Changing the approach to the pruritic dog.
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A dermatology portfolio of skin health solutions has transformed the approach to the pruritic dog. Zoetis treatments offer fast relief from pruritus, flea infestation and infection while still allowing you to diagnose and support long-term management. Protect the bonds that matter—and let dogs and owners get back to enjoying life.

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Risk Factors & Prevalence of Dystocia in Dogs

Selena L. Lane, DVM, DACVECC
University of Georgia

In the Literature

FROM THE PAGE …

Dystocia is a significant cause of mortality in puppies and can be a life-threatening condition in bitches at parturition. Age, size, and breed are known risk factors. Understanding more about patient-specific attributes associated with canine dystocia may help veterinary professionals educate the public about breed-specific risk factors.

Data compiled from primary care and emergency veterinary practices were used to provide epidemiologic data of dystocia in bitches in the United Kingdom. Dystocia cases were defined as bitches requiring veterinary intervention at the time of whelping with at least one puppy retained on presentation.

Among 18,758 intact female dogs seen in UK veterinary clinics, 701 dystocia cases were identified, with a 3.7% prevalence rate of emergent dystocia cases in the overall population.

Dystocia was most common in French bulldogs, Boston terriers, pugs, and Chihuahuas. Brachycephalic breeds represented 3 of the 4 breeds at the highest risk for dystocia. Most (94%) affected dogs were purebred bitches. Purebred dogs were found to be 3.4 times more likely to develop dystocia as compared with crossbreed bitches. Identification of at-risk breeds may help veterinary professionals inform breeders and owners about responsible breeding practices and reduce the incidence of dystocia in high-risk breeds.

Body weight also had an impact on risk, with dogs that weighed less than 22 lb or more than 88.2 lb at higher risk as compared with dogs that weighed 44.1 lb to 66 lb. Bitches between 3 and 5.9 years of age were 3.1 times more likely to experience dystocia as compared with younger intact female dogs.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Brachycephalic breeds and Chihuahuas are at increased risk for dystocia, with dogs 3 to 5.9 years of age more frequently affected than younger dogs.

2. Owners should be educated about responsible breeding practices and potential for dystocia in at-risk breeds.

3. Dystocia is always urgent and may require emergency surgical intervention, regardless of breed and age.

References

Suggested Reading
ProZinc®
(protopamine zinc recombinant human insulin)

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

Description: ProZinc® insulin is a sterile aqueous protamine zinc suspension of recombinant human insulin.

Each mL contains: recombinant human insulin 40 International Units (IU) protamine sulfate 0.466 mg zinc oxide 0.088 mg glycine 16.00 mg dibasic sodium phosphate, heptahydrate 3.78 mg phenol (added as preservative) 2.50 mg hydrochloric acid 1.63 mg water for injection (maximum) 1005 mg pH is adjusted with hydrochloric acid and/or sodium hydroxide.

Indication: ProZinc (protopamine zinc recombinant human insulin) is indicated for the reduction of hyperglycemia and hyperglycemia-associated clinical signs in cats with diabetes mellitus.

Dosage and Administration: USE OF A SYRINGE OTHER THAN A U-40 SYRINGE WILL RESULT IN INCORRECT DOING.

For subcutaneous injection in cats only.

ProZinc insulin should be mixed by gently rolling the vial prior to withdrawing each dose from the vial. Using an U-40 insulin syringe, the injection should be administered subcutaneously on the back of the neck or on the side of the cat. Always provide the Cat Owner Information Sheet with each prescription.

The initial recommended ProZinc dose is 0.1 – 0.3 IU insulin/pound of body weight (0.2 – 0.6 IU/kg) every 12 hours. The dose should be given concurrently with or right after a meal. The veterinarian should re-evaluate the cat at appropriate intervals and adjust the dose based on both clinical signs and glucose nadirs until adequate glycemic control has been attained. In the effectiveness field study, glycemic control was considered adequate if the glucose nadir from a 9-hour blood glucose curve was between 80 and 150 mg/dL and clinical signs of hyperglycemia such as polyuria, polydipsia, and weight loss were improved.

Further adjustments in the dosage may be necessary with changes in the cat’s diet, body weight, or concomitant medication, or if the cat develops concurrent infection, inflammation, nephropathy, or an additional endocrine or other medical disorder.

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

Warnings: User Safety: For use in cats only. Keep out of the reach of children. Avoid contact with eyes. In case of contact, immediately flush eyes with running water for at least 15 minutes. Accidental injection may cause hypoglycemia. In case of accidental injection, seek medical attention immediately. Exposure to product may induce a local or systemic allergic reaction in sensitized individuals.

Animal Safety: Owners should be advised to observe for signs of hypoglycemia (see Cat Owner Information Sheet). Use of this product, even at established doses, has been associated with hypoglycemia. An animal with signs of hypoglycemia should be treated immediately. Glucose should be given orally or intravenously as dictated by clinical signs. Insulin should be temporarily withheld and, if indicated, the dosage adjusted. Any change in insulin should be made cautiously and only under a veterinarian’s supervision. Changes in insulin strength, manufacturer, type, species (human, animal) or method of manufacture (rDNA versus animal-source insulin) may result in the need for a change in dosage.

Appropriate diagnostic tests should be performed to rule out other endocrinopathies in diabetic cats that are difficult to regulate.

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

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

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

Adverse Reactions: Effectiveness Field Study

In a 45-day effectiveness field study, 176 cats received ProZinc insulin. Hypoglycemia (defined as a blood glucose value of < 50 mg/dL) occurred in 71 of the cats at various times throughout the study. Clinical signs of hypoglycemia were generally mild in nature (described as lethargic, sluggish, weak, trembling, uncoordinated, groggy, glassy-eyed or faded). In 17 cases, the veterinarian provided oral glucose supplementation or insulin at home treatment. Most cases were not associated with clinical signs and received no treatment. One cat had a serious hypoglycemic event associated with stupor, lateral recumbency, hypothermia and seizures. All cases of hypoglycemia resolved with appropriate therapy and if needed, a dose reduction.

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

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

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

Extended Use Field Study

Cats that completed the effectiveness study were enrolled into an extended use field study. In this study, 145 cats received ProZinc insulin for up to an additional 136 days.

Adverse reactions were similar to those reported during the 45-day effectiveness study and are listed in order of decreasing frequency: vomiting, hypoglycemia, anorexia, poor appetite, diarrhea, lethargy, cystitis/hematuria, and weakness. Twenty cats had signs consistent with hypoglycemia described as: sluggish, lethargic, unsteady, wobbly, seizures, trembling, or dazed. Most of these were treated by the owner or veterinarian with oral glucose supplementation or food; others received intravenous glucose. One cat had a serious hypoglycemic event associated with seizures and blindness. The cat fully recovered after supportive therapy and finished the study. All cases of hypoglycemia resolved with appropriate therapy and if needed, a dose reduction.

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

To report suspected adverse reactions, or to obtain a copy of the Material Safety Data Sheet (MSDS), call 1-866-638-2226.

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

Effectiveness: A total of 187 client-owned cats were enrolled in a 45-day field study, with 176 receiving ProZinc insulin. One hundred and fifty-one cats were included in the effectiveness analysis. The patients included various purebreds and mixed breed cats ranging in age from 3 to 19 years and in weight from 4.6 to 20.8 pounds. Of the cats included in the effectiveness analysis, 101 were castrated males, 49 were spayed females, and 1 was an intact female.

Cats were started on ProZinc insulin at a dose of 0.1-0.3 IU/kg (0.2-0.7 IU/Lb) twice daily. Cats were evaluated at 7, 14, 30, and 45 days after initiation of therapy and the dose was adjusted based on clinical signs and results of 9-hour blood glucose curves on Days 7, 14, and 30. Effectiveness was based on successful control of diabetes which was defined as improvement in at least one blood glucose variable (glucose curve mean, nadir, or fructosamine) and at least one clinical sign (polyuria, polydipsia, or body weight). Based on this definition, 115 of 151 cases (76.2%) were considered successful. Blood glucose curve means decreased from 415.3 mg/dL on Day 0 to 203.2 mg/dL by Day 45 and the mean blood glucose nadir decreased from 407.9 mg/dL on Day 0 to 142.4 mg/dL on Day 45. Mean fructosamine values decreased from 505.9 μmol/L on Day 0 to 380.7 μmol/L on Day 45.

Cats that completed the effectiveness study were enrolled in an extended use field study. The mean fructosamine value was 342.0 μmol/L after a total of 181 days of ProZinc therapy.

How Supplied: ProZinc insulin is supplied as a sterile injectable suspension in 10 mL multidose vials. Each mL of ProZinc product contains 40 IU recombinant human insulin.

Storage Conditions: Store in an upright position under refrigeration at 36-46°F (2-8°C). Do not freeze. Protect from light.

Manufactured for: Boehringer Ingelheim Vetmedica, Inc. St. Joseph, MO 64060 U.S.A.

Manufactured by: AAPIharma Services Corp., Charleston, SC 29405 ProZinc® is a registered trademark of Boehringer Ingelheim Vetmedica, Inc. © 2010 Boehringer Ingelheim Vetmedica, Inc. All Rights Reserved. 449901-1-0002 Revised 02/2010 Code 449911
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Important Safety Information: For use in cats only. Animals presenting with severe ketoacidosis, anorexia, lethargy, and/or vomiting should be stabilized with short-acting insulin and appropriate supportive therapy until their condition is stabilized. As with all insulin products, careful patient monitoring for hypoglycemia and hyperglycemia is essential to attain and maintain adequate glycemic control and to prevent associated complications. Overdosage can result in profound hypoglycemia and death. Progestogen and glucocorticoid use should be avoided. PROZINC insulin is contraindicated in cats during episodes of hypoglycemia and in cats sensitive to protamine zinc recombinant human insulin or any other ingredients in the PROZINC product.


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See page 44 for product information summary.
Leflunomide & Immune-Mediated Disease

Lisa Singer, VMD, DACVIM
Veterinary Specialist Services
Queensland, Australia

In the Literature

FROM THE PAGE …

Leflunomide is an immunomodulatory drug that has been used as primary and adjunctive therapy for naturally occurring immune-mediated and inflammatory diseases, specifically colorectal polyps in miniature dachshunds and immune-mediated polyarthritis.1,2

This study retrospectively evaluated the safety and efficacy of leflunomide (0.8-4.3 mg/kg q24h) in 92 dogs treated between the years 1995 and 2014. Median duration of treatment was 23.5 weeks (range, 1-208 weeks). Various adjunctive therapies included prednisolone, mycophenolate, cyclosporine, and azathioprine. The most common diseases treated were immune-mediated polyarthritis, immune-mediated thrombocytopenia, and immune-mediated hemolytic anemia. Adverse events possibly attributable to this drug were observed in 11/92 dogs (12%) and included diarrhea, lethargy, unexplained hemorrhage, thrombocytopenia, and increased liver enzymes. After a 30% to 50% dose reduction or drug discontinuation, several adverse events resolved.

Previous studies have reported a starting dose of 3-4 mg/kg q24h.3 The median starting dose was higher in dogs with adverse events (2.9 mg/kg q24h) than in dogs without adverse events (1.6 mg/kg q24h). The overall drug response rate was 70.5%; for dogs receiving leflunomide as monotherapy, drug response rate was 81.8%.

… TO YOUR PATIENTS
Key pearls to put into practice:

1. Leflunomide is well tolerated when used in conjunction with prednisolone.

2. Leflunomide at lower starting doses (eg, 2 mg/kg q24h) when used as an adjunctive therapy may be equally clinically effective in the treatment of immune-mediated diseases as compared with its use at higher doses (3-4 mg/kg q24h).

3. Leflunomide dose reductions of 30% to 50% or drug discontinuation can resolve most adverse events. Leflunomide may rarely cause hemorrhage after 6 weeks or more of drug administration, in which case the drug should be discontinued immediately.

References


Research Note: Autologous Canine Skin Substitute

This proof-of-concept study described an autologous canine skin substitute designed to treat large, deep, or delayed-healing wounds. The grafting capacity of the skin constructs were first assessed by xenografting in mice, then 2 dogs with large, deep skin wounds were recruited for the study. Keratinocytes and fibroblasts were isolated from 8-mm punch biopsy samples from each dog. Skin substitutes were constructed on a fibrin-based matrix and were ready to use within 12 to 14 days after biopsies were obtained. Full wound closure was achieved 25 days after grafting in one dog and 40 days after grafting in the second dog. Permanent epithelialization was confirmed via histology. Although the engineered skin construct did not contain hair follicles or adnexal glands, most requirements of an ideal skin substitute appeared to be fulfilled.

Source

Research Note: Feline Vaccine-Associated Injection Site Sarcomas

Feline vaccine-associated injection site sarcomas (ISSs) were first reported in 1991. Although radical surgery, radiation, and chemotherapy are all used to treat these aggressive tumors, recurrence is common. Nanoparticles can provide building blocks for therapeutic mechanisms and increase ability to visualize tissue. Gold nanoparticles (AuNP) can increase the radiation dose deposited into tissue. This in vitro study evaluated the effect of AuNP on ISS cytotoxicity and colony formation. Although AuNP alone did not apparently alter short-term viability or cell cycle of ISS cells, cellular proliferation decreased significantly. Thus, AuNP shows initial promise as a long-term therapeutic to decrease ISS growth.

Source
Early Diagnosis, Dietary Intervention Offer Promising Results for Dogs with Cognitive Dysfunction Syndrome

The incidence of canine cognitive dysfunction syndrome (CDS) is believed to be an estimated 14 percent of dogs aged 8 and older, but only 1.9 percent are diagnosed. Why is CDS underdiagnosed?

I believe that underdiagnosis of CDS is due to a lack of awareness. The initial signs of CDS can be subtle, so they are often overlooked if pet owners don’t know what to watch for. As veterinarians, our job is to help clients recognize and report behavioral changes in their aging pets.

What is the value of earlier diagnosis of CDS? What can veterinarians do to achieve it?

Signs of CDS are slowly progressive; however, within six months senior dogs can progress from being symptom-free to demonstrating some signs of CDS—or from exhibiting mild symptoms to severe. The benefits of early identification are early diagnosis and the potential for earlier intervention to improve clinical signs. I would recommend that veterinarians begin scheduling twice yearly visits to screen dogs for signs of CDS by age 8, in addition to routine physical exams and laboratory tests. Because CDS is a diagnosis of exclusion, behavioral screening will also help identify signs that might be indicative of other underlying health problems.

A useful tool available to veterinarians is the DISHAA screening questionnaire, which evaluates six categories of behavior signs associated with CDS (see p. 3).

Screening geriatric dogs for behavioral and cognitive health should be as routine as screening for medical issues such as dental and joint health. Educating clients about CDS can also improve the likelihood that clients will volunteer this information themselves.

How should veterinarians manage dogs with CDS following diagnosis?

If CDS is diagnosed, veterinarians can take a multimodal approach to management. Strategies include:

- **Environmental enrichment.** Providing both physical exercise and mental enrichment can improve physical and cognitive health and quality of life.
- **Medication.** Selegiline hydrochloride is a monoamine oxidase inhibitor (MAOI) approved to help manage the clinical signs of CDS.
- **Supplements.** Combinations of ingredients including fish oils, antioxidants and phosphatidylserine may help improve cognitive function.
- **Diet.** CDS can also be managed nutritionally by feeding a therapeutic diet containing medium-chain triglyceride (MCT) vegetable oil and a unique blend of nutrients.

In my experience, we can achieve effective results with nutritional intervention. CanCog Technologies conducted a randomized, double-blinded, 90-day study focusing on nutritional management of dogs diagnosed with CDS. The dogs were fed a trial diet containing 6.5 percent MCT vegetable oil with a unique blend of nutrients.

At 30 days, we found that dogs fed the trial diet showed improvement in 5 of 6 DISHAA categories and, at 90 days, dogs fed the trial diet improved significantly (p<0.05) across all DISHAA categories. Combined with early diagnosis, nutritional intervention can help improve quality of life for affected pets.

<table>
<thead>
<tr>
<th>Clinical Sign</th>
<th>30 Days</th>
<th>90 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disorientation</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Interaction altered</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Sleep/wake cycles</td>
<td>↓</td>
<td></td>
</tr>
<tr>
<td>House soiling</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Activity changes</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>Anxiety</td>
<td>↓</td>
<td>↓</td>
</tr>
</tbody>
</table>

Dietary intervention in dogs with CDS led to improvement in 5 of 6 DISHAA categories at 30 days and significant improvement in all categories at 90 days.

---

Steps to CDS Diagnosis and Management: Pose One Simple Question to Start the Process

When I ask clients if they’ve noticed behavioral changes in their senior dogs, it’s not surprising to hear, “I think he might have doggie Alzheimer’s,” followed by nervous laughter. While owners of older dogs typically think there is nothing they can do about the geriatric behavioral changes occurring in their pets, I see this observation as an opening to begin a gentle discussion that could ultimately lead to a cognitive dysfunction syndrome (CDS) diagnosis and management plan.

**CDS: a “rule out” diagnosis**

CDS cannot be detected with a single blood test or exam — it’s a rule-out diagnosis. Often I begin geriatric exams by asking clients about changes in their pets. Is there a difference in activity level? Are there mentation changes or new anxieties? We have to figure out whether the pet is suffering from medical problems, behavioral or neurologic changes, or all of the above.

If a pet exhibits one or more signs of what may be CDS, a diagnostic workup is necessary to rule out medical, physical and motor dysfunction, as well as neurological disease, sensory decline, endocrine and metabolic disorders, and musculoskeletal disease. I do basic bloodwork including a CBC, chemistry profile and thyroid test to rule out other conditions that could be causing behavioral or neurological issues. I may do further testing for Cushing’s disease, take radiographs or an ultrasound if indicated, etc. If the dog is experiencing a specific disorder such as disruption in sleep, I send the patient home with medications and supplements, such as trazodone and melatonin, to address the most immediate problem.

**Evaluating mental sharpness**

If a patient has one or two symptoms that suggest some cognitive dysfunction, I use the DISHAA questionnaire (see adjacent page) in a conversational way with clients. The DISHAA acronym is derived from the six areas of cognition that it measures: Disorientation; Social Interactions; Sleep/Wake Cycles; Housesoiling, Learning and Memory; Activity and Anxiety. It helps assess the mental acuity of a dog and can enable veterinarians to potentially diagnose CDS.

Clients often tell themselves that behavior changes like losing housetraining are “normal” for old dogs and that they must resign themselves to living with them. The ability to give age-related cognitive changes a name can lead to greater client understanding of their dog’s condition, as well as hope for improved quality of life.

**Creating a CDS management plan**

Most of my clients are receptive to using nutrition as a strategy to help manage dogs with CDS. Feeding a diet containing medium-chain triglyceride vegetable oil and a unique blend of nutrients such as those found in Purina® Pro Plan® Veterinary Diets NC NeuroCare™ Canine Formula, may help improve clinical signs.

Adjusting to lifestyle changes in the geriatric pet is very important to keep them mentally stimulated and to maintain the bond between owner and pet. I tell clients that if they have a young, healthy dog that loves to run and they’re leaving their senior dog at home, they need to make time for that older pet, too. A leisurely walk up and down the block provides an opportunity for bonding, as well as mental stimulation for the dog. Puzzle toys or simple games like hide-and-seek can help reduce boredom and stimulate a dog’s mind. Using gentle massage on a dog that is losing sensory capabilities can help ease anxiety and facilitate bonding between pet and client.

**Key Takeaways**

- The behavioral signs of CDS can progress within six months,² making early diagnosis valuable to effective management.
- Asking clients about behavior changes in their senior dogs can facilitate a discussion that may lead to a CDS diagnosis and management plan.
- Feeding a diet containing medium-chain triglyceride vegetable oil and a unique blend of nutrients may help improve the clinical signs of CDS.³
WHAT IS DISHAA?

DISHAA is a tool to help veterinarians and owners assess the mental acuity of a dog, and for veterinarians to potentially diagnose Cognitive Dysfunction Syndrome (CDS).

The prevalence of CDS increases with age:
8–10 years: 3.4%  
10–12 years: 5%  
12–14 years: 23.3%  
>14 years: 41%

Cognitive Dysfunction Syndrome may be diagnosed using the DISHAA questionnaire. In order for a dog to be diagnosed with CDS, owners must observe their dog exhibiting signs across several DISHAA categories.

---

**D** — DISORIENTATION
- Gets stuck, difficulty getting around objects, goes to hinge side of door
- Stares blankly at walls, floor, or into space
- Does not recognize familiar people/familiar pets
- Gets lost in home or yard
- Less reactive to visual (sights) or auditory (sounds) stimuli

**I** — SOCIAL INTERACTIONS
- More irritable/fearful/aggressive with visitors, family or other animals
- Decreased interest in approaching, greeting or affection/petting

**S** — SLEEP/WAKE CYCLES
- Pacing/restless/sleeps less/waking at night
- Vocalization at night

**H** — HOUSESOILING, LEARNING AND MEMORY
- Less able to learn new tasks or respond to previously learned commands/name/work
- Indoor soiling of urine ___ or stool ___ /decreased signaling to go out
- Difficulty getting dog’s attention/increased distraction/decreased focus

**A** — ACTIVITY
- Decrease in exploration or play with toys, family members, other pets
- Increased activity including aimless pacing or wandering
- Repetitive behaviors, e.g., circling ___ chewing ___ licking ___ star gazing ___

**A** — ANXIETY
- Increased anxiety when separated from owners
- More reactive/fearful to visual (sights) or auditory (sounds) stimuli
- Increased fear of places/locations (e.g., new environments going outdoors)

---

WHAT IF...
WE COULD IMPROVE THE SIGNS OF COGNITIVE DYSFUNCTION SYNDROME?

In a clinical study, dogs with Cognitive Dysfunction Syndrome (CDS) were fed a test diet containing a unique blend of nutrients and MCT vegetable oil; after 90 days, dogs significantly improved across all categories of clinical CDS signs.

That inspired us to create Purina® Pro Plan® Veterinary Diets NeuroCare.

Enhanced with a unique blend of nutrients and medium chain triglyceride vegetable oil
EPA + DHA, omega-3 fatty acids, to help support brain health

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Feline Urethral Obstruction

Elke Rudloff, DVM, DACVECC
Lakeshore Veterinary Specialists
Glendale, Wisconsin

In the Literature

FROM THE PAGE …

Feline urethral obstruction is common in veterinary medicine, and recurrence rates of 14% to 57% have been reported.1-4 Although therapeutic techniques have evolved, no reliable method or medication has been proven to prevent recurrent feline urethral obstruction (rFUO). In 1971, an observational study discussed an escalating approach to therapy, which included IM injections of pancreatic extract, antibiotic administration, and digital and needle manipulation of the urethra.5 Since then, reports have documented use of intravesicular lidocaine, intravesicular and oral glycosaminoglycans, phenoxybenzamine, and prazosin in the prevention of rFUO.2-6-9

Prazosin, an α1-adrenergic blocker, acts as a smooth muscle relaxer and is labeled for the treatment of hypertension in humans. Its use in the treatment of benign prostatic hyperplasia is extra-label and, in veterinary medicine, is prescribed for the prevention of feline urethral obstruction and rFUO.9 No pharmacokinetic information on prazosin in cats has been reported, and recommended doses range from 0.25-1 mg/kg PO q12h.9 Until this study was published, there had only been weak evidence in the form of retrospective studies without control subjects describing the use of prazosin in cats with rFUO, and small studies have reported mixed information regarding prazosin’s efficacy in preventing rFUO.3,10,11

This article prospectively examined whether prazosin at 0.25 mg/cat PO q12h affected rFUO rates. No significant side effects or reduction in rFUO rates were noted in 47 male cats (27 receiving prazosin, 20 receiving placebo) observed for one month. Studies using larger test and control groups are needed to determine statistically relevant differences.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Prazosin at 0.25 mg/cat PO q12h does not appear to have clinically relevant side effects.

2. Based on the study findings, prazosin does not appear to prevent rFUO.

References

Canine Aural Hematoma Techniques

Jason Bleedorn, DVM, DACVS
University of Wisconsin–Madison

In the Literature

FROM THE PAGE …
Aural hematomas occur commonly in dogs. Treatment can include needle drainage +/- steroid infusion or surgical drainage with suture placement. Management of the underlying cause is essential. Information on recurrence is limited, and no robust comparative data to guide initial and recurrence treatment strategies exist.

This survey investigated opinions regarding aural hematoma treatment techniques and success. A total of 251 responses were analyzed. Initial treatments included needle drainage with (43%) and without (16%) local deposition of corticosteroids, surgery (29%), Penrose drain placement (4%), or other (8%). Surgical techniques included linear incision with sutures (35%), sutures with stents (24%), S-shaped incision and sutures (23%), or other punch biopsy or stent approaches (18%). The most common rationale for treatment type provided was history of previous success (77%); less frequent reasons cited were owner preference (6%), cost (5%), practice policy (4%), convenience (4%), and other (4%). The clinicians’ perceived success of initial treatment was good to excellent with surgery (91%) as compared with needle drainage with (59%) and without (38%) steroids. Sixty-five percent of veterinarians predicted a 0% to 25% chance of recurrence; however, only 51% of veterinarians who used needle drainage and steroids expected an outcome equally as favorable as compared with the 96% who chose surgery as a first-line treatment. Recurrent hematomas were more commonly treated with surgery (67%), followed by needle drainage with (16%) or without (7%) steroids, Penrose drain placement (7%), and other (3%). Following a second treatment, 83% of veterinarians predicted a 0% to 25% chance of recurrence.

Study results suggest the most common initial treatment provided for aural hematomas is needle drainage with or without local steroids (59%). Some type of surgical intervention is more common with recurrent hematomas, and the overall perceptions of success with surgery generally are higher than with other treatment options.

… TO YOUR PATIENTS
Key pearls to put into practice:

1. Identification and management of the underlying cause of aural hematoma formation is key to successful treatment.
2. Treatment must be provided in a timely fashion and followed carefully in the short term.
3. Goals include removal of the blood clot, prevention of recurrence, and maintaining cosmetic appearance and function of the ear.
4. Less invasive options (drainage +/- steroids) should be considered for acute or mild cases.
5. Chronic or recurrent cases may require surgical drainage and tacking sutures.

May 2018 cliniciansbrief.com 49
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Mirtazapine has become widely used in veterinary medicine due to its commonly recognized effects of appetite stimulation and weight gain.

**CLINICAL APPLICATIONS**

- Mirtazapine is an effective appetite stimulant in cats and is used for nutritional support in both dogs and cats with acute and chronic illness.
  - Mirtazapine has been demonstrated in placebo-controlled trials to result in appetite stimulation in normal cats and appetite stimulation, weight gain, and improved body condition in cats with chronic kidney disease (CKD).
  - The drug’s mechanism of action is not fully understood but likely involves antagonism of the serotonin 2C (5HT2c) receptor, which is known for its appetite-inhibition activity, as well as antagonism of the histamine 1 (H1) receptor, which also plays a role in appetite regulation.
- Mirtazapine has antiemetic properties due to its antagonism of the serotonin 3 (5HT3) receptor and has been shown to decrease vomiting in cats with CKD.
- Because of its superior receptor-binding affinity, there is some evidence that concurrent administration of mirtazapine with 5HT3-receptor antagonists (eg, ondansetron) may decrease the efficacy of ondansetron in humans.
  - Although evidence for this interaction is not available for cats and dogs, this phenomenon should be taken into account when choosing antiemetic and antinausea regimens.
- Mirtazapine appears anecdotally to have some appetite-stimulating properties in dogs, but no studies have been conducted to assess appetite in healthy or hyporexic dogs receiving this drug.
  - A prokinetic effect has been demonstrated in healthy dogs that received mirtazapine at 1.7-2.0 mg/kg PO once, resulting in improved gastric emptying and colonic motility.
  - The clinical utility of this prokinetic effect merits further investigation.

**PHARMACOKINETICS & PHARMACODYNAMICS**

- In cats, administering one-fourth of a 15-mg tablet (3.75 mg) every 3 days was initially recommended based on an early, mostly anecdotal, open clinical trial in which a dose was extrapolated from use in humans; however, several studies have since helped determine a more appropriate starting dose for cats.
- Mirtazapine is amenable to transdermal administration and has been demonstrated to achieve therapeutic serum concentrations in cats.
• Placebo-controlled pharmacodynamic studies have demonstrated that transdermal administration of mirtazapine results in increased appetite in normal cats and increased appetite and weight in cats with CKD.\textsuperscript{2,3}
• Transdermal mirtazapine obtained from compounding pharmacies can have high variability\textsuperscript{1} among preparations and may not have the same stability and efficacy as that demonstrated in referenced studies.

The pharmacokinetics of mirtazapine is affected by age and several disease states.

• As compared with humans (half-life, 20–40 hours), the half-life of oral mirtazapine in young normal cats is relatively short (9.2 hours).
• A repeat-dosing study demonstrated little drug accumulation with daily administration of 1.87 mg/cat in young cats\textsuperscript{2,3}; median peak serum concentrations were reached in one hour.
• In contrast, the half-life of oral mirtazapine is prolonged in elderly cats (12.1 hours) and cats with CKD (15.2 hours) and/or liver disease (15.1 hours).\textsuperscript{2,12}
  – This is similar to pharmacokinetics in humans in which kidney and/or liver disease prolong half-life by 25\% to 30\%.\textsuperscript{3,13}
• In young healthy dogs, the half-life of mirtazapine is 6 hours, with peak serum concentration at 0.9 hours.\textsuperscript{9}

ADMINISTRATION & DOSE INTERVAL

The variable pharmacokinetics of mirtazapine should be taken into account when determining the dose interval.

The suggested oral dose interval for cats is 1.87 mg/cat PO q24h in younger cats with normal organ function, q48h in cats with CKD, and q48-72h in cats with liver disease.\textsuperscript{2,3,12}

• A higher dose of 3.75 mg has been associated with increased side effects, typically without any greater efficacy for appetite stimulation.\textsuperscript{3,14}
  – Some cats may require titration up to this dose.\textsuperscript{3,14}
• The suggested (anecdotal) dose interval for dogs is 0.6-1.0 mg/kg q12h.
• Studies evaluating dose interval in dogs with liver and/or kidney disease have not been conducted.\textsuperscript{9}

SAFETY & ADVERSE EFFECTS

• Adverse effects in cats are dose-dependent and much more likely to occur at higher doses or with accidental administration of an entire 7.5- or 15-mg tablet.\textsuperscript{3,14}
• Adverse effects, which appear to be more common in cats than in dogs, most commonly include vocalization, agitation, vomiting, abnormal gait/ataxia, restlessness, tremors/trembling, hypersalivation, tachypnea, tachycardia, and lethargy.\textsuperscript{3,14}
• With both the oral and transdermal formulations, the dose should be titrated to the lowest effective amount for appetite stimulation to minimize adverse effects.
• Subclinical reversible increases in liver enzymes (eg, marked increases in alanine transaminase [possibly idiosyncratic]) may occur as a result of mirtazapine administration; discontinuation of the drug is recommended in these patients.\textsuperscript{9}
• Concurrent administration with selective serotonin reuptake inhibitors may increase serotonin syndrome-like adverse effects.\textsuperscript{13}

References
**BRIEF SUMMARY** (for full prescribing information, see package insert)

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

**Indications:**
Bravecto kills adult fleas and is indicated for the treatment and prevention of flea infestations (Ctenocephalides felis) and the treatment and control of tick infestations (ticks including black-legged tick, Dermacentor variabilis (American dog tick), and Amblyomma americanum (lone star tick)) for 12 weeks in dogs and puppies 6 months of age and older, weighing 4.4 pounds or greater. Bravecto is also indicated for the treatment and control of Amblyomma americanum (lone star tick) infestations for 8 weeks in dogs and puppies 6 months of age and older, and weighing 4.4 pounds or greater.

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

**Warnings:**
Not for human use. Keep this and all drugs out of the reach of children. Keep the product in the original packaging until use, in order to prevent children from getting direct access to the product. Do not eat, drink or smoke while handling the product. Wash hands thoroughly with soap and water immediately after use of the product.

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

**Adverse Reactions:**
In a well-controlled laboratory dose confirmation study, one dog developed edema and hyperemia of the upper lips within one hour of receiving Bravecto. The edema improved progressively through the day and had resolved by the next morning.

**Adverse Reaction**

<table>
<thead>
<tr>
<th>Percentage of Dogs with Adverse Reactions in the Field Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse Reaction (AR)</td>
</tr>
<tr>
<td>Bravecto Group: Percentage of Dogs with the AR During the 105-Day Study (n=221 dogs)</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Vomiting</td>
</tr>
<tr>
<td>Decreased Appetite</td>
</tr>
<tr>
<td>Diarrhea</td>
</tr>
<tr>
<td>Lethargy</td>
</tr>
<tr>
<td>Increased Heart Rate</td>
</tr>
<tr>
<td>Increased Respirations</td>
</tr>
<tr>
<td>In the field study, two dogs treated with Bravecto with no prior history of seizures each experienced a seizure. One dog had two seizures a day apart about 18 days after its first dose. The dog was treated on antiepileptic medication and had no additional seizures during the study. A second dog had a seizure 76 days after its first dose and 3 days after starting fluoxetine for separation anxiety. The fluoxetine was discontinued and the dog experienced no additional seizures during the study. One dog treated with Bravecto was observed by the owner to be off balance for about 30 minutes five days after its first dose and had no similar observations after the second dose. One dog with a history of seizures had a seizure the day after the second dose of the active control.</td>
</tr>
<tr>
<td>In two well-controlled laboratory dose confirmation studies, one dog developed mild to moderate redness, flaking, crusts/scabs and alopecia at the treatment site from Day 1 through 14 after application of Bravecto on Day 0, and one dog developed self-limiting generalized erythema (possible allergic reaction) one day after treatment with Bravecto.</td>
</tr>
<tr>
<td>In an European field study in cats, there were three reports of facial dermatitis in humans after close contact with the application site which occurred within 4 days of application.</td>
</tr>
</tbody>
</table>
The challenge

Veterinarians recommend year-round flea and tick protection but...

Do pet owners follow the 12-month recommendation? No.

The average dog owner doses their pet with approximately **4.6 monthly flea treatments in a year**.

What do dog owners think?

of dog owners **agree** that their pets should have 12 months of flea and tick protection

of dog owners **remembered** their veterinarian’s exact flea & tick recommendation

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See page 53 for product information summary.
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External Splinting for Pectus Excavatum in Kittens

Whitney DeGroot, DVM
Karen M. Tobias, DVM, MS, DACVS
University of Tennessee

Pectus excavatum is a congenital, concave deformity of the caudal sternum that results in a reduced ventrodorsal thoracic diameter.¹,² The cause is unknown, although a hereditary component has been suggested.³ Pectus excavatum can result in compromised pulmonary and cardiac function due to decreased intrathoracic capacity and restriction of diastolic filling.²⁻⁴ Common clinical signs include a palpable concavity of the thorax, respiratory distress, exercise intolerance, tachypnea, cyanosis, and failure to thrive, although some animals may appear clinically normal.

Diagnosis is based on physical examination and thoracic radiography findings (Figure 1). Radiographs should show a sternal deformity and decreased caudal thoracic space secondary to dorsal deviation of the sternum.³⁻⁵ The severity of the deformity can be graded using 2 indices (ie, vertebral or frontosagittal; see Deformity Indices, next page), although these indices may not correlate with the severity of clinical signs.⁴ Severity can also be evaluated with CT. A study in kittens found CT to be useful in identifying midline sternal deviation that could potentially cause more severe clinical signs, despite relatively mild skeletal deformity, because of diastolic restriction.⁴

Three types of surgical repair have been described in cats: external splinting, internal splinting (using plates or rods), and sternebral pinning combined with external splinting.¹⁻⁶,⁷ Reports have suggested that external splinting can be attempted in kittens (typically those less than 4 months of age) if the sternebrae are still pliable.⁶,⁸

The brace should be created from a moldable (preferably radiolucent) material and should be U-shaped to fit around the ventral thorax, extending approximately three-fourths of the way to the spine. Surgical scrub sponges can be used to pad the edges of the brace to prevent pressure sores, and holes can be created along
the ventrolateral aspects of the brace to allow for suture passage. Percutaneous sutures should be placed around the sternum (ie, circumsternal) and through, around, or over the brace. The sutures should be tightened and secured so the sternum is pulled outward. To allow evaluation and cleaning of the region, the sutures can be secured by tying in a bow or with replaceable split shot fishing sinkers to allow for loosening and/or retightening. After placement of the circumcostal sutures and brace, lateral radiographs should be obtained to evaluate the position of the sternabrae and verify improvement in the thoracic width as compared with pretreatment measurements (Figure 2). The brace should be kept in place for several weeks until the sternum is sufficiently stiff to prevent inward displacement.

Potential complications of external splinting include inadvertent lung or heart puncture, pneumothorax, re-expansion pulmonary edema, infection associated with the sutures, moist dermatitis from the splint, sinus tracts around the sutures, and deformity recurrence. While the brace is in place, patients must be strictly exercise-restricted and, preferably, kept away from other cats. Prying or scratching at the brace—by the kitten itself or other cats during play—must be prevented, as this can result in suture loosening and/or loss of reduction.

Weekly rechecks are recommended to ensure the brace has not loosened and that there is no evidence of infection at the suture sites. If infection is suspected, the replaceable split shot sinkers can be opened and matching suture ends can be clamped with hemostats until the brace can be elevated from the patient’s chest enough to examine the suture sites and facilitate wound care. Sedation is recommended any time the sutures are to be loosened.

Radiography every 2 weeks is recommended to ensure the defect remains reduced. The brace should remain in place for 4 to 8 weeks, depending on patient age, until the sternum feels palpably non-compliant after splint removal. If reduction fails with external splinting, partial sternectomy, or sternal wedge resection and internal splinting, may be required. Recurrence of clinical signs and evidence of recompression have not been reported in follow-up data for kittens treated with external splinting alone.

There have been no controlled studies to determine whether all kittens with pectus excavatum require correction. The authors primarily perform external splinting on kittens showing clinical signs (eg, respiratory difficulty, exercise intolerance, poor growth). In some of these kittens, final indices after splint removal are not much improved over initial measurements, but clinical signs have resolved. It is possible that the splint prevented the condition from worsening while the kittens grew or that other, unmeasured indices (eg, diastolic volume) were improved by splinting.

**DEFORMITY INDICES**

- **Frontosagittal index**: The ratio of thoracic width at T10 measured on a dorsoventral radiograph and the distance from the center of the ventral surface of the vertebra overlying the deformity to the nearest point on the sternum (normal, 0.7-1.3)

- **Vertebral index**: The ratio of the distance from the center of the dorsal surface of the vertebral body overlying the deformity to the near point of the sternum and the dorsoventral diameter of the centrum of the same vertebra measured on a lateral radiograph (normal, 12.6-18.8)

▲ **FIGURE 2** Patient in Figure 1. The sternum has been pulled ventrally and secured by circumsternal sutures to an external brace with removable split shot fishing sinkers.
**STEP-BY-STEP EXTERNAL SPLINTING IN KITTENS**

### WHAT YOU WILL NEED

- Moldable splint material (preferably radiolucent)
- Nonabsorbable suture (0 or 2-0) material on a taper needle
- Hemostats and needle drivers
- Split shot fishing sinkers
- Adhesive tape

### STEP 1

Anesthetize the patient and position in dorsal recumbency. Aseptically prepare the ventral thorax.

![Image of a kitten being prepared for splinting](image1.jpg)

### STEP 2

Place the first suture, passing the needle underneath the xiphoid or the palpable caudal-most aspect of the sternum and keeping it adjacent to the dorsal surface of the cartilage. Place a hemostat at the suture ends to maintain them as stay sutures.

![Image of the first suture being placed](image2.jpg)

### STEP 3

Place gentle upward traction on the first suture, and place a second suture around the sternum, just cranial to the first, in the same fashion. The needle must be directed to pass dorsal to and circumferentially around the sternum. Exercise caution to avoid damaging essential intra-thoracic structures, including the heart and lungs.

![Image of the second suture being placed](image3.jpg)
Specifically formulated for dogs, Reconcile® (fluoxetine hydrochloride) tablets, in conjunction with the BOND™ training program, are clinically proven to help dogs that experience separation anxiety.

Important Safety Information: The most common adverse events reported in decreasing order of reported frequency are: decreased appetite, depression/lethargy, shaking/shivering/tremor, vomiting, restlessness and anxiety, seizures, aggression, diarrhea, mydriasis, vocalization, weight loss, panting, confusion, incoordination, and hypersalivation. Reconcile chewable tablets are contraindicated for dogs with a history of seizures or when used with MAOIs. For product label, including complete safety information, go to Reconcile.com.

NOW AVAILABLE and AFFORDABLY PRICED!

Talk to your distributor today to learn more.
Results of clinical trials have shown that after 8 weeks, 73% of dogs receiving Reconcile® and behavior modification training combined had significant behavioral improvement compared with only 52% of dogs receiving behavior modification training alone.

The BOND™ training program used in conjunction with Reconcile is just one reason why it’s better than generic fluoxetine. See below for even more reasons to use Reconcile.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Reconcile</th>
<th>Human generic alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavored, chewable, once-a-day tablet</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Clinically tested and FDA approved for use in dogs</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Four convenient strengths: 8 mg, 16 mg, 32 mg, and 64 mg</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Exclusive behavior modification plan</td>
<td>✔</td>
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<tr>
<td>Clinic and pet owner educational materials</td>
<td>✔</td>
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<tr>
<td>Product support services at Reconcile.com</td>
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</tbody>
</table>

Reconcile® chewable tablets are indicated for the treatment of canine separation anxiety in conjunction with a behavior modification plan. Clinical trials have shown that dogs treated with Reconcile chewable tablets showed significantly greater improvement in inappropriate urination, inappropriate defecation, excess salivation, aggression, and stress over those given the control tablet.

Reconcile® is a trademark and Reconcile is a registered trademark of Pegasus Laboratories, Inc. PRN™ Pharmacal, an employee-owned company, has been dedicated to developing specialized therapeutics since 1978. Our commitment: quality solutions—as needed, when needed.
**STEP 4**

With an index finger underneath the sternum, apply upward pressure to reduce the sternal defect and isolate the sternum from the lung and heart. While the sternum is secured in this position, additional sutures can be preplaced, as described above, until the sternal deformity is spanned.

**STEP 5**

Separate the paired suture ends and pass them through the holes in the brace to either side of the midline. Resecure the sutures with hemostats.

**STEP 6**

Once all circumcostal suture pairs have been passed through the brace, pull the sutures tight to reduce the sternal defect and secure them together by tying in a knot or bow or by clamping them with a removable split shot fishing sinker.

**STEP 7**

Secure the suture ends with adhesive tape; do not cut them. The chest and brace can be covered with a bandage or small cloth (ie, t-shirt) to prevent self-trauma.

See page 25 for references.
Redonyl Ultra Soft Chews Released
Dechra Veterinary Products (dechra-us.com) has announced that Redonyl Ultra Soft Chews are now available for purchase. Redonyl Ultra is a veterinary nutraceutical that helps support healthy skin function in dogs with seasonal allergies and can be used as part of a multimodal approach in the management of healthy skin function in dogs. Redonyl Ultra contains palmitoylethanolamide (PEA), which has been shown to have a down-regulating effect on mast cell degranulation in canine skin. The PEA in Redonyl Ultra is ultramicronized to allow improved distribution and diffusion in the body. Redonyl Ultra will be available in 2 soft chew strengths (ie, 100 mg, 200 mg) that can be administered to dogs of all sizes. Redonyl Ultra will also carry the Quality Seal from the National Animal Supplement Council.—Press Release 4/2018

PortionPro Rx Pet Feeder Launched
Vet Innovations (vetinnovations.com) has announced that PortionPro Rx is now available to veterinarians and pet owners to help boost compliance with weight-loss recommendations. PortionPro Rx is a pet feeder that uses proprietary access-control technology to help ensure dogs and cats follow prescription diets and prevent food theft between pets in multipet households. The radio-frequency identification technology controls both portions and access. When the assigned pet approaches, the feeder door opens so the pet can eat. If an unassigned pet approaches, the door closes until that unassigned pet leaves. To control overeating, the device measures and dispenses the recommended amount of food for the assigned pet.

Field trials of the PortionPro Rx reported that 87% of overweight study participants lost weight during the trial, 97% of pet owners said food stealing between pets was eliminated, 83% of pet owners said it was easier to follow a prescription diet, and 86% of pet owners saw reduced stress and frustration at mealtimes. Veterinarians can prescribe PortionPro Rx through Vetsource (vetsource.com; portionprorx.com/get-started).—Press Release 2/2018

LEUKOCARE & Boehringer Ingelheim Enter Agreement
The biotechnology company LEUKOCARE (leukocare.com) has established a partnership with Boehringer Ingelheim (boehringer-ingelheim.com) by licensing its Stabilizing and Protecting Solutions (SPS) technologies. Boehringer Ingelheim will have access to LEUKOCARE’s SPS formulation technologies to use biologic reagents in a new veterinary diagnostics product and stabilize them.—Press Release 4/2018
GALLIPRANT® (grapiprant tablets)

For oral use in dogs only

20 mg, 60 mg and 100 mg flavored tablets

A prostaglandin E, (PGE) EP4 receptor antagonist; a non-
cyclooxygenase inhibiting, non-steroidal anti-inflammatory drug

Contraindications: GALLIPRANT® should not be used in dogs that have a hypersensitivity to grapiprant.

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

Precautions: The safe use of GALLIPRANT has not been evaluated in dogs younger than 9 months of age and less than 8 lbs (3.6 kg), dogs used for breeding, or in pregnant or lactating dogs. Adverse reactions in dogs receiving GALLIPRANT may include vomiting, diarrhea, decreased appetite, mucoid, watery or bloody stools, and decreases in serum albumin and total protein. If GALLIPRANT is used long term, appropriate monitoring is recommended.

Concurrent use with other anti-inflammatory drugs or protein-bound drugs includes cardiac, anticonvulsant and behavioral medications.

Drug compatibility should be monitored.

Use the lowest effective dose for the shortest duration consistent with individual response.

For use in dogs only. Store GALLIPRANT out of reach of dogs and other pets in a secured location in order to prevent accidental ingestion or overdose.

Additional information is available at 1-888-545-5973.

To report suspected adverse drug events and/or obtain a copy of the Safety Data Sheet (SDS) please contact For additional information about adverse drug experience reporting for animal drugs, contact 1-888-FDA-VE TS or online at http://www.fda.gov/AnimalVeterinary/SafetyHealth

For use in dogs only. Keep this and all medications out of reach of children and pets. Store out of reach of dogs and other pets in a secured location in order to prevent accidental ingestion or overdose. Do not use in dogs that have a hypersensitivity to grapiprant. If Galliprant is used long term, appropriate monitoring is recommended. Concomitant use of Galliprant with other anti-inflammatory drugs, such as COX-inhibiting NSAIDs or corticosteroids, should be avoided. Concurrent use with other anti-inflammatory drugs or protein-bound drugs has not been studied. The safe use of Galliprant has not been evaluated in dogs younger than 9 months of age and less than 8 lbs (3.6 kg), dogs used for breeding, pregnant or lactating dogs, or dogs with cardiac disease. The most common adverse reactions were vomiting, diarrhea, decreased appetite, and lethargy. Please see brief summary to the left for full prescribing information.


START SEEING OSTEOARTHRITIS FROM A DIFFERENT PERSPECTIVE

PRESCRIBE GALLIPRANT® (grapiprant tablets) FROM THE EARLIEST DIAGNOSED STAGES OF OSTEOARTHRITIS (OA).

Galliprant is a first-in-class, non-COX-inhibiting prostaglandin receptor antagonist (PRA) that specifically acts on the EP4 receptor. Its mode of action targets OA pain and inflammation while reducing the impact on GI, kidney and liver homeostasis.¹,² It was well-tolerated by healthy dogs in a 9-month safety study at up to 15 times the recommended therapeutic dose.²,³

Visit galliprantfordogs.com/early for more information about Galliprant.

INDICATION

Galliprant is indicated for the control of pain and inflammation associated with osteoarthritis in dogs.

See page 62 for product information summary.
Relapsing Atopy: Tired of “Here we go again”?

Darin Dell, DVM, DACVD
Wheat Ridge Animal Hospital
Wheat Ridge, Colorado
Sponsored by Dechra Veterinary Products

Atopic dermatitis (ie, atopy) is a common and frequent reason for veterinary visits. Diagnosis can be challenging because other potential causes of pruritus, otitis, and alopecia must be ruled out first. Clients may become frustrated by relapses, frequent veterinary bills, and patient discomfort long before atopy can be definitively diagnosed. This frustration often causes pet owners to bounce from one veterinarian to another—or purchase dubious remedies online while pets continue to suffer.

The Case
Maggie, an 8-year-old spayed female chocolate Labrador retriever, was presented in October for pyoderma and otitis externa. The owner described a 5-year history of progressively worsening signs, including pruritus, odor, patchy alopecia, pyoderma, and otitis externa. Signs started in the fall 5 years earlier and initially resolved in the winter. Maggie continues to be most severely affected in the autumn season, although problems persist all year long.

Cytology from the skin and ears was performed. Bacterial infection was found on the trunk and paws. Malassezia spp. infection was found on the paws and in both ears.

Maggie’s owner noted that previous courses of oral antibiotics were effective at improving the skin but caused anorexia and diarrhea. Furthermore, last year’s skin infection recurred soon after the antibiotic course was complete. Similar relapses have been observed after using medicated ear ointments for otitis. Maggie’s owner is unable to bathe her at home but takes her to the groomer every 2-3 weeks for a bath.

Topical Management
MiconaHex+Triz® Shampoo was recommended to be used at the groomer every 2 weeks. The owner was advised that weekly bathing is ideal. The owner was instructed to use MiconaHex+Triz® Mousse daily on the trunk as well as the paws. Mal-A-Ket® Plus TrizEDTA® Flush was recommended for the yeast otitis. The owner was instructed to clean both ears every other day for 10 days and then twice weekly. A 30-day trial of a non-steroid allergy medication was initiated.

Follow-up
Maggie’s owner was contacted after a week. The owner reported significant improvement in the ear and skin condition. The pruritus was also markedly improved but not totally absent.

Maggie was re-presented for examination 3 weeks later. Aside from the alopecia (which was improving), all of her other signs had resolved. Maggie had received 2 medicated baths since the initial visit. The owner was not experiencing any trouble with the ear flush or mousse products. Cytology revealed a slight amount of yeast on the paws but no infection in other locations. The owner was instructed to continue to use MiconaHex+Triz® Shampoo indefinitely. Ear cleaning was to continue twice weekly during the fall and weekly during the rest of the year. The paws were visually much improved, but the presence of a few yeast organisms suggested that continued topical management would be helpful. MiconaHex+Triz® Wipes were recommended to be used on the paws every other day. Wipes have the added benefit of helping to remove pollen and other irritants from the skin. In addition, most owners find using wipes on the paws easier than mousse or sprays.

Take-Home Tips
When owners claim they are unable to bathe their dog, other topical strategies need not be immediately ruled out. Sometimes owners are unable to bathe their dog at home because they do not have appropriate equipment; some owners have medical problems that physically prevent them from bathing their dog. Prevent “I can’t bathe my dog” from stopping your topical management conversation—gently ask more questions with the goal of finding the best fit for each pet, person, and situation.

In this case, there are a couple of reasons to avoid systemic antibiotic therapy. First, the patient had been treated multiple times in previous years with oral antibiotics, and studies have shown that frequent antibiotic usage increases the risk of bacterial resistance. Second, the owner noted severe gastrointestinal side effects related to previous antibiotic use.

Maggie’s history strongly supports the diagnosis of atopy. Although many owners in this situation suspect their dog has “allergies,” it is important to clearly define and confidently diagnose the problem. Only with a solid, clear diagnosis of atopy can you educate the client about management and prognosis. Remember that having a definitive diagnosis of allergy does not mean you can skip identifying potential infections at each visit; cytology is essential at almost every dermatology-related visit.

The purpose of the recheck examination is three-fold: First, you are able to evaluate the response to antimicrobial therapy and make adjustments; use cytology to guide your decisions. Second, you can evaluate the patient’s response to the allergy medication. This must be done in light of the past and current infection status. Third, you can reinforce the fundamentals of allergy and provide encouragement. Veterinarians tend to think of the benefit of a veterinary visit in regards to the products we prescribed or the procedures we performed; however, most clients place much greater value on what we say and how we say it.

Don’t let the topical management discussion turn into an argument. If a client says, “I can’t bathe my dog,” don’t give up! Change your focus to other topical options. Topical management has immense medical value because it reduces the risk of side effects, does not perpetuate antibiotic resistance, and can lessen the overall length of treatment.

REFERENCES AND ADDITIONAL MATERIALS

References and additional materials available at brief.vet/Derm-Medical
With the patient positioned in lateral recumbency, dental radiographs are obtained. The patient is stable under anesthesia, and the team prepares to begin the procedure.

What are the next steps?

**THE CHOICE IS YOURS …**

**CASE ROUTE 1**
To maintain good visualization with a spring-loaded mouth gag, which may be most convenient, for maximal opening of the jaw, go to page 66.

**CASE ROUTE 2**
To maintain good visualization with a small mouth gag crafted from a hypodermic needle cap cut to 20 mm in length and use your fingers to retract the lips during the procedure, go to page 68.

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**THE CASE**
A 7-year-old spayed female domestic shorthair cat is presented for routine dental cleaning and extraction of the left maxillary premolar. The patient is bright and alert with a normal energy level. Physical examination is unremarkable, with the exception of grade 3 periodontal disease. Preoperative CBC, serum chemistry profile, total thyroxine, urinalysis, and blood pressure are normal.

The cat is premedicated with butorphanol (0.2 mg/kg IM) and tiletamine–zolazepam (3 mg/kg IM) before sedation is induced with propofol (6 mg/kg IV to effect). The patient is intubated, and anesthesia is maintained with isoflurane (1.5%) in 100% oxygen. Intravenous fluid rate during anesthesia is 10 mL/kg/hr. Monitoring includes pulse oximetry reading (peripheral capillary oxygen saturation [SpO₂]), systolic blood pressure, and echocardiography. SpO₂ is maintained above 95%, blood pressure ranges from 100 to 110 mm Hg, and heart rate is stable between 160 and 170 bpm with no arrhythmias.
Clinical Considerations

These findings are suggestive of a left cortical lesion and cortical blindness. Blindness and cerebral ischemia in cats following oral and transoral procedures is uncommon; the literature on this topic consists largely of isolated case reports and case series, leaving the true prevalence of postanesthetic blindness in the feline population unknown. Recovery from postanesthetic blindness is variable. Approximately 70% of cats will have partial or complete recovery of vision within 1 day to 6 weeks, but some will remain blind.

Eighty-five percent of affected cats will have concurrent neurologic deficits (eg, abnormal mentation, ataxia, circling, head tilt) that may or may not improve with time.

Postanesthetic blindness is often attributed to hypoxemia or hypotension during anesthesia; however, because mouth gags apply continual force to keep the mouth open, a hypothesis has suggested that mouth gags are to be attributed. Opening the mouth to such an abnormal degree has been thought to disrupt maxillary arterial blood flow, potentially causing cerebral ischemia and blindness. In one study, mouth gags were used in 16 of 20 cats with postanesthetic cortical blindness and were identified as a possible risk factor.

A knowledge of feline anatomy and the relationship of the maxillary artery to surrounding structures is essential to understanding why cats are at increased risk for ischemia as compared with other species. Feline anatomy is unique in that the internal carotid artery is functionally absent; thus, the blood supply to the brain, retina, and inner ear is largely supplied by the maxillary artery. The maxillary artery is located at the caudal aspect of the mandible and between the tympanic bulla and angular process of the mandible. Surrounding soft tissues, specifically the pterygoid and temporal muscles, are hypothesized to bulge and compress the maxillary artery when the mouth is held in a fully extended position.
In addition, cadaver dissection has revealed that full jaw extension causes stretching of the vasculature. Blood flow through the maxillary artery is compromised due to compressive and stretching forces. Spring-loaded mouth gags, especially when fully opened, may be particularly dangerous because the forces holding the mouth open are continuous and strong. Blood supply to critical brain and eye structures are at risk for compromise when the jaw is fully opened for a period of time, which increases the risk for ischemia.

Cats can be affected with blindness unilaterally or bilaterally. Vascular angiogram and dynamic CT studies have found more vascular compromise on the side ipsilateral to the mouth gag. This could be because the distance between the angular process of the mandible and tympanic bulla is smaller on the ipsilateral side, thereby amplifying the compressive forces on the maxillary artery.

In addition, all cats are not equally susceptible to ischemic injury. One study found that maximal opening of the mouth by a mouth gag produced electroretinography (ERG) changes consistent with vascular compromise in one of 6 cats, whereas 4 of 6 cats assessed with magnetic resonance angiography had vascular compromise. The reason cats are unequally affected is unknown, although it is hypothesized that some cats have enough variation in their vascular anatomy to allow collateral blood flow or altered blood flow through the basilar arteries.

Clinical blindness and neurologic signs appear to develop sporadically as postoperative complications in cats; however, the incidence is unknown. Deafness is also possible. Maximal opening of the mouth can alter the brainstem auditory evoked response (BAER) test (see Brainstem Auditory Evoked Response Test), which suggests that maximal opening of the mouth impairs blood flow to the auditory parts of the brain, which are also supplied by the maxillary artery. It is likely that multiple factors (eg, the degree and duration of mouth opening, type of mouth gag used, anatomic variation, anesthetic protocols, degree of systemic oxygenation and blood pressure) are involved in clinically affected cats. Recovery is variable, ranging from days to months, and some cats may have permanent neurologic deficits or blindness.

**Outcome**

The patient’s recovery is slow. After 9 days, the patient is still blind OU and weak on the right side but no longer circling. At follow-up examination 4 months later, vision is normal and neurologic signs have resolved.

**Your Choice’s Implications**

Spring-loaded mouth gags can cause altered blood flow to the maxillary artery, which provides the primary blood supply to the brain and retina of cats. Therefore, mouth gags—especially spring-loaded mouth gags—that fully extend the mouth are not recommended in cats because of the risk for ischemia. Blindness and neurologic signs secondary to ischemia can be temporary or permanent. It is recommended to use caution in cats when opening the mouth widely, and the duration the mouth is open should be minimized as much as possible.

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**Brainstem Auditory Evoked Response Test**

The BAER test is a minimally invasive, electrodiagnostic test used to detect electrical activity in the cochlea and auditory pathways within the brain. The BAER test has also been found to be useful in detecting ischemic processes within the brain. An abnormal BAER would suggest that maximal opening of the mouth has impaired blood flow to the auditory parts of the brain.

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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>BAER</td>
<td>Brainstem auditory evoked response</td>
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<tr>
<td>ERG</td>
<td>Electroretinography</td>
</tr>
<tr>
<td>OU</td>
<td>Both eyes</td>
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CASE ROUTE 2

You elect to use a small mouth gag crafted from a hypodermic needle cap cut to 20 mm in length (Figure 2), and you use your fingers to retract the lips during the procedure.

Case Progression
The procedure takes approximately one hour and is completed without complication. Anesthesia is uneventful, and the cat is placed in a cage for recovery. The patient is slow to recover but appears normal.

Clinical Considerations
Maximally opening the mouth has the potential to compromise blood flow of the maxillary artery in some cats. Compromised blood flow is problematic because the maxillary artery is the main blood supply to the brain and retina in cats. Altered blood flow increases the risk for developing blindness, deafness, and cortical ischemia postoperatively. Larger mouth gags, specifically spring-loaded mouth gags, exert an exponentially increased amount of force on tissues as compared with smaller mouth gags.

It has been hypothesized that using something similar to a spring-loaded gag (eg, the cap of a hypodermic needle) could provide a suitable alternative and not fully opening the mouth could decrease the compromise of the maxillary artery. In one study evaluating the effects of a 42-mm plastic mouth gag and a spring-loaded 7.6-mm mouth gag on magnetic resonance angiography in 6 healthy adult cats, 4 cats (66%) had altered blood flow with their mouths maximally opened with the spring-loaded gag; however, one cat also had reduced blood flow with submaximal mouth opening using the 42-mm plastic gag, about the size of a standard hypodermic needle cap. Even though the spring-loaded mouth gag was smaller, it resulted in a disproportionate amount of force exerted on the tissues. The results of this study are important and indicate that even submaximal openings of the mouth can cause alterations in maxillary arterial blood flow in some cats. There have been no studies evaluating the risk for postoperative ischemic complications in cats from submaximal openings of the mouth.

It is essential to recognize that changes to maxillary arterial blood flow can occur very quickly after mouth gag application. In experimental studies, alterations in blood flow occurred within 5 minutes. In one cat, reduced retinal blood flow in the eye ipsilateral to the mouth gag was documented on ERG as early as 3 minutes after placing a spring-loaded mouth gag. The changes in retinal blood flow were reversible, and the ERG waves returned to normal physiologic levels within 30 seconds of removing the mouth gag. In a retrospective case series, the duration of anesthesia was not associated with the severity of clinical signs. In affected cats, the duration of anesthesia ranged from 20 minutes to 5.5 hours, and all affected cats had the mouth gags in full extension.

Another consideration is that as the mouth is opened more widely, increased tension on the lips makes them more difficult to retract, which can impair visualization and complicate the procedure. With smaller mouth gags, the lips have more movement and can be easily moved out of the way. Ideally,
a mouth gag should not be used at all and the lips should be retracted out of the working visual field as needed.

**Outcome**

The cat does well postoperatively and makes a full recovery.

**Your Choice’s Implications**

Although use of a smaller mouth gag may seem safer than a spring-loaded mouth gag, some cats may still experience compromised blood flow to the maxillary artery with submaximal opening of the mouth. These blood flow changes occur quickly, and there are no predictive factors as to which cats will be affected. The safest option is to avoid the use of mouth gags altogether in cats. If a mouth gag must be used in a feline patient, the smallest possible gag, ideally less than 30 mm, should be chosen and the duration of use minimized.

**References**

New therapeutic advancements help control your patient’s pruritus, but the underlying disease and risk of pyoderma flares still exist. Dechra’s topical therapy products should be a central part of addressing atopic dermatitis and pyoderma. Daily topical therapy helps remove allergens, support the management of infection and pruritus, and repair the skin barrier for both acute and chronically affected patients. Dechra makes it easy to implement a multimodal management protocol.

**Multi-Modal Management: Benefits and Frequency**

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- **Infection Control**

- **Pruritus Control**

- **Skin Barrier Repair**

  *Shampoo frequency depends on severity and chronicity.
  
  **Acute and Severe:** Every Other Day.
  **Acute and Mild:** Once or Twice Weekly.
  **Chronic:** Weekly to Every Other Week.

  **Daily mousse, spray and wipe therapy achieves the best results.**

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Veterinarians make decisions every day about diagnostic and treatment options for their patients. Clinical reasoning, along with a sound and relevant knowledge base, forms the cornerstone of these decisions. Undergraduate and continuing education tend to focus on acquisition of knowledge; however, knowledge is only useful if it can be accessed, formulated, and applied to the problem at hand. Thus, successful case assessment requires knowledge, understanding, and clinical reasoning.

**Case Example**
Sheba, a 3-year-old spayed rottweiler located in New York, is presented with an acute history of melena and collapse overnight. She had vomited bile once a few hours prior, had been active and normal the preceding day, and had eaten well the preceding afternoon. On physical examination, she is overweight and weak with pale mucous membranes, a prolonged capillary refill time (>2 seconds), a heart rate of 160 bpm, and a normal rectal temperature. A systolic heart murmur (grade 2/6) is auscultated on the left-hand side. Her spleen appears large on abdominal palpation. She is up-to-date on vaccinations and parasite preventives and has not recently traveled.

**Clinical Reasoning Models**
Clinical reasoning is a complex process that varies widely depending on the clinician’s preferred thinking and learning style, past experiences and expertise, the clinical problem itself, and the context in which the problem is encountered. Clinical reasoning used by clinicians can be broadly classified as

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**Successful case assessment requires knowledge, understanding, and clinical reasoning.**
Type 1 (nonanalytic) or Type 2 (analytic). A blended approach or triangulation of both types (to cross-check clinical reasoning and diagnostic conclusions) is advocated for successful diagnostic decision-making.¹

**Nonanalytic Clinical Reasoning**

Nonanalytic reasoning, often referred to as pattern recognition, occurs quickly and subconsciously and primarily relies on the clinician accessing knowledge and patterns from past experiences that can be applied to the present case. Thus, limited previous case exposure may hinder pattern recognition in students and new graduates, veterinarians returning to practice after a prolonged break, or veterinarians changing their area of practice. Nonanalytic reasoning based on pattern recognition can be also be flawed if the clinician recognizes only a small number of salient factors in the case.

Use of pattern recognition as the primary mode of clinical reasoning works well for many common disorders and has the advantage of being quick and cost-effective, provided that the diagnosis is correct. Pattern recognition is also effective in cases for which:

- A disorder has a unique and recognizable pattern of clinical signs
- There are only a few diagnostic possibilities that can be easily remembered or ruled in or out by routine tests
- The clinician has extensive experience (and thus a rich bank of illness scripts to recall), is well read and up-to-date, reviews all diagnoses made regularly and critically, and has an excellent memory

Alternatively, pattern recognition as the primary clinical reasoning process can be problematic:

- For uncommon diseases
- For common diseases that present atypically
- When the patient is exhibiting multiple clinical signs that are not immediately associated with a specific disease and may or may not be related to a single diagnosis
- If the pattern of clinical signs is suggestive of certain disorders but not specific for them

For an experienced clinician, the success of pattern recognition relies on a correct diagnosis for the previously observed pattern. In general practice, the clinician must often form a provisional diagnosis and make treatment decisions in the absence of complete knowledge or data and without confirming the diagnosis.² These decisions will likely be reinforced by the presumption that the diagnosis was correct if the patient clinically improves with treatment.

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**Table: Diagnostic Biases in Clinical Medicine**

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<thead>
<tr>
<th>Bias</th>
<th>Description</th>
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<tbody>
<tr>
<td>Availability</td>
<td>A tendency to favor a diagnosis because of a case the clinician has seen recently</td>
</tr>
<tr>
<td>Anchoring</td>
<td>An initial diagnosis is favored but is misleading. The clinician persists with the initial diagnosis and is unwilling to change his or her mind.</td>
</tr>
<tr>
<td>Framing</td>
<td>Features that do not fit with the favored diagnosis are ignored.</td>
</tr>
<tr>
<td>Confirmation</td>
<td>When information is selectively chosen to confirm—not refute—a hypothesis. The clinician only seeks or takes note of information that will confirm his or her diagnosis and does not seek or ignores information that will challenge it.</td>
</tr>
<tr>
<td>Premature closure</td>
<td>Narrowing the choice of diagnostic hypotheses too early</td>
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</tbody>
</table>
Even experienced clinicians are vulnerable to bias (Table) in nonanalytic reasoning. Such bias is generally subconscious, although some authors suggest that an awareness of bias can help avoid such errors. Diagnostic error can involve a combination of biases. Cognitive skill errors (ie, processing biases) are reported to be a more common reason for diagnostic error as compared with errors caused by knowledge gaps. Overconfidence is believed to be a major factor contributing to diagnostic error and bias, even among specialists.

In Sheba’s case, the range of diagnoses that will be suggested by veterinarians based on pattern recognition may include an acute GI disease, a bleeding disorder, acute cardiac failure, splenic torsion, splenic hemangiosarcoma, hypoadrenocorticism, and hemolytic anemia. All of these are feasible and all require different diagnostic and treatment strategies.

The Minimum Database
Routine diagnostic tests (eg, hematology, serum chemistry profile, urinalysis) can be useful and often essential in understanding a patient’s clinical condition. Relying on a minimum database to provide more information about the patient before clinical reasoning is engaged may be reasonable for some diseases but unhelpful for others. Serious, even life-threatening, disorders of the GI tract, neuromuscular system, pancreas (especially in cats), and heart rarely cause significant diagnostic changes in the routine hematologic and biochemical parameters measured in general practice. In addition, diagnostic tests are rarely 100% sensitive or specific. Using blood testing to screen for diagnoses can therefore be misleading, as the positive and negative predictive value of any test is influenced by the prevalence of a disorder in the population.

Abnormal results in an unwell patient can create confusion if not critically reviewed as an integral part of the clinical assessment of all data relevant to the patient and related to the presenting problem(s). Veterinarians may overestimate the information gained from laboratory and imaging results, especially if the fundamentals (ie, comprehensive history, thorough clinical examination) are bypassed in favor of tests. It is recommended to avoid performing a test if not looking for a specific disease, as results can be misleading. For example, total thyroxine and fecal panels are tests that are requested frequently but that may be misinterpreted.

Analytic Clinical Reasoning
For cases in which nonanalytic reasoning is not helpful, analytic reasoning is required. An analytic approach to clinical reasoning is also needed to double-check presumptive diagnoses that are based on pattern recognition.

In contrast to nonanalytic reasoning, analytic reasoning is reflective and systematic, permitting hypothesis formation and abstract reasoning.

Analytic reasoning is less prone to bias than nonanalytic reasoning but is limited by working memory capacity, unless strategies are developed to provide the clinician with a logical, methodical, and memorable process through which to problem-solve any case presentation.

Problem-Based Inductive Reasoning
In problem-based inductive reasoning, also described as logical clinical problem-solving, each significant clinicopathologic problem is assessed before being related to the patient’s other problems. Using this approach, the pathophysiologic basis and key questions for the most specific clinical signs the patient is exhibiting are considered before a pattern is sought. This ensures that the clinician’s mind remains more open to other diagnostic possibilities beyond the most obvious based on...
pattern recognition and thus helps prevent diagnostic bias.

The Problem List
The initial step in problem-based inductive reasoning is to clarify and articulate the patient’s clinical signs by constructing a problem list. Constructing a problem list (either mentally, orally, or in written form) helps make the clinical signs explicit to the clinician’s current level of understanding, transforms vague presenting information to specific problems, and helps the clinician determine the key clinical problems (ie, hard findings) versus the “background noise” (ie, soft findings). Most importantly, it helps prevent the clinician from overlooking less obvious, but nevertheless crucial, clinical signs and becoming overwhelmed with information. Incidental findings can mislead the clinician, particularly in older patients (eg, by focusing on the chronic diseases present instead of recognizing that it may be an acute disease that is responsible for the current clinical signs). Constructing and critically assessing a problem list can help prevent this. Problems should be prioritized, and those that are most specific and/or diagnostically useful can act as “diagnostic hooks.”

Sheba’s problem list would include:
- Profound weakness
- Melena
- Pale mucous membranes
- Systolic murmur and tachycardia
- Vomiting
- Splenomegaly
- Obesity (which would not contribute to the diagnostic plans but would need to be addressed at a later stage)

Each acute problem is important, and answering key questions related to each can provide important clues to guide diagnosis.

Problem Assessment
Problem-based inductive clinical reasoning provides steps to bridge the gap between the problem list and the list of differential diagnoses via a structured format. Once the problem list has been formulated, it can be used as the foundation for problem-based reasoning. After the key problems have been assessed as below, rather than listing every possible differential diagnosis for every problem on the problem list, a list of feasible differential diagnoses based on the problem list as a whole should be made.

The specific problems identified should be investigated through rigorous use of key steps:
- Define and refine the problem (What is the problem?).
- Define and refine the system (What system is involved and how is it involved?).
- Define the location (Where in the system is the problem located?).
- Define the lesion (What is the lesion?).

This structured approach to defining and refining the problem and system in particular will help determine the appropriate questions to ask when obtaining the history. The owner responses may alert the clinician to pay particular attention to aspects of the physical examination, indicate the most...
appropriate diagnostic test(s) to use, and prepare the clinician intellectually to assess the results of the chosen tests.

**Define & Refine the Problem**

When assessing a patient’s clinical signs, it is essential to define the problem as accurately as possible. Considering whether there is another clinical sign with which the problem could be confused is a vital first step, as failure to define the problem correctly can derail a clinical investigation that might otherwise have been relatively straightforward.

In Sheba’s case, melena in particular requires careful problem definition, as digested blood in the GI tract can be a result of either GI bleeding or swallowed blood (eg, from eating raw red meat, a bleeding lesion in the mouth or nasopharynx, coughing up then swallowing blood, licking a bleeding wound). It should be confirmed that the melena is due to GI bleeding by ruling out possible sources of ingested blood.

**Define & Refine the System**

Once the problem is defined, the body system that is malfunctioning should be considered. For every clinical sign, there is a system(s) that must be involved or that “creates” the clinical sign. However, the most important question is how it is involved. The key specific questions are what system could be involved in causing this clinical sign and is it a primary (ie, structural) problem of a body system or a secondary (ie, functional) problem whereby the system involved in creating the particular clinical sign is secondarily affected in the pathophysiologic process. An alternative, although closely related, question for some problems is if the problem is local or systemic.

In Sheba’s case, the key questions related to system definition include:

- Is her profound weakness due to primary or secondary neuromuscular disease? Given the other clinical signs, secondary (eg, cardiovascular, hematopoietic) is most likely.
- Is her melena a result of GI bleeding due to local disease (eg, parasites, foreign body, neoplasia, drug damage [eg, NSAIDs]) or systemic disease, such as coagulopathy or GI ulceration due to nonGI disease (eg, hypoadrenocorticism, mast cell tumor, hepatic disease, uremia, gastrinoma)?
- Are her pale mucous membranes due to anemia or decreased peripheral perfusion?
- Are her systolic murmur and tachycardia due to primary cardiac disease or secondary noncardiac disease (eg, anemia)?
- Is her vomiting a result of primary or secondary GI disease?

The range of diagnoses to consider, diagnostic tools used, and potential treatment or management options for primary structural problems of a body system are often very different from those relevant to secondary functional problems of that system. Investigation of primary structural problems often involves imaging (eg, radiology, ultrasonography, advanced trans-sectional imaging, endoscopy, surgical exploration) and/or biopsy. Routine hematology, serum chemistry profile, and urinalysis are often of little value in confirming the diagnosis but can be helpful in assessing the consequences of the underlying pathology (eg, anemia from GI bleed, metabolic perturbations as a result of vomiting and diarrhea in primary GI disease).

In contrast, for secondary functional disorders, hematology and serum chemistry profile are often critical in reaching a diagnosis.

In Sheba’s case, the problem-based approach has clarified that there are several key questions that need to be answered:

- Are the pale mucous membranes due to anemia or decreased peripheral perfusion? This signals that packed cell volume (PCV) and total protein values should be obtained.
Is the systolic murmur due to cardiac disease or anemia?
Is the melena due to GI ulceration (primary or secondary) or a coagulopathy? This signals that platelet count and rapid assessment of clotting capability (eg, activated clotting time) should be obtained. Coagulation status should be established before any invasive diagnostic procedures (eg, endoscopy) are performed (if needed).

Is the vomiting due to primary or secondary GI disease? Serum chemistry profile and hematology should help identify whether secondary (ie, metabolic) GI disease is present.

For some cases, once the system and its involvement are defined, the location within the system may need to be determined. For all problems, once the system and its involvement are determined, the lesion should be defined (ie, the differential diagnosis list).

In Sheba’s case, the key findings include:
- Significant anemia (PCV, 18%); it should now be determined whether anemia is due to decreased RBC production (ie, bone marrow disease), hemolysis, or hemorrhage.
  - The acute onset of the clinical signs suggest that hemorrhage or hemolysis is more likely than bone marrow failure.
- A total plasma protein level of 7.8 mg/mL, signaling that external hemorrhage from the GI tract was not the sole cause of the anemia. Loss of at least 50% of RBCs through the gut (for the PCV to drop to 18%) would result in a plasma protein in the lower reference range. Thus, the patient has either internal (abdominal) hemorrhage or hemolysis.
- Profound thrombocytopenia (10 × 10^6/mL); it should be determined whether this is due to decreased platelet production (ie, bone marrow disease), platelet consumption (eg, disseminated intravascular coagulation), platelet destruction (eg, immune-mediated disease), or infectious causes. Of note, bleeding alone will reduce platelet numbers but rarely below about 50 × 10^6/mL; thus, melena is likely a result of the thrombocytopenia and not vice versa.

Helpful diagnostic tools would include a full hemogram and blood smear examination to assess RBC, WBC, and platelet morphology; a full coagulation profile; assessment for infectious diseases if in an endemic area; and abdominal imaging to check for abdominal hemorrhage and assess the liver and spleen.

Sheba’s final diagnosis is primary immune-mediated anemia and thrombocytopenia (ie, Evan’s Syndrome). She is treated successfully with corticosteroids and azathioprine.

**Conclusion**
As with all skills, it takes time to develop the knowledge base and mental discipline required for successful logical clinical problem-solving. However, once the logical clinical problem-solving approach is embedded (and, ideally, becomes part of the clinician’s nonanalytic reasoning), it can save time by quickly eliminating extraneous information and helping the clinician focus on the information that is truly important for patients and owners.

**References**
UC-II® reduces inflammation by inducing immune tolerance to help break the cycle of discomfort and inflammation. It has been studied in humans, horses, and dogs as a potential therapy for addressing joint issues.\(^5\)-\(^9\)

The present study shows Flexadin® Advanced is a safe, palatable joint supplement option for cats.

**REFERENCES**

Equitable Access to Veterinary Therapeutics
The World Small Animal Veterinary Association (WSAVA; wsava.org) has launched a campaign to secure equitable access to veterinary therapeutics for veterinarians globally and is forming a Therapeutics Guidelines Group to spearhead the campaign’s efforts. The WSAVA has launched the campaign to address long-standing problems experienced by companion animal veterinarians in some regions of the world by gaining access to the veterinary medicinal products they require to provide a high level of patient care. These inequalities stem from a variety of factors but likely are commonly the result of financial or regulatory issues. Several leading veterinary associations have already signed the WSAVA’s position statement on the issue.

The Therapeutics Guidelines Group will be composed of individuals with global expertise in the area and will work toward goals that include:
- The development of minimum standards for a veterinary hospital pharmacy to ensure it can support a veterinarian’s ability to provide an appropriate standard of care
- Monitoring issues relating to access to veterinary therapeutics and recommending solutions using an evidence-based approach
- Engaging global stakeholders to raise awareness of the issue and build a collaborative approach to resolve the issues—Press Release 3/2018

First Fear Free Certified Veterinary Practice
The Pet Doctor (thepetdoctorinc.com), a veterinary hospital in Missouri, has become the world’s first Fear Free Certified Veterinary Practice. The Pet Doctor has incorporated Fear Free (fearfreepets.com) in all aspects of their practice culture and leadership, including pet owner education, staff training, and facility and patient experience.

Fear Free training and certification has been available to individual veterinary professionals since 2016. The course educates, tests, and certifies pet care providers in reducing and eliminating fear, anxiety, and stress in pets. The certification course was developed with input from a 160-member advisory group, including board-certified veterinary behaviorists, veterinary practice management experts, and other leaders in the field. Before a practice can apply for Fear Free certification, a majority of the veterinary team members must be individually trained and certified, and team-wide familiarity and adoption of Fear Free approaches must be in place. Once a practice applies for certification, a consultant veterinarian from the Ceva Animal Health (ceva.us) veterinary field team conducts an onsite evaluation.—Press Release 4/2018

Campaign to Address Heartworm Preventive Compliance
To address concerns about the decline in consistent use of heartworm preventives in dogs, Merial (merial.com), now a part of Boehringer Ingelheim (boehringer-ingelheim.com), has announced a campaign to help veterinarians and veterinary teams protect their patients from heartworm disease. The campaign team will engage with veterinary practices and pet owners to learn about the challenges they face when starting and/or keeping patients on heartworm preventive for year-round protection. The program will also collect and share best practices with the wider professional community while aiming to inspire pet owners to reverse the recent trends in declining consistent use of heartworm preventive. The first component of the campaign, launched in April, is Take the Paw Pledge, which asks pet owners to pledge to protect their dog against heartworm disease with 12 doses of heartworm preventive.—Press Release 4/2018

New Practice Management Software
Shepherd Software (shepherd.vet) has released Shepherd V1.0, Veterinary Experience Technology (VET), a cloud-based practice-management software. VET requires virtually no training and has been proven to improve hospital flow, increase revenue and efficiency, and eliminate errors. The software houses templates, treatment plans, and automatic discharge instructions and can automatically calculate drug dosages. The new software will also have the capability to roll out user enhancements, additional features, and integrations faster than previous practice-management software.—Press Release 2/2018

SEND INFORMATION FOR PRACTICE HOTLINE TO editor@cliniciansbrief.com
A transtracheal wash is a simple method for collecting samples from the airways for cytologic evaluation. It involves instilling saline into the lower trachea and subsequently retrieving the fluid, with the goal of obtaining cells from the trachea and bronchial tree. These cells can then be viewed microscopically to detect possible airway disease, including inflammation, infection, and neoplasia.

Transtracheal wash is a minimally invasive technique for sampling larger airways (eg, trachea, mainstem bronchi). Although bronchoalveolar lavage is superior in cases of lower airway or interstitial lung disease, transtracheal wash can be performed on patients without anesthesia, offering an advantage over bronchoalveolar lavage.

Transtracheal washes can be grouped into several categories based on the types and proportions of cells identified: suppurative (septic and nonseptic), eosinophilic, hemorrhagic, and neoplastic. Categorizing transtracheal washes can allow clinicians to narrow the list of differential diagnoses.

![FIGURE](image-url) Oropharyngeal contamination resulting from improper sampling technique is a common problem in transtracheal wash cytology. The presence of uniform squamous epithelial cells (black arrow) alongside oral bacterial flora, such as *Simonsiella* spp (red arrow), indicates oropharyngeal contamination. *Simonsiella* spp can be recognized by their pathognomonic morphology that resembles a pill capsule with internal striations (ie, “stacked coin” appearance). *Modified Wright's stain, 600× magnification*
Patient
A canine patient was presented for surgical ablation of an acral lick granuloma overlying the anterior aspect of the left carpus (Figure 1). The client had been dealing with this for about five years, and the lesion was very large, alopecic, firm, erythematous, irregularly shaped, and non-ulcerated. X-rays revealed no arthritic changes, and a biopsy was not performed.

Anesthesia
Appropriate preanesthetic induction followed by general anesthesia was used.

Recommended Laser Equipment and Settings
Aesculight flexible hollow waveguide CO₂ laser with 0.4 mm and 3 mm laser focal spot sizes.
- Resection and debulking: up to 15 watts continuous wave (CW) with 0.4 mm focal spot size is used to excise most of the granulation tissue, ensuring not to remove the entire thickness (Figure 2). Note that wattage may be increased for thicker, more fibrous tissue.
- Ablation/vaporization: Initially vaporize the remaining excess tissue at 30 to 40 watts CW (depending on the thickness of the remaining tissue) with 3 mm focal spot size. Then progressively reduce to 10 to 12 watts (ideally in SuperPulse mode) to increase control of the speed of tissue ablation and remove down to the level of normal dermis.

Technique
The affected area is clipped and aseptically prepped for surgery. It is usually unnecessary to debulk the lesion. In the case shown in Figures 1 to 6, however, the lesion was very large, and it was much quicker to first debulk (Figure 3) and then to vaporize the remainder of granulomatous tissue. Typically, the technique involves vaporizing tissue layer by layer in a tracking linear motion over the entire surface of the lesion. It is imperative to frequently wipe away char or carbonized tissue with saline-soaked sponges. Doing so helps to ensure the optimal delivery of laser energy to the target tissue.

After each pass, the depth of ablation is evaluated in relation to the adjoining healthy dermis. The wattage selected depends on the surgeon’s preference and the thickness of the granulomatous tissue to remove. I normally set wattage very high at first (30 to 40 watts, CW, 3 mm spot size), then progressively decrease it when getting close to completion.

The surgeon may see numerous microabscesses (Figure 3) throughout the granulation tissue, but as one gets close to normal tissue, these should disappear (Figure 4). When the laser procedure is finished, there should be no appreciable thickened tissue upon digital palpation, but there should be dermis covering the subcutaneous tissue. There should be no appreciable bleeding, and the tissue should have a more normal appearance (Figure 4).

Note
This procedure is relatively simple but can be quite time-consuming if the lesion is large and the granulation tissue is thick. The most crucial part of the procedure involves getting a feel for how deep to go or when to stop removing tissue. It is critical not to go beyond the normal dermal margins, or bleeding and delayed healing will occur.

Post-Operative Care
A thick layer of Collasate, then a Telfa pad and bandage are applied. The bandage is changed at least once a week until the surgical site is completely healed. The dog should wear an Elizabethan collar until the lesion heals. The patient is rechecked at each bandage change until complete resolution. Typically, the clinical outcome of CO₂ laser treatment is fairly cosmetic and has some hair regrowth (Figure 6).

Conclusion
A high power CO₂ laser — ideally, the Aesculight’s VetScalpel® VS-4530 system (Figure 7) — gives the surgeon precise control over the amount of tissue to be removed without extensive mechanical or thermal trauma to the healthy surrounding tissues. There is virtually no bleeding intraoperatively, and laser energy effectively kills bacteria at the surgical site, thus reducing the risk of infection.

Surgical laser treatment results in uncomplicated healing and esthetic clinical outcome. It is important to remember that acral lick granulomas are caused by a number of underlying etiological factors, such as behavioral issues, infections, metabolic disease and osteoarthritis. The patient should be monitored for these factors in order to ensure the appropriate support therapy and to avoid possible recurrence of acral lick granuloma.
Preoperative appearance of acral lick granuloma

Most of the excess tissue is debulked with a CO₂ laser.

Intraoperative appearance with the bulk of the acral lick granuloma lesion excised. Several abscesses can be seen (arrows).

Postoperative view of the surgical site. After the entire acral granuloma lesion is excised, the remaining excess tissue is ablated to the level of the dermis. No bleeding is present.

Three weeks after surgery

Thirteen weeks after surgery

Watch CO₂ laser surgery videos at www.Aesculight.com

About the Author:
Dr. Ray Arza earned his DVM at the University of Tennessee in 1979. He was a small animal general practitioner for 23 years with a special interest in surgery and dentistry. Dr. Arza started using a surgical laser in 1998, and soon thereafter became a popular lecturer at conferences, universities, and seminars on laser technologies. In 2002, he left private practice to join industry as an educator, trainer, consultant, and lecturer.

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NexGard can be administered with or without food. Care should be taken that the dog consumes the complete dose, and treated animals should be observed for a few minutes to ensure that part of the dose is not lost or refused. If it is suspected that any of the dose has been lost or if vomiting occurs within two hours of administration, redoze with another full dose. If a dog vomits any of the dose, administer the appropriate combination of NexGard doses to treat the dog.

4 Common Ectoparasite Misconceptions

1. Fleas are only on the dog’s body.
   - Fleas can lay eggs, thus preventing subsequent flea infestations after the start of treatment of existing flea infestations.

2. Fleas can be controlled by treating the entire household.
   - To minimize the likelihood of flea reinfestation, it is important to treat all animals within a household with an approved flea control product.

3. Fleas cannot jump across a threshold.
   - Fleas can jump up to 6 inches, which can disperse them throughout the house.

4. Fleas are only found on certain animals.
   - Fleas can infest any animal, including humans.

Advantage® (imidacloprid-mosquitoxon®) is a treatment for the reduction of adult flea infestations (C. felis). Advantage® is not intended for the treatment or prevention of flea infestations on cats. Only dogs and puppies weighing 4 pounds or greater (at least 8 weeks old) are treated with Advantage®. If the dog is 4 weeks old, a dose is given at 6 weeks of age. If the dog is older than 6 weeks of age, a dose is given at the scheduled time of treatment. If the dog is younger than 6 weeks of age, a dose is given at 6 weeks of age, and a second dose is given 3 weeks later. If the dog is older than 12 weeks of age, a dose is given at the scheduled time of treatment. In the case of a new dog, a dose is given at the scheduled time of treatment. If the dog is older than 12 weeks of age, a dose is given at the scheduled time of treatment. If the dog is younger than 6 weeks of age, a dose is given at 6 weeks of age, and a second dose is given 3 weeks later. If the dog is older than 12 weeks of age, a dose is given at the scheduled time of treatment.
QUIZ CORNER

QUIZ YOURSELF on this issue’s features

1. CONSULT THE EXPERT PAGE 14
   The predictive values of breakpoints for antimicrobials are reliable regardless of the dose regimen (eg, route of administration).
   A. True
   B. False

2. DIAGNOSTIC TREE PAGE 20
   Which of the following palpable pulse alterations would be expected to occur in a patient with early sepsis/SIRS?
   A. Dyssynchronous with tachycardia
   B. Dyssynchronous with bradycardia
   C. Synchronous hyperdynamic pulse
   D. Synchronous hypodynamic pulse

3. COMPARATIVE IMAGERY PAGE 26
   Acanthocytes can be difficult to differentiate from ________.
   A. Echinocytes
   B. Reticulocytes
   C. Schistocytes
   D. Spherocytes

4. THERAPEUTICS SNAPSHOT PAGE 51
   Which of the following effects are seen when cats with chronic kidney disease are administered mirtazapine?
   A. Decreased appetite, decreased weight gain
   B. Increased appetite, decreased weight gain
   C. Decreased appetite, increased weight gain
   D. Increased appetite, increased weight gain

5. PROCEDURES PRO PAGE 57
   Which of the following is not true regarding pectus excavatum in kittens?
   A. It is a convex deformity of the caudal sternum.
   B. It may result in respiratory distress.
   C. It may restrict diastolic filling.
   D. It may result in failure to thrive.

6. CASE ROUTES PAGE 65
   What unique aspect of feline anatomy puts cats at increased risk for cerebral ischemia from use of spring-loaded mouth gags?
   A. The internal carotid artery is functionally absent.
   B. The external carotid artery is functionally absent.
   C. The left common carotid artery is functionally absent.
   D. The right common carotid artery is functionally absent.

7. A MATTER OF OPINION PAGE 71
   ___________reasoning is reflective and systematic, permitting hypothesis formation and abstract reasoning.
   A. Analytic
   B. Nonanalytic
   C. Inductive
   D. Conditional

**This Month’s Question …**

Which immunomodulatory drug do you use most often for treating atopy?
A. Glucocorticoids
B. Cyclosporine
C. Oclacitinib
D. I do not use immunomodulatory drugs to treat dermatologic conditions.

**You Answered …**

If you could add any diagnostic modality to your practice, what would it be?

Endoscopy: 30%
Ultrasonography: 43%
Telemedicine services: 8%
Dental x-ray unit: 19%

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\(^1\)Data on file at Merial.
\(^2\)Data on file at Merial. Based on veterinary dispensed dose data.

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See page 83 for product information summary.