CASE REVIEW: SEVERE ANEMIA & HEART MURMUR IN A CAT

IN THIS ISSUE

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- Anticonvulsants Overview
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- Chronic Weight Loss & Diarrhea in a Dog
- Differential Diagnoses for Monocytosis
Baytril® Otic
(enrofloxacin/silver sulfadiazine) Emulsion

Your go-to for fighting Pseudomonas ear infections

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• Attacks on the inside
• Destroys bacterial DNA
• Effective against Gram (+) cocci and Gram (–) rods

SILVER SULFADIAZINE
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• Breaks down cell walls/membranes
• Effective against Gram (+) cocci, Gram (–) rods and budding yeast

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NON-IRRITATING

Only Baytril® Otic (enrofloxacin/silver sulfadiazine) Emulsion fights Pseudomonas with two mechanisms of action.
Stock Baytril® Otic for your toughest otitis externa cases.

CAUTION: Available only from a licensed veterinarian. Federal law prohibits the extra-label use of this drug in food-producing animals.
PRECAUTIONS: The safe use of Baytril® Otic in dogs used for breeding purposes, during pregnancy, or in lactating bitches has not been evaluated. The use of Baytril® Otic in dogs with perforated tympanic membranes has not been evaluated. Therefore, the integrity of the tympanic membrane should be evaluated before administering this product. If hearing or vestibular dysfunction is noted during the course of treatment, discontinue use of Baytril® Otic.
CONTRAINDICATIONS: Baytril® Otic is contraindicated in dogs with suspected or known hypersensitivity to quinolones and/or sulfonamides.

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Baytril® Otic (enrofloxacin/silver sulfadiazine) Antibacterial-Antimycotic Emulsion

For Otopathic Use in Dogs

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

Federal law prohibits the extralabel use of this drug in food-producing animals.

PRODUCT DESCRIPTION:
Each milliliter of Baytril® Otic contains: enrofloxacin 5 mg (0.5% w/v), silver sulfadiazine (SSD) 10 mg (1.2% w/v), (a benzene sulfoxide) and benzalkonium chloride (BKC) 0.01% w/v. BKC is a neutral oil and purified water emulsion. The active ingredients are delivered via a physiological carrier (a non-irritating emulsion).

CHEMICAL NOMENCLATURE AND STRUCTURE:
Enrofloxacin: 1-cyclopropyl-7-(4-ethyl-1-piperazinyl)-6-fluoro-1,4-dihydro-4-oxo-3-quinolinecarboxylic acid.
Silver sulfadiazine: Benzzenesulfonamide, 4-amino-3,2-pyrimidinylnisulvernose.

ACTIONS:
Enrofloxacin, a 4-fluoroquinolone compound, is bactericidal with activity against a broad spectrum of both Gram negative and Gram positive bacteria. Fluoroquinolones elicit their bactericidal activities through interactions with two intracellular enzymes, DNA gyrase (DNA topoisomerase II) and DNA topoisomerase IV, which are essential for bacterial DNA transcription, synthesis and replication. It is believed that fluoroquinolones actively bind with bacterial DNA/ENZYME complexes and thereby inhibit the essential processes catalyzed by the enzymes (DNA supercoiling and chromosomal decatenation). The ultimate outcome of the fluoroquinolone-intervention is DNA fragmentation and bacterial cell death.

Silver sulfadiazine is a broad-spectrum anti-bacterial and anti-fungal agent. This compound has a wide spectrum of antimicrobial activity against Gram negative and Gram positive bacteria and is also an effective antimycotic. SSD suppresses microbial growth through inhibition of DNA replication and modification of the cell membrane.

INDICATIONS:
Baytril® Otic demonstrated elimination or reduction of clinical signs associated with otitis externa and in vitro activity against cultured organisms. Baytril® Otic is effective when used as a treatment for canine otitis externa associated with or one or more of the following organisms: Malassezia pachydermatis, coagulate-negative Staphylococci spp., Pseudomonas aeruginosa, Enterococcus spp., Proteus mirabilis, Streplococcus spp., Aeromonas hydrophila, Aspergillus spp., Kottulinsia albicans, and Candida albicans.

In vitro assays, such as disk-diffusion and agar-broth-dilution, are used to determine the susceptibilities of microbes to antimicrobial therapies. Results of agar-diffusion assays are reported as a Minimal Inhibitory Concentration (MIC) which represents the lowest antimicrobial concentration, expressed in μg/mL, capable of inhibiting the growth of a pathogenic microorganism. MICs are used in conjunction with pharmacokinetics to predict the in vivo-efficacy of systemically administered antimicrobials. Topical administration of Baytril® Otic to an exudate and debris-free canal, however, will generally result in local antimicrobial concentrations that greatly exceed serum and tissue levels resulting from systemic therapy. Therefore, when using Baytril® Otic as a treatment for canine otitis externa, interpret susceptibility data cautiously.

CONTRAINDICATIONS:
Baytril® Otic is contraindicated in dogs with suspected or known hypersensitivity to quinolones and/or sulfonamides.

ADVERSE REACTIONS:
Baytril® Otic is indicated as a treatment for canine otitis externa complicated by bacterial and fungal organisms susceptible to enrofloxacin and/or silver sulfadiazine (see microbiology section).

EFFECTIVENESS:
Due to its combination of active ingredients, Baytril® Otic provides antimicrobial therapy against bacteria and fungi (which includes yeast) commonly encountered in cases of canine otitis externa.

The effectiveness of Baytril® Otic was evaluated in a controlled, double-blind, multi-site clinical trial. One hundred and sixty-nine dogs (n=169), with naturally occurring active otitis externa participated in the study. The presence of active disease was verified by aural cytology, microbial culture and otoscopic/c clinical scoring. Qualified cases were randomly assigned to either Baytril® Otic treatment (n=113) or a comparable placebo-based regimen (n=56). Treatments were administered twice daily for up to 14 days. Assessment of effectivity was based on continued resolution of clinical signs 3 to 4 days following administration of the last dose.

At study conclusion, Baytril® Otic was found to be a significantly more effective treatment for canine otitis externa than the placebo regimen. Based on the scoring system used to assess treatment response, therapeutic success occurred in 87% of Baytril® Otic-treated infections compared to 14% with placebo (n=4), p<0.001, after 14 days of treatment.

HUMAN WARNINGS:
Not for human use. Keep out of the reach of children. Avoid contact with eyes. In case of contact, immediately flush eyes with copious amounts of water for 15 minutes. In case of dermal contact, wash skin with soap and water. Consult a physician if irritation develops or persists following topical or dermal exposures. Individuals with a history of hypersensitivity to quinolones compounds or antibacterials should avoid handling this product. In humans, there is a risk of user photosensitization within a few hours after excessive exposure to quinolones. If excessive accidental exposure occurs, avoid direct sunlight.

PRECAUTIONS:
The use of Baytril® Otic in dogs with perforated tympanic membranes has not been evaluated. Therefore, sterility of the tympanic membrane should be evaluated prior to administering this product. If hearing or vestibular dysfunction is noted during the course of treatment, discontinue use of Baytril® Otic.

Quinolone-class drugs should be used with caution in animals with known or suspected Central Nervous System (CNS) disorders. In such animals, quinolones have, in rare instances, been associated with CNS stimulation which may lead to convulsive seizures.

Quinolone-class drugs have been associated with cartilage erosions in weightbearing joints and other forms of arthropathy in immature animals of various species.

The safe use of Baytril® Otic in dogs used for breeding purposes, during pregnancy, or in lactating bitches, has not been evaluated.

ADVERSE REACTIONS:
During clinical trials, 2 of 113 (1.7%) dogs exhibited reactions that may have resulted from treatment with Baytril® Otic. Both cases displayed local hypersensitivity responses of the aural epithelium to some component within the Baytril® Otic formulation. The reactions were characterized by acute inflammation of the ear canal and pinna.

For medical emergencies or to report adverse reactions, call 1-800-422-9874. For customer service or to obtain product information, including Material Safety Data Sheet, call 1-800-633-3796.

SAFETY:
General Safety Study:
In a target animal safety study, Baytril® Otic was administered in both ears of 24 clinically normal beagle dogs at either recommended or exaggerated dosages: 10, 30 or 50 drops applied twice daily for 42 consecutive days. A control group of 8 beagle dogs was treated by administering 50 drops of vehicle in one ear twice daily for 42 consecutive days, with the contralateral ear untreated. Erythema was noted in all groups, including both treated and untreated ears in the controls, which resulted following termination of treatment.

Oral Safety Study:
In order to test safety in case of ingestion, Baytril® Otic was administered, twice daily for 14 consecutive days, in one of the buccal mucosa of 5 clinically normal dogs. No adverse local or systemic reactions were reported.

DOSEAGE AND ADMINISTRATION:
Shake well before each use.

Tilt head so that the affected ear is presented in an upward orientation. Administer a sufficient quantity of Baytril® Otic to coat the aural lesions and the external auditory canal. Apply twice daily for a duration of up to 14 days.

STORAGE:
Store between 4° and 25°C (40° - 77°F). Store in an upright position. Do not store in direct sunlight.

SUMMARY:
Summary:

Bayer HealthCare LLC
Animal Health Division
Shawnee Mission, Kansas 66201 U.S.A.

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Who says, “Sharing is Caring?”

A Jack Russell Terrier on ElleVet Complete
Providing small animal practitioners and their teams with practical, relevant information on the latest topics in veterinary medicine
If 2020 was a dog breed, which would it be and why?

“A 120-lb German shepherd dog with uncontrolled atopy and an anal stricture.”—Amy BC

“A pug that is hyperactive, probably cannot breathe, is gassy, almost definitely snores, and is consistently an atopic mess.”—Nicole B

“A 14-year-old chihuahua with bad dental disease, a heart murmur, one eye, and a terrible attitude.”—Joni S

“Not sure the breed, but it would definitely be named Lucky”—Angie S

“Not a dog, but a Bengal cat”—Samantha P

If you had to choose one species to limit your practice to, what would it be?

“Cats; nothing else, just cats”—Claire O

“Dogs under 30 lbs”—Jazmin A

“Bats”—Dana P

“Sea lions”—Jane R

“In my imaginary world, goldfish”—Stefanie G

“Pet rocks”—Cat B

Do you prescribe phenobarbital when the pet owner declines testing of phenobarbital levels?

66% Yes

34% No

Do you use an isoxazoline as first-line treatment of demodectic mange in dogs?

66% Yes

34% No

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INVEST IN YOURSELF AND YOUR STAFF
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- Technicians make great sonographers! Leverage your staff and train 1-3 advanced technicians
- Continue your ultrasound education to maintain an upward learning curve
- Design your ultrasound service to be a profit center for your hospital

PATIENT PREPARATION TIPS
- Patient should be fasted if no medical contraindications
- Encourage the pet owner NOT to let pet urinate within 3 hours of appointment
  - Full or partial bladder is very helpful for examination
- Get pre-approval for: sedation, bicavity exam, sampling, (FNA, biopsy or other ancillary procedures)
  - Sedation minimizes patient stress while maximizing diagnostic value making the exam more pleasurable and efficient for all

DURING THE SCAN
- Obtain complete image sets - every single time, as pathology is often unexpected
  - When repeat scans are needed you risk delayed diagnoses and unhappy clients
- Record “edge to edge” abdominal cine loops rather than still images
  - Video enables full organ evaluation reducing the chance of missing subtle pathology
- Perform FNA or other procedures (as you already have consent)

CONSIDER YOUR EQUIPMENT
- No one wants to miss pathology because of insufficient acoustic power or outdated equipment
- Consider an upgrade if:
  - your unit is 5 years or older
  - you have poor image quality - regardless of the age of your machine
  - you’re not receiving full technical support from your distributor
  - upgrading will improve your confidence, diagnostics, or profitability

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CONTINUING EDUCATION WEBINAR
How a Public Health Emergency Affects Veterinary Prescribing Protocols
This webinar offers guidance on how to handle disaster declarations that impact protocols, best practices for authorizing prescriptions and preventing interruption of drug therapy, and how current drug shortages can impact veterinary medicine. brief.vet/emergency-protocols
JULIE ALLEN, BVMS, MS, MRCVS, DACVIM (SAIM), DACVP, is a former clinical assistant professor of clinical pathology at Cornell University. She earned her veterinary degree from University of Glasgow and her MS from Iowa State University, where she completed a rotating internship in small animal medicine and surgery and a residency in small animal internal medicine. She also completed a residency in clinical pathology at North Carolina State University. Dr. Allen focuses on cachexia/anorexia, endocrinology, and hepatobiliary and pancreatic disease and has committed her career to improving the diagnosis of disease.

Differential Diagnosis Page 21

TODD ARCHER, DVM, MS, DACVIM (SAIM), is an associate professor of small animal internal medicine at Mississippi State University, where he also earned his DVM and MS and completed an internship and residency in small animal internal medicine. Dr. Archer’s clinical interests include endocrinology, hematology, and immunology.

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MICAH A. BISHOP, DVM, PhD, DACVIM (Small Animal), works at WAVE Veterinary Internal Medicine in Naples, Florida. He earned his DVM from Ross University, completed an internship at University of Minnesota, and earned his PhD from Texas A&M University, where he also completed a residency in small animal internal medicine. Dr. Bishop has published multiple manuscripts and abstracts and lectures worldwide.

Case in Point Page 27

KATRIN HARTMANN, DrMedVet, DrHabil, DECVM-CA (Internal Medicine), is a professor of internal medicine and head of the clinic of small animal medicine at LMU of Munich in Germany, where she also earned her veterinary degree and completed her doctoral thesis and habilitation thesis. Dr. Hartmann has authored many articles and book chapters and has lectured at numerous international meetings and congresses. She is a member of the European Advisory Board on Cat Diseases. Her research interest is in infectious diseases in cats and dogs, with a special focus on virus infections in cats.

Consult the Expert Page 12

HEIDI L. BARNES HELLER, DVM, DACVIM (Neurology), is the owner of Barnes Veterinary Specialty Services in Madison, Wisconsin. She earned her DVM from Michigan State University and completed a rotating internship at University of Illinois and a residency in neurology/neurosurgery at University of Florida. Dr. Barnes was previously a staff neurologist outside of Chicago and on faculty at University of Wisconsin–Madison. In 2019, Dr. Barnes founded Barnes Veterinary Specialty Services, a mobile neurology and neurosurgery business providing teleneurology services nationwide.

Consult the Expert Page 61

Continues on page 10
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REGINA HOFMANN-LEHMANN, DrMedVet, FVH, is head of the clinical laboratory and center for clinical studies at University of Zurich in Switzerland, where she also earned her veterinary degree and completed her doctoral thesis. Dr. Hofmann-Lehmann is the principle investigator of many research grants, is the author of many articles and book chapters, and speaks at international scientific meetings. She is president of the Swiss Association of Veterinary Laboratory Diagnostics and a member of the European Advisory Board on Cat Diseases. Her main research interest is in clinical infectiology, with a focus on feline infections.

CONSULT THE EXPERT PAGE 12

LISA M. POHLMAN, DVM, MS, DACVP, is an associate professor and the director of clinical pathology at Kansas State University. She earned her DVM from University of Guelph and her MS in clinical pathology from Auburn University, where she also completed a residency. Dr. Pohlman serves as the president and medical director of the Riley County Humane Society in Manhattan, Kansas, and is an active teacher and mentor of veterinary interns, residents, and graduate students. She enjoys providing CE in clinical pathology through speaking engagements, online courses, and publications. Her research interests include improvement of clinical pathology laboratory methods and identification and characterization of disease in domestic species, particularly in shelter animals, as well as pets owned by individuals who cannot afford routine veterinary care.

CASE IN POINT PAGE 55

MICHAEL SHETTLER, DVM, is a diagnostic imaging specialty intern at Gulf Coast Veterinary Specialists in Houston, Texas. He earned his DVM from Kansas State University, where he also completed a small animal rotating internship, through which he educated 4th-year veterinary students and performed research. His research interests include orthopedic disease in brachycephalic breeds and incomplete ossification of the humeral condyle in dogs.

CASE IN POINT PAGE 55

BINXI WU, DVM, is a first-year clinical pathology resident at University of California, Davis. He earned his DVM from Michigan State University before completing a rotating internship at The Ohio State University and a 1-year clinical pathology internship at Kansas State University. Dr. Wu has also spent 4 years in small animal practice.

CASE IN POINT PAGE 55
No More Double Plating

The Plate Large Enough for Giant Breed Dogs

The new Arthrex 4.5 mm TPLO locking plate was designed after extensive research and includes several key features that make plate placement easier and more consistent. For dogs with severe stifle instability, surgeons have the option to use a knotless anti-rotational lateral stabilization technique (InternalBrace™ ligament augmentation).

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CONSULT THE EXPERT

DIAGONOSING DIFFERENT COURSES OF FELV INFECTION

Katrin Hartmann, DrMedVet, DrHabil, DECVIM-CA (Internal Medicine)
LMU of Munich
Munich, Germany

Regina Hofmann-Lehmann, DrMedVet, FVH
University of Zurich
Zurich, Switzerland
FeLV is a retrovirus that affects cats worldwide. In the United States, FeLV prevalence is ≈2% in healthy cats and ≈30% in high-risk and sick cats. It was originally estimated that FeLV caused at least one-third of all tumor-related deaths in cats; many other cats died of FeLV-associated anemia or infectious diseases as a result of FeLV suppressive effects on bone marrow and the immune system, respectively.
Although prevalence and importance of FeLV as a pathogen in cats have decreased—primarily because of effective testing, eradication programs, and routine use of FeLV vaccines, particularly in high-risk cats—recent studies have suggested a stagnation in this decrease in prevalence in several countries. In a recent study in 30 European countries, FeLV prevalence was still ≈2% in all cats visiting veterinary clinics; therefore, the importance of FeLV and its prevention should not be neglected.

**Exposure & Transmission**

FeLV is transmitted via close contact among cats, particularly in cats that live together or fight, and is commonly transmitted from infected queens to their kittens. Viremic cats (ie, cats that are progressively infected or in the early phase of regressive infection; see **FeLV Infection Courses**) shed the virus mainly in saliva, but the virus can also be found in nasal secretions, milk, urine, and feces. FeLV susceptibility is age-dependent; older cats are more resistant and rarely develop progressive FeLV infection, which is the most severe course.

After exposure, FeLV is found in local lymphoid tissues. FeLV subsequently spreads via monocytes and lymphocytes (first viremia) into the periphery. During the first viremia, the virus can infect the bone marrow. Following bone marrow infection, a second viremia can occur, with FeLV-containing neutrophils and platelets appearing in the blood. Within 1 week of FeLV exposure, plasma viral RNA is usually detectable by reverse transcriptase PCR (RT-PCR), followed by proviral DNA (ie, a DNA copy of viral RNA integrated into the cat’s genome) detectable by PCR (without reverse transcription being necessary) a few days to weeks later, and finally by free (soluble) FeLV p27 antigen (virus core protein), which is detectable by ELISA (or other immunochromatographic or rapid immunomigration assays), usually after 3 to 6 weeks.

Ideally, FeLV status should be determined for every cat because infection can impact health status and requires long-term management. FeLV testing includes evaluation of different viral and immunologic parameters. FeLV diagnosis can be challenging because of variable infection dynamics secondary to interplay between host immune and viral factors. For example, the virus can be reactivated in a cat that has regressive FeLV infection with subsequent viremia; conversely, a cat that has persistent viremia can clear the virus from the blood years later.

**FeLV Infection Courses**

FeLV courses of infection (ie, progressive, regressive, abortive, focal; **Table**) have been characterized in experimental infections, but natural FeLV infection cannot always be clearly stratified into one course. FeLV clinical course is determined by virus and host immune interactions, particularly in the early phase of infection (generally the first 12 weeks). Although the course of infection is typically determined in the early phase, lifelong host immune system and virus interactions can affect and change the course of infection later. In FeLV-infected cats, the equilibrium between host and virus can be altered by several factors (eg, immunosuppression, coinfection, environmental changes) that can influence disease outcome and prognosis.

**Progressive**

Approximately one-third of cats that live in multicat environments with FeLV shedding cats develop persistent viremia and become progressively infected. Progressive infection is characterized by insufficient FeLV-specific immunity. FeLV is not contained during early infection, and extensive viral replication...
## TABLE

### FELV INFECTION COURSES & TEST RESULTS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Progressive Infection</th>
<th>Regressive Infection</th>
<th>Focal Infection (rare)</th>
<th>Abortive Infection</th>
<th>No Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>FeLV infection status &amp; immune response</td>
<td>Persistent viremia</td>
<td>Undetectable or transient viremia</td>
<td>Discordant FeLV results</td>
<td>Virus undetectable</td>
<td>No FeLV infection</td>
</tr>
<tr>
<td></td>
<td>(ineffective immune response)</td>
<td>(effective immune response)</td>
<td>(effective immune response)</td>
<td>(highly effective immune response)</td>
<td>(no immune response)</td>
</tr>
<tr>
<td>Free FeLV p27 antigen in blood (ELISA or immunomigration on blood samples)</td>
<td>Positive (&gt;3-6 weeks after infection)</td>
<td>Always negative or only short-term positive during transient viremia (or positive after reactivation)*</td>
<td>Alternating or low positive</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Intracellular FeLV p27 antigen (IFA on blood smear)</td>
<td>Positive (&gt;3 weeks after free p27 antigen testing)</td>
<td>Always negative or only short-term positive during transient viremia (or positive after reactivation)*</td>
<td>Negative or alternating</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Proviral FeLV DNA (PCR of whole blood)</td>
<td>Positive (&gt;2 weeks after infection)</td>
<td>Positive (&gt;2 weeks after infection)</td>
<td>Negative or low positive</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Anti-FeLV antibodies (different tests on serum or plasma)</td>
<td>Negative (or low titers)</td>
<td>Positive (high titers)</td>
<td>Positive (high titers)</td>
<td>Positive (variable titers)</td>
<td>Negative (possibly positive if vaccinated)</td>
</tr>
<tr>
<td>Replicating virus (virus isolation from blood samples)</td>
<td>Positive</td>
<td>Always negative or only short-term positive during transient viremia (or positive after reactivation)*</td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Viral RNA (RT-PCR of blood samples)</td>
<td>Positive (&gt;1 week after infection)</td>
<td>Usually negative</td>
<td>Usually negative</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Viral shedding</td>
<td>Yes</td>
<td>No (only during transient viremia or after reactivation)</td>
<td>Unlikely</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Consequences</td>
<td>FeLV-associated disease common; poor long-term prognosis</td>
<td>Usually no clinical signs; rarely, FeLV-associated lymphoma or bone marrow suppression can be caused by regressive infection</td>
<td>Unlikely</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Usefulness of vaccination</td>
<td>No</td>
<td>No</td>
<td>Unlikely</td>
<td>Unlikely</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Some regressively infected cats never develop detectable antigenemia or viremia.
occurs in the lymphoid tissues, bone marrow, and mucosal and glandular epithelial tissues.\textsuperscript{23-25} Mucosal and glandular infection is associated with excretion of infectious virus mainly in saliva.\textsuperscript{13-15} Progressively infected cats have shorter survival times and commonly succumb to FeLV-associated diseases.\textsuperscript{6,10,34,39,45,46}

**Regressive**

Approximately one-third of cats that live in multi-cat environments with FeLV shedding cats develop regressive infection.\textsuperscript{41} Although these cats never have (or will eventually clear) viremia, FeLV provirus is integrated into the cat’s genome, resulting in lifelong infection (ie, FeLV provirus carrier state).\textsuperscript{39,47} FeLV proviral DNA can be detected in the blood by PCR.\textsuperscript{28,33} No antigen or culturable virus is present in the blood and the virus is not shed in saliva after these cats have undergone the initial infection phase and their immune system has suppressed the virus\textsuperscript{26,28,33,48}; therefore, these cats are not infectious to other cats except via blood transfusion or if reactivation occurs.\textsuperscript{49,50}

Regressive infection is characterized by an effective immune response and high antibody concentrations, and viral replication is contained prior to or at the time of bone marrow infection.\textsuperscript{26,28,33} Although FeLV is integrated in the cat’s genome, viral shedding does not occur after viral replication is suppressed by the immune system.\textsuperscript{26,28,33,48} Regressive infection can be distinguished from progressive infection by FeLV proviral DNA load and viral load in the blood, both of which decrease after an initial peak.\textsuperscript{26,28,31} FeLV replication in cats with regressive infection can be reactivated and viremia can reoccur, particularly during immunosuppression, at which point cats become antigen-positive, shed virus, and can develop FeLV-associated diseases.\textsuperscript{39,40,51} The risk for reactivation of viremia decreases with time\textsuperscript{28,51-55}; however, integrated provirus maintains its replication capacity, and reactivation is possible years (possibly lifelong) after initial exposure to FeLV.\textsuperscript{39,40} In some cats, regressive infection can cause clinical problems (eg, lymphoma, bone marrow suppression).\textsuperscript{56,57} In cats with regressive infection, vaccination is ineffectual because these cats have already developed a strong anti-FeLV immune response and reactivation is not prevented by vaccination.\textsuperscript{23,34,29,33,58}

**Focal**

Focal infection (ie, atypical infection) is considered very rare and occurs in cats that have FeLV infection restricted to certain tissue (eg, spleen, lymph nodes, small intestine, mammary glands).\textsuperscript{6,17,41,55,59} These cats frequently have discordant and varying FeLV test results.\textsuperscript{60,61} They do not shed the virus in saliva but can still transmit infection under certain circumstances; for example, a queen with focal FeLV infection of the mammary glands can transmit FeLV to her kittens via milk.\textsuperscript{17}

**Abortive**

Approximately one-third of cats that live in multi-cat environments with FeLV shedding cats develop abortive infection characterized by low-grade infection and immunity.\textsuperscript{19,33,34,62} In these cats, direct virus detection methods produce negative results, and the only sign of FeLV exposure is the presence of FeLV-specific antibodies.\textsuperscript{62} Abortive infection is characterized by a strong immune response to the virus.\textsuperscript{34} Cats test negative for culturable virus, antigen, viral RNA, and proviral DNA but have FeLV-specific antibodies.\textsuperscript{62} Cats with abortive infections do not shed infectious virus and do not develop clinical signs.\textsuperscript{19,33,34,62}

**Diagnosis**

Diagnosing FeLV can be difficult because of the different courses of infection. In addition, interaction between the virus and immune system can change over time depending on various factors (eg, age, immune function, infectious pressure, pathogenicity of the virus strain, genetic variability of the virus over time).\textsuperscript{41,42} The European Advisory Board of Cat Diseases (ABCD) has created a diagnostic
algorithm (the ABCD FeLV diagnostic tree; **Figure**) outlining the diagnostic steps for FeLV.

Although FeLV infection tests can detect presence of the virus (eg, FeLV antigen, FeLV DNA) or antibodies, they cannot be used to diagnose lymphoma or leukemia (ie, forms of leukosis) and should not be called *leukosis tests*. These tests cannot determine whether a cat has FeLV-associated disease because clinical signs in FeLV-infected cats can be secondary or completely unrelated to FeLV.35

Most available tests detect the virus directly, with the exception of recently introduced antibody tests (ie, indirect detection method).63 Direct FeLV infection tests are not influenced by maternal antibodies, so kittens (including neonates) can be tested at any age. FeLV vaccinations do not cause a positive result in direct FeLV tests.29,34 Tests can vary in diagnostic value, particularly point-of-care tests (POCTs) performed in-house, and results should be confirmed by other methods or by repeating the POCT, ideally from a different brand (see **Figure** and *When to Immediately Repeat an FeLV Point-of-Care Test*, next page).6,65-71

**Diagnostic Tests**

**ELISAs & Immunomigration**

Assays to Detect Free FeLV Antigen

ELISAs and other immunochromatographic or rapid immunomigration assays that detect free (soluble) FeLV p27 antigen in blood are available as POCTs or laboratory tests (usually plate ELISAs).65-72 POCTs generally have a good overall performance with only slightly varying diagnostic sensitivities and specificities. Laboratory tests that detect FeLV p27
antigen have similar sensitivities and specificities as compared with POCTs, but some also quantify the antigen load.\textsuperscript{65,70} POCTs based on ELISA should be performed with serum or plasma, not whole blood. POCTs and laboratory tests for detection of free FeLV p27 antigen in blood should not be used with saliva because false-negative results are possible.\textsuperscript{71-75} Antigenemia is present if test results are positive; antigenemia is generally a measure for viremia and, if persistent, is diagnostic for progressive infection. False-positive results have become more common because of decreased FeLV prevalence in many countries. Negative results are reliable because of low FeLV prevalence in most populations.\textsuperscript{12,70,76} In the early phase of infection (within the first 3 weeks), antigen tests are commonly not yet positive.\textsuperscript{30}

Immunofluorescence Assays to Detect Intracellular FeLV Antigen

Immunofluorescence assays (IFAs) detect intracellular p27 antigen on blood smears (in neutrophils and platelets) and provide positive results later (typically, \( \approx 3 \) weeks later) than tests for free p27 antigen because intracellular FeLV p27 antigen can only be detected by IFAs in infected neutrophils and platelets after bone marrow becomes infected.\textsuperscript{76-78} IFAs are therefore not recommended as screening tests because cats in the first weeks of viremia already shed FeLV. False-negative IFA results can occur, mainly in cats with neutropenia and thrombocytopenia. False-positive results can occur as a result of nonspecific staining, smears of inappropriate thickness, high background fluorescence, or interference when using anticoagulated blood.\textsuperscript{79,80} IFAs require special processing, fluorescence microscopy, and highly experienced staff; thus, only results from experienced reference laboratories should be interpreted.\textsuperscript{77}

Virus Isolation to Detect Replicating Virus

Virus isolation detects replicating virus in blood and requires culture of virus in feline cell lines.\textsuperscript{81} This is a sensitive test that can be used to detect FeLV infection during primary viremia; therefore, results can be positive early postinfection, even before tests for free p27 antigen. However, virus isolation is not practical for routine diagnosis because it is difficult and time-consuming to perform and requires special facilities; thus, it is not recommended as a screening test but can be used for confirmation of positive FeLV p27 antigen test results.

PCR to Detect Proviral DNA

PCR detects proviral DNA (FeLV provirus) in blood that are viral nucleic acid sequences integrated in the cellular genome of cats.\textsuperscript{28,31,82,83} Diagnostic values can vary because PCR methods are not standardized; only laboratories with adequate quality control should be used. PCR is generally a sensitive method because it amplifies FeLV sequences and can detect small amounts of DNA; it is also highly specific, which can lead to false-negative results, when minor variations in the viral genome prevent binding of the primers. Primers should therefore target highly conserved regions of the FeLV genome. PCR can also be performed on bone marrow or tissue instead of blood\textsuperscript{25,28,31,39,67,82} and can help resolve cases with discordant p27 antigen test results. It is the recommended confirmatory test for positive p27 antigen test results and the test of choice to detect regressive

WHEN TO IMMEDIATELY REPEAT AN FELV POINT-OF-CARE TEST

If a positive result:
- Is found in cats from areas with low prevalence of FeLV infection
- Is found in low-risk cats
- Would lead to euthanasia (eg, shelter situation)

If a negative result:
- Is found in a high-risk cat
- Is found in a cat that recently traveled from a high-risk area or country

IFA = immunofluorescence assay
POCT = point-of-care test
RT-PCR = reverse transcriptase PCR
infection (positive PCR in combination with negative p27 antigen test).28,29

RT-PCR to Detect FeLV RNA
RT-PCR detects viral RNA in blood and saliva. Viral RNA can be detected during viral replication; therefore, RT-PCR detecting viral RNA does not provide the same information as PCR detecting FeLV provirus (DNA).18,29 RT-PCR is highly specific and sensitive but has the same methodologic advantages and disadvantages as PCR14,15,43 and, therefore, should only be performed in specialized laboratories. RT-PCR performed on blood or saliva has different clinical significance. Positive RT-PCR in saliva indicates FeLV shedding, whereas strong positive RT-PCR in blood indicates viremia and progressive (or early regressive) infection, although low positive RT-PCR in blood also can occur in regressively infected cats and then serve as an indicator of future reactivation.34 When performed on blood, RT-PCR is helpful in detecting FeLV infection in the early phase because it provides positive results earlier than do tests for free p27 antigen.14,15,18,29 When performed on saliva, RT-PCR is a reliable indicator of antigenemia.15 The presence of FeLV-shedding cats living in a multicat environment can be ruled out when testing saliva (swabs), for which saliva samples from up to 10 cats can be pooled in the laboratory.14

Tests to Detect FeLV Antibodies
The presence of FeLV antibodies in serum indicates previous exposure to the virus (or certain FeLV vaccines). FeLV antibody tests are positive in cats with regressive or abortive infection. These are the only tests that can identify abortive infection.62,63 Determination of antibodies can also be used to quantify the immune response in cats with FeLV infection.28,34,50,63 Antibody tests are not currently routinely used and are only performed in specialized laboratories, but they could be of future importance. A new POCT that detects antibodies against p15E antigen (ie, envelope transmembrane protein) has recently been commercialized in Europe; however, its diagnostic value has yet to be evaluated.

Conclusion
FeLV is an important infection still affecting many cats worldwide. Courses of infections differ among individual cats and can vary over time. The complex pathogenesis, variety in outcome, and availability of different tests make FeLV infection complicated and a challenge for clinicians.

References

References continue on page 68.
When treating four-legged patients, make each moment matter.

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**Monocytosis**

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

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Following are differential diagnoses for patients presented with monocytosis.*

- Chronic neutropenia
- Granulocyte colony-stimulating factor administration
- Increased endogenous or exogenous corticosteroids (especially in dogs)
- Inflammation (eg, infectious vs noninfectious, acute vs chronic)
- Monocytic or monoblastic leukemia (very rare)
- Necrosis and/or tissue destruction (eg, from coccidioidomycosis or immune-mediated hemolytic anemia)
- Paraneoplastic response with various tumors (associated with poor prognosis)
  - Lymphoma (ie, increased monocyte chemotactic protein; possible secretion of granulocyte-macrophage colony-stimulating factor)
  - Osteosarcoma
- Recovery from acute bone marrow injury
  - Secondary to administration of a chemotherapeutic agent
  - Secondary to parvovirus infection (rare)

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**References**


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*Monocytopenia is not recognized as a clinically significant problem.*
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Reproductive Diseases in Birds

Reproductive disease is common in captive birds. Although most wild psittacine birds have a breeding season, captive birds can breed at any time due to environmental manipulation of factors such as photoperiod and light spectrum. Egg-related peritonitis is more common in captive birds because of abnormal reproductive hormonal activity that can occur in captive settings; signs include dyspnea, depression, anorexia, shock, and acute death. Mild cases may respond to antibiotics, anti-inflammatory drugs, and ovulation-inhibiting drugs, but severe cases often require surgery, and prognosis is guarded to poor. Chronic egg-laying is metabolically taxing and can lead to egg-yolk stroke, sterile or septic egg yolk peritonitis, or hypocalcemia and subsequent dystocia (ie, mechanical obstruction of the egg in the caudal reproductive tract); the latter is common and may result in cloacal impaction or prolapse. Etiologies for dystocia include nutrition deficiency, excessive egg production, oversized eggs, age, obesity, out-of-season breeding, and genetics, among others. Treatment is aimed at correcting the underlying abnormality (eg, hypocalcemia) if possible. If no obstruction is present, prostaglandin F₂α may be applied to the cloacal mucosa. Digital manipulation, ovocentesis, or ventral laparotomy may be attempted when medical intervention is unsuccessful.

Deslorelin acetate, a GnRH agonist, is effective at reducing or stopping egg production for 6 months to 1 year in hens and decreasing testosterone production for up to 3 months in cocks. Deslorelin acetate may also be used successfully for management of nonresectable ovarian neoplasia in cockatiels and Sertoli cell tumors in budgerigars. Leuprolide acetate is used to control malignant ovarian neoplasia and macro-orchidism and to manage chronic egg layers.—Barron HW

Lipomas, Liposarcomas, & Atypical Fatty Tumors

Lipomas are generally soft, slow-growing masses on dogs; fine-needle aspirates of these tumors typically leave an oily substance on the slide that mostly disappears during the fixative process. All suspected typical lipomas should be aspirated at least once and then mapped in the medical record with measurements, as other tumors (eg, mast cell tumors, myxosarcomas) may mimic lipomas in appearance, location, and feel. Surgery should be considered if tumor site and size impede normal function, if the mass troubles the patient or pet owner, or if the mass grows rapidly. Large lipomas can have a large blood supply; removal should occur before the lipoma gets too large, and blood products should ideally be kept available during surgery. An atypical form of lipoma can also grow intramuscularly; these tumors are fixed on palpation and, although benign, can cause lameness. Infiltrative lipomas are locally aggressively, as can be seen on CT, on MRI, or during surgery, but cannot be differentiated from benign lipomas by cytology. Incomplete excision often results in regrowth with increased and more rapid recurrence; adjuvant radiation can help local control.

Liposarcomas do not arise from previously benign lipomas. These palpate as firm, poorly defined masses, and they can occur anywhere in the body. Differentiation between lipomas and liposarcomas can be seen on fine-needle aspirates; malignant mesenchymal cells are seen with liposarcomas. Liposarcomas are locally invasive and generally metastasize slowly, typically to liver, lungs, and bone. Treatment involves wide excisional surgery and adjuvant radiation.—Erhart N
Because of its light weight, bubble wrap is particularly useful in keeping anesthetized rabbits warm.


Rabbits have an increased anesthetic risk as compared with other small mammals; thus, elective procedures should be carefully planned. Many anesthetic considerations are the same across species. Baseline preanesthetic blood work should be checked whenever possible.

IV catheterization can be achieved in rabbits with proper restraint or mild sedation; the marginal ear, cephalic vein, and saphenous vein are good candidates. Intraosseous (IO) catheterization, using the proximal tibia at the tibial crest or the proximal femur at the greater trochanter, is another good option; this is more easily achieved in emergencies. A microneonatal IO needle, spinal needle, or 22- to 20-gauge hypodermic needle can be used. Anesthetic induction via mask or boxing down is discouraged; IM or SC sedation is preferred if an IV or IO route is unavailable. Opioids, midazolam, dexmedetomidine, and alfalfalone can be used in various combinations. Local anesthesia with lidocaine or bupivacaine can also be used, as in other small animals. There is a current paradigm shift in the literature regarding intraoperative IV fluid rates in small animals, including rabbits, that suggests lower administration rates of only 2 to 5 mL/kg/hour.

Blind endotracheal intubation in rabbits requires practiced skill. If intubation is not possible, a modified tube that covers only the supraglottic region can be used; alternatively, a forced mask ventilation technique with a premanufactured or, if necessary, homemade mask can be used.

Anesthetic monitoring should be performed as is done in cats and dogs, with attention paid to maintaining normothermia; because of its light weight, bubble wrap is particularly useful in keeping anesthetized rabbits warm. Blood pressure can be difficult to maintain in this species.—Cital S
Feeding vessels open into this stroma. Mesenchymal tumor cells are generally spindle-shaped and arranged diffusely in sheets with no stroma; feeding vessels open directly between the tumor cells. Malignancy is then determined based on differentiation, growth rate and pattern, and metastasis. Benign tumors are well-differentiated and slow-growing, with expansile growth with encapsulation; they do not metastasize. Malignant tumors demonstrate tumor necrosis, high cellularity, and nuclear changes.

One stained slide should be evaluated to ensure proper cellularity and origin prior to submission to a pathologist.

This is especially important with intracavitary samples obtained with image guidance. If the cytologic description or diagnosis does not match the tentative clinical diagnosis, a pathologist should be consulted or the procedure should be repeated. With histology reports, the nomenclature and cell type should be reviewed, as some related neoplasms can have considerably different prognoses. Soft tissue sarcomas and carcinomas with higher grades are more aggressive and likely to metastasize. A higher mitotic index suggests a higher histologic grade. Poor prognosis is also associated with a higher level of tumor necrosis. A variety of factors affect the accuracy and evaluation of surgical margins; as such, false negative results may be possible.—Dhaliwal RS

References
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Chronic Weight Loss & Diarrhea in a Dog

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WAVE Veterinary Internal Medicine
Naples, Florida

Clinical History & Signalment
Trixie, a 2-year-old, 44-lb (20-kg) spayed German shepherd crossbreed, was presented for an ≈3-month history of chronic, marked weight loss and small bowel diarrhea. Stool was voluminous, pale in color, and soft and unformed in consistency. Her owner reported that Trixie had a good appetite and appeared to be healthy otherwise. Trial treatment with a hypoallergenic and novel protein diet for 3 weeks did not ameliorate the diarrhea or weight loss.

Physical Examination
On physical examination, Trixie was bright, alert, and responsive. Vital signs were within normal limits. Her BCS was 2/9 and she had marked muscle wasting (Figure, next page). Abdominal palpation was normal, and soft, yellow feces was detected during rectal examination; flatulence was also noted. The rest of the examination was within normal limits.

Diagnosis
Differential diagnoses included intestinal parasitism, chronic enteropathy (eg, food-responsive enteropathy, antibiotic-responsive enteropathy, immunosuppressant-responsive enteropathy), protein-losing enteropathy, juvenile neoplasia, chronic intussusception, chronic foreign body, hypoadrenocorticism (ie, Addison’s disease), chronic kidney disease, chronic liver disease, and infection with Pythium spp, which is endemic in Florida.1 CBC, serum chemistry profile, and urinalysis results were within normal limits. Fecal flotation results were negative.

Because of Trixie’s dramatic weight loss, abdominal radiography and ultrasonography were completed on the day of presentation. Radiographs were unremarkable but revealed mild loss of serosal detail, presumably secondary to patient emaciation. Ultrasound images revealed no mural thickening, abdominal mass, lymphadenopathy, or other abnormality. Adrenal glands were slightly decreased in size.

After Trixie was fasted for 12 hours, serum cobalamin (ie, vitamin B₁₂), folate, canine trypsin-like
immunoreactivity (cTLI), and baseline cortisol levels were obtained (Table). The results demonstrated a decreased cTLI, which was diagnostic for exocrine pancreatic insufficiency. Cobalamin was also decreased, which was consistent with ileal pathology. Baseline cortisol was increased, ruling out hypoadrenocorticism.2

**DIAGNOSIS:** EXOCRINE PANCREATIC INSUFFICIENCY

**Treatment & Long-Term Management**

Trixie was initially started on pancreatic enzyme replacement powder at 1 tsp/22 lb (10 kg) of body weight mixed with food.3 She was also given 1 cyanocobalamin tablet daily (1 mg PO every 24 hours is recommended for dogs weighing >44 lb [20 kg]).4 Her owner was instructed to closely monitor Trixie’s stool for improvement in consistency, frequency, and volume and to return to the clinic every 2 weeks for assessment and monitoring for weight gain. Lifelong treatment with enzyme replacement therapy and cyanocobalamin is recommended for exocrine pancreatic insufficiency. Trixie was also empirically dewormed with fenbendazole (50 mg/kg/day for 5 days).5

**Prognosis & Outcome**

Trixie was returned for a recheck examination 2 weeks after presentation. She was rapidly gaining weight, and her stool had improved in quality but was still soft; however, she had also started periodically vomiting daily. Tylosin (25 mg/kg every 12 hours) was given because of her history of low cobalamin in conjunction with the high prevalence of dysbiosis and antibiotic-responsive enteropathy (formerly called small intestinal bacterial overgrowth) associated with exocrine pancreatic insufficiency (EPI).6,7 Dysbiosis was most likely associated with changes in motility, lack of bacteriostatic pancreatic juices, and altered immune function.8 At the next recheck examination, the owner reported that Trixie was thought to be completely back to normal (ie, prior to the development of clinical signs). There were no GI

**TABLE**

**GI PANEL RESULTS**

<table>
<thead>
<tr>
<th>Assay</th>
<th>Result</th>
<th>Reference interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>cTLI</td>
<td>1.5 µg/L</td>
<td>5.7-45.2 µg/L</td>
</tr>
<tr>
<td>Cobalamin</td>
<td>150 ng/L</td>
<td>251-908 ng/L</td>
</tr>
<tr>
<td>Folate</td>
<td>12.8 µg/L</td>
<td>9.7-21.6 µg/L</td>
</tr>
<tr>
<td>Cortisol</td>
<td>7 µg/dL</td>
<td>2-6 µg/dL</td>
</tr>
</tbody>
</table>
signs, her BCS was 4/9 and expected to continue to improve, and her weight had increased to 57 lb (26 kg). Over the next few months, her BCS returned to normal (ie, 5/9) and her weight increased to 66 lb (30 kg); pancreatic enzyme replacement therapy was tapered to a lower dose. Tylosin was stopped without recurrence of signs ≈6 weeks after diagnosis. Cobalamin supplementation was continued, and Trixie was transitioned to a primary care veterinarian.

**TREATMENT AT A GLANCE**

- Pancreatic enzyme replacement therapy is the treatment of choice. The dose can typically be tapered over time. These enzyme replacement powders typically contain lipase, amylase, and other proteases.

- Oral cobalamin supplementation can be as effective as parenteral administration, but oral supplementation has not been studied exclusively in EPI patients. In the author’s experience, the supraphysiologic dose of cobalamin has been sufficient for these patients; however, serum cobalamin concentration levels should be rechecked, especially if there is a lack of response to treatment.

- Antibiotic-responsive enteropathy (ie, dysbiosis, small intestinal bacterial overgrowth) is a common complication and may result in partial response to treatment.

- Treatment with enzyme replacement is lifelong and expensive. Enteric-coated tablets may be a less expensive alternative, as would be fresh, raw pancreas. Uncoated enzymes can cause gingival bleeding, but this usually can be eliminated by decreasing the dose or administering tablets.

- Dietary change is generally not necessary; however, some dogs—especially those with poor response to treatment—may benefit from highly digestible hypoallergenic diets or low-fat diets.

- Eighty percent of dogs respond favorably to therapy, and long-term prognosis is good.

**TAKE HOME MESSAGES**

- Although marked weight loss with chronic small-bowel diarrhea and flatulence is a common clinical sign of EPI, it is beneficial to rule out EPI in any patient with weight loss regardless of GI signs.

- cTLI is a highly sensitive and specific test for EPI that should always be done on a fasted blood sample.

- Previous administration of pancreatic enzymes does not interfere with cTLI testing.

- Cobalamin and folate derangements are common secondary findings that should be addressed. In a study, low cobalamin was associated with decreased survival. Eighty-two percent of dogs with EPI have decreased serum cobalamin concentrations; however, there is some disagreement as to what the cutoff reference interval should be and whether serum methylmalonic acid concentration should instead be assessed, as this may indicate earlier deficiency.

- Laboratory findings, radiography, and ultrasonography can be used to rule out common differential diagnoses.

- German shepherd dogs and rough-coated collies are predisposed to EPI, likely due to an autosomal-recessive inheritance pattern.

**Eighty-two percent of dogs with EPI have decreased serum cobalamin concentrations.**

cTLI = canine trypsin-like immunoreactivity
EPI = exocrine pancreatic insufficiency

See page 69 for references.
Two reasons to recheck.

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INDICATION: OSURNIA is indicated for the treatment of otitis externa in dogs associated with susceptible strains of bacteria (Staphylococcus poudrii/intermedius) and yeast (Malassezia pachydermatis).

DOSAGE AND ADMINISTRATION: OSURNIA should be administered in the clinic. Clean and dry the external ear canal before administering the initial dose of the product. Administer one dose (1 tube) per affected ear(s) and repeat administration in 7 days. Do not clean the ear canal for 45 days after the initial administration to allow contact of the gel with the ear canal. Cleaning the ear may affect product effectiveness (see Effectiveness in the product insert). If alternative otic therapies are required it is recommended to clean the ear(s) before administration. Open tube by twisting the soft tip. Insert the flexible tip into the affected external ear canal(s) and squeeze entire tube contents into the external ear canal(s). After application, gently massage the base of the ear to allow the gel to penetrate to the lower part of the ear canal.

CONTRAINDICATIONS: Do not use in dogs with known tympanic perforation (see Precautions in the product insert). Do not use in dogs with a hypersensitivity to florfenicol, terbinafine, or corticosteroids.

WARNINGS: Not for use in humans. Keep this and all medications out of reach of children. Consult a physician in case of accidental ingestion by humans. In case of accidental skin contact, wash area thoroughly with water. Avoid contact to the eyes.

PRECAUTIONS: Do not administer orally. The use of OSURNIA in dogs with perforated tympanic membranes has not been evaluated. The integrity of the tympanic membrane should be confirmed before administering this product. Reevaluate the dog if hearing loss or signs of vestibular dysfunction are observed during treatment. Use of topical otic corticosteroids has been associated with adrenocortical suppression and iatrogenic hyperadrenocorticism in dogs (see Animal Safety in the product insert). Use with caution in dogs with impaired hepatic function (see Animal Safety and Adverse Reactions in the product insert). The safe use of OSURNIA in dogs used for breeding purposes, during pregnancy, or in lactating bitches, has not been evaluated.

ADVERSE REACTIONS: The following adverse reactions were reported during the course of treatment for otitis externa in dogs treated with OSURNIA with 1 tube per affected ear(s) and repeated after 7 days. The following adverse events are listed in decreasing order: elevated alkaline phosphatase, vomiting, elevated AST, ALT, ALP, weight loss (>10% body weight), and hearing decrease/loss. To report suspected adverse events, for technical assistance or to obtain a copy of the SDS, contact Dechra Veterinary Products at (866) 933-2472. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at http://www.fda.gov/AnimalVeterinary/SafetyHealth.

EFFECTIVENESS: Effectiveness was evaluated in 235 dogs with otitis externa. The study was a double-masked field study with a placebo control (vehicle without the active ingredients). One hundred and fifty-nine dogs were treated with OSURNIA and seventy-six dogs were treated with the placebo control. All dogs were evaluated for safety. Treatment (1 mL) was administered to the affected ear(s) and repeated 7 days later. Prior to the first administration, the ear(s) were cleaned with saline but not prior to the Day 7 administration. Six clinical signs associated with otitis externa were evaluated: pain, erythema, exudate, swelling, odor and ulceration. Total clinical scores were assigned for a dog based on the severity of each clinical sign on Days 0, 7, 14, 30 and 45. Success was determined by clinical improvement at Day 45. The success rates of the two groups were significantly different (p=0.0094). 64.78% of dogs administered OSURNIA were successfully treated, compared to 43.42% of the dogs in the placebo control group.

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Canine hyperadrenocorticism (HAC) is a common endocrine disease that can be successfully managed with trilostane. Trilostane therapy for canine HAC should only be initiated in patients with compatible clinical signs and not solely based on HAC-associated laboratory abnormalities.

Following are the top 5 indicators to monitor in canine HAC patients receiving trilostane therapy according to the author.

1. **Resolution of Clinical Signs**
   In addition to the classic signs of canine HAC (ie, polyuria, polydipsia, polyphagia, panting, alopecia, pot-bellied appearance), other less obvious clinical signs that detract from quality of life may include lethargy, muscle wasting, and weakness. At diagnosis, all clinical signs affecting the patient should be identified and their severity quantified. This can be achieved via a standardized questionnaire with numeric or other scale-based measures (eg, mild, moderate, severe) that is completed by the pet owner and

### TOP 5 TRILOSTANE MONITORING TIPS

1. Resolution of Clinical Signs
2. Signs of Oversuppression or Addisonian Crisis
3. Cortisol Levels
4. Serum Electrolytes
5. Signs Consistent with Macroadenoma Syndrome
confirmed by the clinician after evaluation. After initiation of trilostane treatment, the same questionnaire should be completed at each recheck to gauge resolution of clinical signs and identify any signs of potential adrenal oversuppression.

Owners often notice an improvement in polyuria and polydipsia and increased activity or energy after 1 to 2 weeks of therapy, although complete resolution of signs may require ≥1 month. Resolution of panting and polyphagia can be variable and may never be completely achieved. Owners should be informed that dermatologic signs may take 3 to 6 months to resolve.

Control of clinical signs should be assessed and the dosage adjusted if indicated.

2 Signs of Oversuppression or Addisonian Crisis

Transient oversuppression of the adrenal axis involves temporary excessive steroidogenic enzyme inhibition, in which, decreasing the trilostane dose or ceasing trilostane therapy typically results in adrenal axis recovery. Although generally transient, cortisol production may be suppressed long-term (eg, weeks to years3) in some patients; thus, ensuring recovery of the adrenal axis (eg, resolution of clinical signs, rebound of resting cortisol and/or adrenocorticotropic hormone [ACTH] stimulation levels) prior to resuming trilostane therapy is critical. Complete adrenal necrosis is an infrequent but potentially life-threatening complication of trilostane therapy that may result in acute hypoadrenocortical crisis (ie, Addisonian crisis), thus requiring emergency stabilization with prolonged or permanent glucocorticoid and mineralocorticoid supplementation.

Owners should be counseled about signs of adrenal axis oversuppression and/or onset of Addisonian crisis; however, some dogs receiving trilostane therapy may display transient, mild, self-limiting drug effects at the onset of therapy may be difficult. Owners should be advised to monitor for GI signs (eg, vomiting, diarrhea, anorexia), lethargy, collapse, and any other non-specific clinical signs. If signs are observed, trilostane therapy should be stopped and dexamethasone (0.15 mg/kg PO) administered; dexamethasone should be dispensed prior to initiation of trilostane therapy. Owners should then seek immediate veterinary care, at which time physical examination, a minimum database (eg, CBC, serum chemistry profile, urinalysis), cortisol testing (ie, resting cortisol/ACTH stimulation test), and supportive care are indicated.

The estimated cumulative incidence of hypoadrenocorticism in a study of trilostane-treated dogs was 15% by 2 years and 26% by 4.3 years.3 Of the dogs that developed hypoadrenocorticism, 74% were transient in nature and 26% were permanent.

3 Cortisol Levels

Cortisol testing is necessary during trilostane therapy to determine whether therapy can be safely continued or if a dose increase can be safely done, depending on the assessment of the patient. Cortisol testing should not be used to determine whether the patient is clinically well-controlled; rather, clinical signs should be assessed. Cortisol testing is recommended 10 to 14 days after initiation of trilostane therapy, after any dose alteration, and 1 month, 3 months, and every 3 to 6 months after a dose has been established.

Resolution of panting and polyphagia can be variable and may never be completely achieved.
ACTH stimulation testing is recommended 4 to 6 hours after trilostane administration. Owners should be advised to administer the morning trilostane dose with food each day, including the day of the recheck examination. The author, based on anecdotal experience, considers a post-ACTH stimulation level >1.6 µg/dL to indicate safe continuation of therapy in a clinically well-controlled dog showing no signs of illness, whereas the package insert for trilostane recommends a threshold of ≥1.45 µg/dL.

In clinically well-controlled patients that show no signs of illness but for which ACTH stimulation testing shows oversuppression of the adrenal axis (post-ACTH cortisol level <1.6 µg/dL), trilostane may be stopped, the dosage decreased, or an ACTH stimulation test performed later in the administration interval (often ≈9 hours post-administration). In some patients, cortisol levels may increase later in the administration interval and demonstrate recovery of the adrenal axis, indicating a suitable dosage. If signs are undercontrolled and persistent and if an ACTH stimulation test excludes oversuppression, the dose or frequency (eg, daily dose divided into 2 doses) may be increased. In sick patients with low cortisol levels following ACTH stimulation testing, trilostane therapy should be stopped and supportive care administered as needed.

An alternative to ACTH stimulation testing is measurement of cortisol at the end of the administration interval, just prior to trilostane administration (ie, “prepill” cortisol; see Analyzing Prepill Cortisol Levels). ACTH stimulation testing is still recommended in sick dogs that show signs of oversuppression, and prepill cortisol is most useful in clinically well-controlled dogs in which oversuppression of cortisol is not suspected.

Serum Electrolytes
Monitoring serum electrolytes is recommended during therapy. Trilostane inhibits 3β-hydroxysteroid dehydrogenase, which inhibits the production of cortisol and, to a lesser extent, mineralocorticoids (eg, aldosterone). The electrolyte levels (specifically sodium and potassium) of patients receiving trilostane therapy often remain within the normal reference range; however, sodium may decrease slightly, and potassium may increase slightly as compared with baseline values at diagnosis. Electrolytes should be assessed at recheck examinations when cortisol testing is being conducted and especially after every dose alteration. Monitoring of electrolytes is particularly crucial when trilostane is concurrently administered with medications that interfere with aldosterone production (eg, potassium-sparing diuretics, ACE inhibitors, angiotensin-receptor blockers [eg, telmisartan]) because the additive inhibitory effects on aldosterone can increase the risk for electrolyte derangements.

Signs Consistent with Macroadenoma Syndrome
Macroadenoma syndrome develops in dogs with pituitary-dependent HAC when the pituitary tumor begins to grow and applies pressure to surrounding structures in the brain.
Neurologic signs associated with macroadenoma syndrome occur in ≈10% to 30% of dogs with pituitary-dependent HAC, with most cases showing signs after initiation of therapy. The most common signs are behavior changes (eg, dullness, restlessness, loss of interest in normal activities, disorientation, pacing) and decreased appetite. Initial or mild signs may be dismissed as changes associated with normal aging but may be suggestive of pituitary macroadenoma. Advanced imaging is necessary for antemortem diagnosis of pituitary macroadenoma, and treatment most commonly involves radiation therapy, although some case reports have described treatment with hypophysectomy.1,6,7

Conclusion
Trilostane can be an efficacious treatment option for canine hyperadrenocorticism, but appropriate monitoring during therapy is essential for success.

References
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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**Evacuation via Emesis**
Amanda A. Cavanagh, DVM, DACVECC

**Diphenhydramine vs Cetirizine for Atopic Dermatitis**
Christina Gentry, DVM, DACVD

**High Comorbidity in Cats with Traumatic Pelvic Fractures**
Jason Bleedorn, DVM, MS, DACVS-SA (Orthopedics)

**Animal-Assisted Interventions & Canine Welfare**
Leslie Sinn, DVM, DACVB

**Higher Room Temperature Combats Perioperative Hypothermia**
William Alexander Fox-Alvarez, DVM, DACVS-SA

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**Pet Owner Behavior Effects on Canine Obesity**
Cecilia Villaverde, BVSc, PhD, DACVN, DECVN

**Bacteria & Corneal Stains**
Audrey Pierson, DVM, DACVO

**Oral Cavity Disease in Cats**
Andrew Sparkes, BVetMed, PhD, DECVIM, MANZCVS, MRCVS

**IgE Testing in Feline Asthma**

**Benazepril in Cats with Heart Disease**

**3D Drill Guides for Canine Humeral Intracondylar Fissure Repair**
Evacuation via Emesis

Amanda A. Cavanagh, DVM, DACVECC
Colorado State University

In the literature

FROM THE PAGE …
Pharmacologic induction of emesis is a commonly employed technique used to achieve gastric decontamination following acute toxin ingestion. This retrospective study showed that induction of emesis can also be used to evacuate gastric foreign bodies shortly after a witnessed ingestion. Successful emesis can prevent the need for costly invasive interventions such as endoscopic removal or laparotomy to prevent pyloric or small intestinal mechanical obstruction.

Apomorphine is a centrally acting emetic that elicits vomiting by activating dopamine receptors in the chemoreceptor trigger zone.1 In this study, 97% of dogs vomited following IV apomorphine administration and 78% successfully evacuated a foreign object via emesis. No dogs experienced immediate complications related to vomiting (eg, object becoming lodged in the esophagus or oropharynx, aspiration of the object, aspiration pneumonia, esophagitis resulting in stricture formation).

Apomorphine does not induce emesis in cats and may cause CNS excitation.2 α2-adrenergic agonists (eg, dexmedetomidine, xylazine) can be used to induce emesis in cats.3 Clinicians should discourage the use of hydrogen peroxide to induce emesis in cats, as it is ineffective in cats and can lead to esophageal, gastric, and/or jejunal lesions in dogs.3,4

… TO YOUR PATIENTS
Key pearls to put into practice:

1. In dogs and cats presented for recent foreign body ingestion, pharmacologic induction of emesis should be considered.

2. Apomorphine (0.02-0.04 mg/kg IV) in dogs and dexmedetomidine (7-10 µg/kg IM or 3.5 µg/kg IV) in cats are the preferred pharmacologic methods.3,5

3. Contraindications to inducing emesis include increased aspiration risks (eg, diminished mentation, megaesophagus, brachycephalic anatomy, laryngeal paralysis), composition of the foreign object (eg, large, sharp, caustic), and the presence of small intestinal foreign objects. Objects in the small intestine are not amenable to removal via emesis; abdominal radiography should be considered in such cases to determine the location of ingested objects.

References
Diphenhydramine vs Cetirizine for Atopic Dermatitis

Christina Gentry, DVM, DACVD
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Houston, Texas

In the literature

FROM THE PAGE …

Type 1 antihistamines (H₁ antihistamines) bind to histamine receptors in mast cells and endothelium. Medications in this group include diphenhydramine, cetirizine, hydroxyzine, fexofenadine, and loratadine. H₁ antihistamines have been used in veterinary medicine for the prevention and treatment of hives, allergic rhinitis, allergic conjunctivitis, angioedema, and atopic dermatitis. Oral absorption of diphenhydramine in dogs is poor, with <10% systemic availability.¹ In a study, there was no reduction in histamine-induced wheals in dogs at plasma levels that would be clinically helpful in humans.²

This double-blind crossover study investigated the effects of diphenhydramine and cetirizine on immediate and late-phase cutaneous reactions in 12 healthy laboratory beagles. Antihistamines were administered at previously recommended dosages for allergic dermatitis: 2.2 mg/kg and 2 mg/kg PO twice daily for diphenhydramine and cetirizine, respectively, for 6 days with a 2-week washout period. Histamine, compound 40/80 (positive control), and saline (negative control) were injected intradermally in the right thorax 10 days prior to drug administration as a baseline, then again on day 6, then 10 days after final drug administration.

Both immediate (20 minutes after testing) and late-phase (6 hours after testing) scores were recorded. No significant differences in wheal scores were identified between baseline and diphenhydramine administration after twice-daily administration. There was a significant decrease in wheal scores between baseline and cetirizine at both time points after twice-daily administration and no significant decrease during the return to baseline test 10 days after the last dose of cetirizine. This suggested that cetirizine (2 mg/kg PO every 12 hours) is more likely to prevent and treat cutaneous allergic reactions as compared with PO diphenhydramine.
Antihistamines have variable efficacy in the prevention and control of atopic dermatitis. Based on their mechanism of action, H1 antihistamines are only recommended as a preventive for atopic dermatitis and are unlikely to be beneficial as the sole treatment of an acute flare or chronic stages of atopic dermatitis.

Hydroxyzine is rapidly metabolized to cetirizine in dogs. At 2 mg/kg every 12 hours, 50-mg hydroxyzine tablets/capsules may provide an easier and potentially more cost-effective option for larger dogs as compared with 10-mg cetirizine tablets.

Antihistamines and steroids should be withdrawn prior to intradermal allergy testing. Current minimum withdrawal recommendations include antihistamine administration for 1 week, oral and topical steroid administration for 2 weeks, and injectable steroid administration for 1 month. These recommendations may vary based on dosages and duration of use. Most dermatologists do not require modified cyclosporine, oclacitinib, or lokivetmab to be withdrawn prior to intradermal allergy testing.

References

Suggested Reading
Backed by 16 research studies and years of testing, Malaseb® has a track record you can trust. Give your stamp of approval to a line proven to kill common skin pathogens* in less than one minute in vitro."

"Staphylococcus pseudintermedius, Malassezia pachydermatis and Pseudomonas aeruginosa

The clinical significance of in vitro has not been determined.

Reference on file. Bayer. Studies were performed using Malaseb® concentrate rinse (0.2% Miconazole and 0.2% Chlorhexidine).

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High Comorbidity in Cats with Traumatic Pelvic Fractures

Jason Bleedorn, DVM, MS, DACVS-SA (Orthopedics)
University of Wisconsin–Madison

In the literature

FROM THE PAGE …

Pelvic fractures are common in cats and frequently associated with concurrent damage to other body regions.

This study retrospectively reviewed comorbidities and mortality in 280 cats with pelvic fractures over a 13-year period. Pelvic fractures were classified as unilateral or bilateral and by involvement of weight-bearing elements; concurrent injuries were grouped by body region.

Concurrent injury of the thorax (49.6%), abdomen (57.5%), neurologic system (43.6%), and soft tissue (48.6%) was most frequent, with 50% of cats having injuries to ≥3 regions. Abdominal injury was more common with motor vehicle trauma, whereas thoracic injury was more common with high-rise falls. The highest mortality rate (ie, 26.2%) was identified in cats with neurologic injury. The number of body regions affected was correlated with mortality, with each additional body region increasing the odds for mortality by 1.85.

Surgical treatment was performed in 58.6% of cases and was more frequently performed when the injury involved the weight-bearing axis. Surgery and euthanasia were more common in cats that had more severe or comminuted fractures. Conservative management was pursued in 24.6% of cats; these patients often had non-weight-bearing or non-comminuted fractures. Cats with bilateral disruption of the weight-bearing axis had twice the mortality rate of cats with unilateral fractures. Overall mortality of cats with pelvic fractures was 20%.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Each additional body region affected in cats with pelvic fractures increases the risk for death.

2. Damage to the weight-bearing axis occurs in >90% of pelvic fractures, and bilateral involvement is negatively associated with outcome.

3. Complete orthopedic and neurologic examination, as well as imaging of the thoracic and abdominal cavity, are imperative to identifying comorbidities with pelvic trauma.
Animal-Assisted Interventions & Canine Welfare

Leslie Sinn, DVM, DACVB
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In the literature
De Carvalho IR, Nunes T, de Sousa L, Almeida V. The combined use of salivary cortisol concentrations, heart rate, and respiratory rate for the welfare assessment of dogs involved in AAI programs. J Vet Behav. 2020;36:26-33.

FROM THE PAGE …

In this study, researchers investigated factors that may contribute to poor welfare among dogs participating in animal-assisted interventions (AAIs). Salivary cortisol was used to measure the stress response associated with activation of the hypothalamic–pituitary axis, and the response of the sympathetic–adrenal–medullary axis was assessed using respiratory rate and heart rate. Dogs (n = 19) were predominantly spayed, with a median age of 6 years. Six different breeds, including crossbreed dogs, were represented in the convenience sample.

Saliva samples were collected, and heart and respiratory rate were monitored both at home and immediately after an AAI session. Handlers filled out an extensive demographic questionnaire about themselves and their dog. All data were analyzed, and the following parameters were found to be significant: heart rate at home and after an AAI session, respiratory rate at home and after an AAI session, and dogs subjected to ≥50 minutes of transportation time.

Although all dogs had heart rates in the normal range (ie, 60-120 bpm) and most dogs had respiratory rates within normal limits (range, 10-30 breaths per minute), dogs with the most elevated heart rates had longer transportation times and participated in AAI in rooms with higher ambient temperatures. Only 4 of the 19 dogs had significantly elevated postsession salivary cortisol levels.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. There are certain risks associated with AAIs, including burnout of the animals involved. Handlers/owners must be cognizant of the factors that impact their AAI partner’s welfare. In this study, environment had the greatest impact, with longer transportation time (≥50 minutes) to the AAI site and higher ambient temperature (ie, uncomfortably warm for the human participants) at the AAI site significantly increasing heart and respiratory rates. All dog handlers and owners should be educated on how the environment impacts canine welfare. Situations in which high temperatures and prolonged travel time will be encountered should be avoided, limited, or mitigated.
Although only 4 of the 19 dogs had elevated salivary cortisol levels, those 4 dogs were significantly impacted. Based on information gathered via the questionnaire, 1 dog was identified as being afraid of car rides, 1 dog worked in an uncomfortably warm room, 1 dog had an extremely thick coat and worked in warm conditions, and 1 dog entered the AAI site during playtime and was subsequently surrounded by dozens of children. All dog handlers and owners should be educated on signs of stress in dogs and learn to actively run interference for their partner to prevent stressful situations from occurring. Resources are available to help handlers and owners learn about canine body language and become more effective advocates for their dog (Suggested Reading).

The fact that some dogs are not suitable for AAI work should be acknowledged and discussed with handlers and owners. Fearful dogs, dogs that exhibit aggression directed toward other dogs and/or unfamiliar humans, dogs with noise sensitivities, and dogs that become stressed during car rides should not be subjected to the additional stress that accompanies this critical but challenging work, as it may negatively impact their welfare.

Suggested Reading
Higher Room Temperature Combats Perioperative Hypothermia

William Alexander Fox-Alvarez, DVM, DACVS-SA
University of Florida

In the literature

FROM THE PAGE …
In human medicine, perioperative inadvertent hypothermia (PIH) is associated with higher infection rates, reduced immune function, increased discomfort, and prolonged recovery.1-3 Increasing ambient temperature in induction and surgical areas can help decrease the risk for PIH in pediatric patients.4

This hospital protocol study from Cornell University evaluated hypothermia in canine (n = 277) and feline (n = 20) patients undergoing general anesthesia for open surgery. Data were compared under 3 different PIH prevention protocols: baseline, baseline and raised environmental temperatures (75°F [24°C]), and a new thermal care protocol with raised environmental temperatures (75°F [24°C]). Baseline data were collected for the

▲ FIGURE Standard wide clip and sterile preparation for an abdominal exploratory surgery
hospital’s standard prestudy warming measures, including active (ie, forced air blanket, circulating water beds, warmed lavage fluid) and passive (ie, blanket) warming techniques at anesthetist discretion. The new thermal care protocol implemented specific warming techniques when patient temperatures dropped below 100.5°F (38°C) during premedication or below 101°F (38.3°C) postinduction.

In the baseline group, mean induction and operating room temperatures were 70.1°F (21.2°C) and 65.5°F (18.6°C), respectively. Hypothermia was documented in 35.6% of these patients and was more likely to occur in cats (50%) than in dogs (35.1%). The greatest drop in body temperature occurred between induction and start of surgery, which took a median of 59 minutes. Increasing room temperature to 75°F (24°C) reduced incidence of hypothermia to 13% without changing the baseline warming protocol. No additional decrease in PIH was detected after adding the new thermal care protocol to the elevated ambient temperature. Patients from rooms at 75°F (24°C) were extubated faster (ie, 5 minutes) than patients in nonwarmed rooms (ie, 7 minutes).

Other factors associated with greater PIH risk included larger clip sites (Figure) and preoperative imaging during the same anesthetic episode. For each 9% increase in body surface area clipped, the odds for hypothermia increased by 1.82. Preoperative imaging under anesthesia was associated with a 5.72 times increased risk for hypothermia. Duration of surgery/anesthesia was not associated with increased risk.

The greatest drop in body temperature occurred between induction and start of surgery, which took a median of 59 minutes.

**References**


TO YOUR PATIENTS

**Key pearls to put into practice:**

**1.** In addition to active monitoring and treatment of PIH, raising temperatures in induction and operating areas to 75°F (24°C) reduced the incidence of hypothermia by >50%. This is an easy and effective intervention that can be instituted to combat PIH.

**2.** Measures to reduce time between induction and surgery, particularly after patients have been clipped and scrubbed, may reduce the risk for hypothermia. Patient preparation exposes moistened skin to air, causing evaporative cooling. Monitoring patient temperatures and using warming measures during this interval should not be discounted.

**3.** Performing preoperative imaging under premedication instead of under general anesthesia may reduce the risk for hypothermia.
Pet Owner Behavior Effects on Canine Obesity

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In the literature

FROM THE PAGE …

The combined prevalence of obese and overweight pet dogs in the United States is estimated to be ≥40% to 50%.\(^1\) It is important for veterinary staff to identify areas of intervention for success in patient weight management. Although information exists regarding the relationship between some factors (eg, age, neuter status) and obesity, there is less knowledge on the relationship between human behaviors and beliefs and canine obesity.\(^2\)

This study* about canine obesity aimed to incorporate the principles of several social cognitive frameworks that have been used to better understand the same problem in humans. More than 3000 dog owners from 5 countries submitted a validated questionnaire about their beliefs and behaviors about obesity, the dog–owner bond, feeding, and exercise.

The study found that owners of an overweight dog were more likely to think about their dog’s weight and to believe their dog was more vulnerable to weight gain, that their dog was unfit, and that others think they are overfeeding their dog. These owners also tended to underestimate their dog’s BCS. These findings suggest that, although owners of dogs with a high BCS can and do underestimate the magnitude of the problem, they also recognize and are aware that there is a problem and therefore may be amenable to commit to a weight-loss plan. In this study, owners of an overweight dog were also less likely to have social support from friends for exercising their dog.

*This research was funded by Nestlé Purina Company.
Although this study did not identify associations between factors relating to attachment among dog, owner, and BCS, such associations may exist. A strong attachment can result in behaviors that can have both positive and negative effects on body weight; a more in-depth assessment is necessary to further current understandings. Similarly, no association was found between feeding treats and a high BCS, which likely reflects the variability of treating practices.

The design of this study did not allow for distinguishing between factors that are present before weight gain (potential risk factors) and those that are not; therefore, more prospective studies are required to clarify the specific relationship between human behaviors and beliefs and canine BCS. These initial findings, however, provide valuable information that can be applied to daily practice to prevent and manage canine obesity.

**… TO YOUR PATIENTS**

Key pearls to put into practice:

1. Owners should be educated about BCS assessments, and BCS assessments completed by owners should be regularly compared with those conducted by veterinary staff to identify dogs at risk due to owner underestimation of BCS.

2. Owners should be encouraged to schedule exercise for their dog with a group of friends and/or family to promote this practice in a consistent manner.

3. Educate owners regarding obesity, weight loss, and nutrition so they are able to understand and consider how this information relates to their pet. This will better enable customization of a weight management plan that will work for their individual circumstances and goals.

**References**


**No association was found between feeding treats and a high BCS, which likely reflects the variability of treating practices.**
Bacteria & Corneal Stains

Audrey Pierson, DVM, DACVO
Gulf Coast Veterinary Specialists
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In the literature

FROM THE PAGE …

Corneal integrity is necessary for clear, functional vision. Although the cornea’s natural lack of vascularization and immune privilege supports corneal clarity, defects in the corneal surface can predispose it to vision-threatening infections. Commonly used corneal stains help assess the integrity of the corneal surface. This study sought to evaluate how these corneal stains affect assessment of corneal infection.

Three basic ocular surface stains (ie, fluorescein, rose bengal, lissamine green) were assessed. Fluorescein is hydrophilic and adheres to intercellular spaces and stromal connective tissue. This stain is used most

▲ FIGURE Fluorescein stain applied to the ocular surface of an infected cornea. The diffuse pattern of stain uptake is common in melting corneal ulcers, which may affect culture and susceptibility results.
commonly to screen for corneal ulcerations; it is also used to determine nasolacrimal transit time and tear film stability. Rose bengal stain is used to identify tear film abnormalities and superficial corneal erosions; both degenerate and normal cells stain in the presence of an abnormal tear film with rose bengal only. Lissamine green, although similar in staining pattern to rose bengal, does not stain healthy cells, regardless of tear film dynamics.

In the first part of this study, the impact of these stains on the growth of gram-positive and gram-negative bacteria commonly encountered with ocular surface infections was evaluated. Through the Kirby-Bauer disk-diffusion method, strips containing 3 different amounts (0.01, 0.1, and 1.0 mg) of each stain were applied to plates containing a pure culture inoculum of each bacterial strain being evaluated. The plates were incubated and zones of inhibition were measured. All 3 stains were shown to have antimicrobial activity against the gram-positive bacteria (ie, *Staphylococcus aureus*, *S pseudintermedius*, *Streptococcus* spp); gram-negative bacteria (ie, *Escherichia coli*, *Pseudomonas aeruginosa*) exhibited no growth inhibition at lower concentrations of stain and minimal inhibition (ie, resistance) at higher concentrations.

The second part of the study evaluated the effect of the stains on bacteria growth using both preservative-containing and preservative-free formulations of the stains and inoculating them directly with the same bacteria. The presence of bacteria was evaluated over 28 days. The preservative-containing solutions all showed a significant decrease in bacterial counts. All preservative-free stains had some bacteria present after 7 days; at 28 days postinoculation, only preservative-free fluorescein continued to maintain gram-negative bacteria cell counts.

…” TO YOUR PATIENTS

Key pearls to put into practice:

1. Bacterial culture and susceptibility testing should be performed prior to corneal staining or after copious flushing of the ocular surface after staining.

2. Preservative-free staining solutions prepared in-house to be used as multidose applications (eg, a fluorescein strip diluted in sterile saline in a syringe) may harbor bacterial colonies; thus, their use is discouraged.

3. Preservative-containing, commercially available stain preparations appear to prevent bacterial growth and can likely be used for ≥28 days.

Suggested Reading

Research Note:
**IgE Testing in Feline Asthma**

This study aimed to determine if an association exists in cats between serum allergen-specific immunoglobulin E (IgE) testing results and a clinical diagnosis of asthma. The study also aimed to determine whether the number of allergens with positive IgE reactivity and magnitude of IgE responses correlates with severity of clinical signs or airway eosinophilia. Eighteen cats were studied, and serum allergen-specific IgE testing supported an allergic etiology in 78% of cats, with all but 1 cat having polysensitization, indicating a strong association between detection of allergen-specific IgE and asthma in cats. The severity of clinical signs and the magnitude of airway eosinophilia did not correlate with the degree of IgE reactivity. However, positive allergen-specific IgE results may guide avoidance or elimination of sensitizing allergens.

**Source**

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Research Note:
**Benazepril in Cats with Heart Disease**

There are no well-controlled prospective clinical trials that provide evidence of the benefit of any particular medication in feline heart disease. This prospective blinded clinical trial compared the angiotensin-converting enzyme inhibitor benazepril (mean dosage, 0.7 mg/kg once daily; range, 0.5-1.0 mg/kg once daily) with placebo given once daily for up to 2 years. Client-owned cats (*n* = 151) with confirmed heart disease of various etiologies with or without clinical signs of congestive heart failure were included. Benazepril was found to be well-tolerated; however, no significant differences in time to treatment failure, quality-of-life scores, or echocardiographic measurements were identified between the groups. However, because there were several important limitations of this study, no widespread conclusions should be made regarding potential treatment benefits.

**Source**
Humeral intracondylar fissure repair in dogs is typically achieved using a 4.5-mm transcondylar screw (TCS). Proper placement can be challenging considering the complex anatomy, width of the implant, and proximity to the joint. This retrospective case series evaluated the accuracy of a 3D-printed patient-specific drill guide (3D-PDG) for TCS placement in cases of humeral intracondylar fissure. Entry point, exit point, and angulation of the implant was planned preoperatively for 11 dogs (16 elbows) using CT and computer-aided design software. A virtual drill guide was created and the 3D-PDG fabricated using a 3D printer; this was used to place 5-mm TCSs. Postoperative CT images were taken to compare planned versus actual screw placement using the drill guide. Mean entry and exit point deviation were 1.3 and 1.8 mm, respectively, and mean maximum screw angulation was 5.2°. There was no intra-articular screw placement. The authors concluded that 3D-PDG is accurate and consistent for placing TCSs in dogs with humeral intracondylar fissure.

Source
Oral Cavity Disease in Cats

Andrew Sparkes, BVetMed, PhD, DECVIM, MANZCVS, MRCVS
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Co-Editor, Journal of Feline Medicine and Surgery

In the literature

FROM THE PAGE …

A substantial retrospective study evaluated 297 surgically removed feline oral cavity lesions submitted to a pathology laboratory service in Lisbon, Portugal, over a 6-year period. Most samples were incisional (86.2%) or punch biopsies (1.7%), and 12.1% were excisional biopsies.

Overall, 64.4% of biopsies were from cats ≥7 years of age and 31.9% were from cats 7 months to 6 years of age. The major anatomical regions biopsied were the gingiva (43.1%), oral mucosa (16.2%), tongue (10.8%), lips (8.1%), and palate (5.7%). Other sites included the oropharynx, maxillary bone, salivary glands, floor of the mouth, and tonsils. Histopathology revealed an inflammatory process in 63% of cases and a neoplastic process in 37%. The proportion of neoplastic cases increased with age and accounted for most lesions in cats ≥11 years of age. However, even in young cats (ie, 7 months to 2 years of age) and young adult cats (ie, 3-6 years of age), neoplastic lesions were seen frequently, representing 5.4% and 16.7% of biopsies in cats of those ages, respectively.

▲ FIGURE Two cats with sublingual mass lesions in which the importance of biopsy and histology is emphasized. The lesion in Figure A was diagnosed as an eosinophilic granuloma complex legion and the lesion in Figure B as squamous cell carcinoma.
Of the 187 cases of inflammatory disease, 62% (n = 116) were feline chronic gingivostomatitis (FCGS), with the most common sites affected being the gingiva (n = 66), oral mucosa (n = 22), and oropharynx (n = 12). FCGS was seen in cats of all ages but was most common in male cats 7 months to 10 years of age. Eosinophilic granuloma complex (EGC) lesions accounted for 17.6% (n = 33) of inflammatory lesions and comprised 23 eosinophilic ulcers and 10 eosinophilic granulomas. The most common sites of EGC lesions were the lips (n = 12) and tongue (n = 5). Other inflammatory lesions included nasopharyngeal polyps, nonspecific stomatitis, and gingival hyperplasia.

Of the 110 neoplastic lesions, 90 (81.8%) were classified as malignant, and overall, squamous cell carcinoma (SCC) was the most common tumor (n = 49; 44.5%). The gingiva (n = 18) and mandible (n = 10) were the most common sites affected by SCC, and most of these cats were ≥11 years of age. Other neoplastic lesions included undifferentiated tumors (17.3%), odontogenic tumors (8.2%), peripheral nerve sheath tumors (8.2%), adenocarcinomas (5.4%), and fibrosarcomas (4.5%).

... TO YOUR PATIENTS

Key pearls to put into practice:

1. This study emphasizes the breadth of pathologies that occur in the feline oral cavity and the need for histologic examination of biopsy material for an accurate diagnosis.

2. In this study, inflammatory lesions were more common than neoplastic lesions, with FCGS and EGC being the most common. This emphasizes the importance of differentiating the disease process, as underlying etiologies and management options differ markedly.1

3. Although neoplastic disease is more common in older cats, oral tumors can also be seen in younger cats, and the presence of malignant disease does not invariably equate to a poor prognosis. Dependent on the underlying disease, different treatment options may be possible.2-4

References

Although neoplastic disease is more common in older cats, oral tumors can also be seen in younger cats, and the presence of malignant disease does not invariably equate to a poor prognosis.
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Carly, a 2-year-old spayed domestic shorthair cat, was referred to an after-hours emergency service after severe anemia (packed cell volume, 16%) and a heart murmur were diagnosed by the referring clinician. According to the pet owner, Carly had a history of progressive lethargy; she had stopped eating 3 days prior to presentation and had a 1-month history of inconsistent appetite. Prior to adoption (≈3 to 4 months before presentation), she was an outdoor cat.

Physical Examination
On physical examination, Carly was quiet, alert, and responsive with pale and tacky mucous membranes. Capillary refill time was within reference range. Other abnormalities included pyrexia (104.1°F [40.1°C]), tachycardia (220 bpm), and tachypnea (40 breaths per minute). FeLV/FIV results were negative.

Diagnosis
CBC revealed macrocytic (mean corpuscular volume, 51.3 fl; reference interval, 41-51 fl), hypochromic (mean corpuscular hemoglobin concentration, 31.6 g/dL; reference interval, 32-35 g/dL), and regenerative (reticulocyte count, 0.1 x10⁶/µL; reference interval, 0.01-0.06 x10⁶/µL) anemia (packed cell volume, 15%; reference interval, 35%-50%). Leukogram was unremarkable. Many small cocci and ring-shaped structures (Figures 1 and 2, next page, and Figure 3, page 57) adhered to the RBC surface were observed on blood smear. Structures were distributed individually, in clusters, and occasionally in chains.

Serum chemistry profile indicated mild hyperbilirubinemia (0.3 mg/dL; reference interval, 0-0.2 mg/dL), which was likely prehepatic secondary to
hemolysis, and mild hypoalbuminemia (2.9 g/dL; reference interval, 3.2-4.5 mg/dL) likely due to inflammation, as albumin is a negative acute-phase protein. Bilirubinuria was also observed.

**DIAGNOSIS:**
MARKED REGENERATIVE ANEMIA DUE TO ERYTHROPARASITE MYCOPLASMA HAEMOFELIS

**Treatment**
Carly received pradofloxacin oral solution (7.5 mg/kg PO) once daily for 2 weeks. Because of the organism’s classic appearance and rapid response to therapy during the weekend of presentation, no molecular testing was performed. After 2 weeks, Carly’s anemia had greatly improved (packed cell volume, 32%), the heart murmur had resolved, and no organisms were observed on blood smear. Pradofloxacin was continued for an additional 2 weeks at the same dosage, after which the anemia had completely resolved. No episodes of recrudescence have been noted in the year since initial presentation.

**Discussion**
*Mycoplasma haemofelis* is an unculturable bacterium that infects RBCs by attaching to the outer surface membrane.1,2 Formerly classified in the genus Hemobartonella, *M haemofelis* was reclassified as a *Mycoplasma* spp bacterium due to the similarity of the 16S rRNA gene sequence.1-3

The mode of transmission for *M haemofelis* is not well-established. Blood-sucking arthropods (eg, fleas) are reported to play a central role in transmission,4,5 but experimental evidence may be considered weak.2 Cats of any age can be infected, but younger male cats that roam outdoors and cats infected with FIV and FeLV are overrepresented.1,2,5 Horizontal transmission via cat bite is possible for both the biting and bitten cat,2 and abscesses may precede infection by a few weeks.6 In addition, although the exact mechanism is not understood, vertical (transplacental) transmission of *M haemofelis* may occur.2,7
Studies of experimental IV inoculation have demonstrated that after pathogen exposure, a preparasitemic phase occurs and typically lasts 1 to 3 weeks.7 Parasitemia follows and usually lasts 1 to 2 days and rarely beyond 4 days.7,8 During parasitemia, *M haemofelis* attaches to the RBC membrane, resulting in anemia due to extravascular erythropagocytosis by macrophages in the spleen and other organs.8 In untreated patients that survive, clinical disease may last a month or longer, with several parasitemic episodes.7,8 Clinical episodes of *M haemofelis* parasitemia are often fatal if left untreated.1 Despite treatment and recovery, cats often become carriers for months to years, if not for life. Thus, low numbers of bacteria may still be observed occasionally. Stressful events and immunosuppression may trigger recrudescence and clinical disease.1,2,7,8

Clinical signs are attributed to the resulting hemolytic anemia and may include mucosal pallor, depression, fever, dehydration, icterus, tachypnea, weakness, anorexia, and splenomegaly.1,2 Abnormalities on CBC and blood smear typically include anemia, agglutination, and indicators of regeneration (eg, anisocytosis, macrocytosis, polychromasia, increased Howell–Jolly bodies, reticulocytosis).1,2 However, if anemia is peracute and the bone marrow has not had sufficient time to respond or cannot adequately respond due to underlying disease, the anemia may appear nonregenerative.2 Serum chemistry profile and urinalysis abnormalities are nonspecific and inconsistent; abnormalities may include bilirubinuria and hyperbilirubinemia secondary to extravascular hemolysis and increased ALT activity due to hypoxic injury with or without metabolic acidosis and prerenal azotemia.1 All cats with suspected *M haemofelis* infection should be tested for FIV and FeLV; ≈40% to 50% of cats with clinical hemotropic mycoplasmosis based on microscopic findings are FeLV positive.1

Although identification of *M haemofelis* via blood smear evaluation is a valuable diagnostic method, the bacterium is only present in sufficient numbers to enable microscopic identification in less than half of cases.1,2,7 Due to the intermittent parasitemia, molecular testing via PCR of the 16S rRNA gene is the test of choice to confirm diagnosis.1,2 In experimental infections, PCR yielded positive results 4 to 15 days postinfection and until appropriate antibiotic therapy was initiated.1,8 For feline carriers, PCR results are typically positive 3 days to 5 weeks after discontinuation of antimicrobial therapy.1 Although PCR is considerably more sensitive than identification on blood smear, it may produce

![FIGURE 3 Blood smear showing numerous erythrocytic bacteria typical of Mycoplasma haemofelis (black arrows) and polychromatophilic cells (white arrows). Modified Wright’s stain, 1000× magnification. Inset is a magnified image of the smaller boxed region; a chain of organisms can be seen on the center cell.](image)

**TREATMENT AT A GLANCE**

- Cats infected with *M haemofelis* can be treated with pradofloxacin (5-10 mg/kg PO every 24 hours for 14 days)1,2,10 or doxycycline (5 mg/kg PO every 12 hours for 21 days).1,10
- Pradofloxacin may offer a longer duration of bacterial clearance.10
- In severe cases, glucocorticoids, transfusion, and IV fluids with glucose may be warranted.1,2
a false-negative result if the number of bacteria is below the detection limit. The ACVIM consensus statement states that potential feline blood donors should test PCR-negative prior to being accepted into a blood donor program.

Antimicrobial treatment can reduce the bacterial load and eliminate clinical signs but often does not clear the pathogen from the body. Tetracyclines and fluoroquinolones are typically used. However, pradofloxacin may offer more effective long-term bacterial clearance than doxycycline and does not pose the same risk for retinal degeneration and blindness as does enrofloxacin. Thus, pradofloxacin was the therapy of choice in Carly’s case. Although not prescribed in Carly’s case, glucocorticoid therapy, in conjunction with antimicrobial treatment, may need to be considered for severely anemic patients to decrease erythropagocytosis. In severe cases, supportive therapy (eg, blood transfusion) and IV fluids with glucose may be indicated.

**References**


**TAKE-HOME MESSAGES**

- *M haemofelis* was formerly classified as *Haemobartonella*.
- Cats of any age can be infected, but younger male cats that roam outdoors and cats infected with FIV or FeLV are overrepresented.
- *M haemofelis* can cause severe anemia that is usually regenerative but may be preregenerative if the bone marrow has not had time to respond or nonregenerative if underlying disease inhibits the response.
- The bacterium is not consistently found on routine blood smear, but a sensitive and specific PCR assay is available.
- All patients with suspected or confirmed *M haemofelis* should be tested for FIV and FeLV.
- Infected cats often become carriers with possible recrudescence during stress or illness.
- Cats should have a negative PCR screening test prior to being accepted into a blood-donor program.
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Anticonvulsants

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Anticonvulsants have been used since the mid-1800s in both human and veterinary medicine. Phenobarbital and bromide are the oldest reported anticonvulsants used in veterinary medicine and remain commonly used by veterinary specialists despite the development of many novel anticonvulsants.

Initiation of Anticonvulsant Therapy
The International Veterinary Epilepsy Task Force has published guidelines for the initiation of anticonvulsant treatment in dogs that can be extrapolated for cats. The task force recommends initiation of anticonvulsant therapy if a dog (or cat) has ≥2 seizures in 6 months and/or a single seizure that lasts >5 minutes. These guidelines are written to aid clinicians in decision-making for epileptic patients; however, individual differences (eg, metabolic state, severe adverse effects experienced during or after the seizure) may drive earlier initiation of anticonvulsant therapy than outlined.

The presence of postictal signs that are especially severe (eg, aggression) or long-lasting (ie, >24 hours) is a secondary reason to consider anticonvulsant therapy. The author also encourages initiation of anticonvulsant therapy if the patient is at high risk for additional seizures but the frequency recommendations are not met. For example, anticonvulsant therapy may be considered for a young dog with clinical hydrocephalus in which one seizure has already been observed.

Despite decades of research on genetic factors, identification of specific seizure syndromes, and development of novel anticonvulsants, selection of appropriate anticonvulsants by clinicians is still largely based on seizure semiology (ie, the appearance, or phenotype, of the seizure), patient health status, pet owner considerations (eg, frequency of administration, cost, formulation type), and the clinician’s comfort with anticonvulsants.
Monotherapy is typically recommended over polytherapy during the initial treatment period. Starting one anticonvulsant drug and assessing the clinical response—including clinical adverse effects, effect on seizure control, and, if applicable, serum drug concentrations—is recommended long enough for attainment of steady state and an observation period. The author recommends observing for a minimum of 3 seizure cycles before changing the drug protocol. Exceptions to this include patients with severe adverse clinical effects. Initiation with polytherapy is more often employed when using potassium bromide without a loading period. In this situation, potassium bromide takes up to 12 weeks to reach steady state; therefore, a “bridge” drug is used to improve seizure control until bromide is at steady state. After attaining steady state, the bridge drug can be tapered or removed if indicated.

**Common Anticonvulsant Drugs**

Due to their relatively high frequency of use and availability in the United States, this article focuses on phenobarbital, potassium bromide, levetiracetam, and zonisamide.

**Phenobarbital**

Phenobarbital has been widely used for seizure management since the 1900s and is effective for seizure control in both dogs and cats.2,4 The anticonvulsant effect of phenobarbital is likely due to increased intracellular chloride secondary to prolonged opening of the γ-aminobutyric acid receptors on the postsynaptic membrane. Increased intracellular chloride causes increased negative membrane potential, which reduces nerve firing.5

Adverse effects are rare in cats but common in dogs6 and can include sedation, ataxia, weakness, polydipsia, polyphagia, and polyuria. Hepatopathy and hepatotoxicity have been well-documented in dogs receiving phenobarbital. Hepatopathy/toxicity has not been reported in cats receiving phenobarbital long-term; therefore, elevated ALP or ALT in cats receiving phenobarbital should prompt investigation into other hepatopathies.4 Clinical adverse effects and risk for hepatopathy are serum phenobarbital-dependent; therefore, maintaining serum phenobarbital concentrations <35 µg/mL can be targeted to reduce these adverse effects. Conversely, blood dyscrasias are idiosyncratic and not dependent on serum concentration. Blood dyscrasias have been reported in 4.2% of dogs receiving phenobarbital. If anemia, thrombocytopenia, leukopenia, or pancytopenia are noted, phenobarbital should be safely and swiftly removed from administration and replaced by another anticonvulsant.7 CBC monitoring is recommended 14 days after starting phenobarbital and every 6 months thereafter.

A typical starting dosage for dogs and cats is 2-5 mg/kg PO every 12 hours (reported range, 1.8-10 mg/kg/day).2,4,6,8-10 Steady state is expected 10 to 14 days after initiation of treatment in both species.11,12 The reference interval for monitoring serum concentrations at steady state levels for dogs is 15 to 40 µg/mL; however, the author agrees that optimal therapeutic success is frequently obtained with serum phenobarbital concentrations of 25 to 30 µg/mL, which can help limit toxicity.4,9-11

A therapeutic reference interval for cats is not available, but seizure control was achieved in a study in 93% of cats with serum phenobarbital concentrations of 15 to 45 µg/mL, regardless of the underlying cause.4 Transdermal phenobarbital has been investigated for use in cats.13,14 In these studies, serum phenobarbital concentrations in healthy cats were within the therapeutic reference range for dogs13,14; however, a prospective clinical trial in epileptic cats showed the serum concentrations did not correlate with the dose administered.15 Additional routes of administration in cats are being explored.
Clinicians are encouraged to monitor forthcoming literature for additional options beyond per os administration of phenobarbital.

Potassium Bromide
Bromide has well-documented seizure control success in dogs. In a study, there was a strong level of evidence for use of potassium bromide as a monotherapy and weak evidence for use as adjunct therapy. Another study reported bromide to be a reasonable first-line choice for dogs with seizures but found that it was slightly less effective than phenobarbital in the first 6 months of therapy. In the author's clinic, bromide is preferentially used in dogs with cluster seizures and focal seizures.

Bromide is a halide salt that is thought to mimic chloride and thereby hyperpolarize neuronal membranes and result in seizure control. Due to chloride mimicry, serum chemistry analyzers may misidentify bromide as chloride, which can cause falsely elevated chloride on serum chemistry results. Clinicians should take care to differentiate mimicry and actual changes in chloride. Further, dietary chloride may affect serum bromide concentrations. Lowering the chloride content in the body can lead to an increase in bromide and vice versa. Dogs do not require a specific diet during bromide treatment but should be provided a chloride-stable diet (ie, a dog receives the same food, treats, and access to human food every day, without change, to avoid fluctuations in chloride).

The starting dosage of bromide is 40 mg/kg PO once or twice (divided dose) daily. Time to steady state is ≈12 weeks, and a therapeutic reference interval for dogs is available. Serum bromide concentrations of 0.88-3 g/L are considered to be within the acceptable reference interval. Common adverse effects include polyuria, polydipsia, increased appetite, and neurologic signs (eg, ataxia, sedation, weakness). Pancreatitis has commonly been associated with bromide administration, but whether this is a primary adverse effect of bromide or secondary to polyphagia remains unclear. 

Bromide is not recommended for use in cats. Reversible neutrophilic and eosinophilic lower airway disease have been documented in cats receiving bromide for seizure management.

Levetiracetam
Levetiracetam has a novel mechanism of action as compared with other common anticonvulsants. The therapeutic reference interval of levetiracetam for dogs and cats is unknown and has been extrapolated from that of humans (5-45 µg/mL). The most commonly reported adverse effects include vomiting, sedation, hypersalivation, ataxia, and hyperactivity. Adverse clinical effects have been reported in >30% of studies; however, reports of toxicity are not well-documented.

Two formulations of levetiracetam are available: intermediate-release and extended-release. The starting dosage for intermediate-release levetiracetam is 20 mg/kg PO every 8 hours (dogs and cats) and for extended-release levetiracetam is 30 mg/kg PO every 12 hours for dogs ≥33 lb (15 kg) and 500 mg PO once daily for cats ≥11 lb (5 kg). When administering 500-mg extended-release levetiracetam to a cat, it is important to give the entire tablet once daily and not to crush, split, or allow the cat to chew the tablets, any of which could nullify the release effect. In dogs, administration of extended-release levetiracetam with food typically results in a lower maximal serum concentration as compared with that in fasted dogs. In one study, rectal levetiracetam at 40 mg/kg successfully stopped active

Reversible neutrophilic and eosinophilic lower airway disease have been documented in cats receiving bromide for seizure management.


seizures in most dogs. Rectal levetiracetam may be an alternative to rectal diazepam for home use in some epileptic patients.

Loss of efficacy over time has been suggested to occur in dogs but has not been documented in cats. However, the lack of documentation does not exclude the possibility of long-term tolerance in cats. Administration of intermittent or pulse levetiracetam for several days has been recommended for cluster seizure management. This approach has not been validated in cats and therefore should be employed with caution.

Levetiracetam has been championed for use in specific seizure syndromes in human and veterinary medicine. Specifically, reflex seizures in dogs and cats and myoclonic seizures in humans demonstrate a marked response to levetiracetam as compared with other anticonvulsants. As genetic factors that influence seizures are discovered, syndrome-specific anticonvulsant recommendations will become more common.

Zonisamide
Zonisamide is a sulfonamide-derived anticonvulsant developed for use in cats and rats in the late 1970s in Japan. According to the 2015 Small Animal Consensus statement, there is a low level of evidence supporting the use of zonisamide in cats and dogs. The starting dosage for dogs and cats is 10-20 mg/kg PO every 12 hours; a therapeutic serum reference interval of 10 to 40 µg/mL has been reported in dogs. The reported half-life in cats is longer than in dogs, which is suspected to be due to the decreased hepatic glucuronide conjugation in cats.

In one study, 50% of cats receiving zonisamide at 20 mg/kg/day had GI adverse effects; thus, a lower dose may be required. Several small studies have reported seizure control in 60% to 80% of dogs receiving zonisamide at 7-10 mg/kg PO twice daily, with 40% to 60% of dogs showing 1 or more adverse clinical effect. The most frequently reported adverse effects in dogs and cats include ataxia, sedation, and GI upset (eg, vomiting, diarrhea, nausea). Elevations in ALT and ALP, with rare idiosyncratic hepatotoxicity and renal tubular acidosis, have been well-documented. In a study of 107 dogs, acute clinical and serum chemical hepatopathy was reported to be low (<1%). The study authors suggested that monitoring for changes in liver enzymes within 4 weeks of initiating therapy should detect acute hepatopathy.

Renal tubular acidosis has been reported with zonisamide use in dogs and humans. Monitoring for this rare adverse effect should include blood gas testing and urinalysis. Care should be taken to avoid concurrent administration of bromide and zonisamide. Clinicians should inform owners of the limited published data when prescribing zonisamide.

**Conclusion**
Anticonvulsants are the mainstay treatment for dogs and cats with epilepsy. The clinical benefits, adverse effects, and disposition of phenobarbital, bromide, and levetiracetam are well-reported in the veterinary literature. Therefore, these drugs—with the exception of levetiracetam in cats—may be recommended as first-line therapy. Fewer studies have been published regarding the clinical benefits, adverse effects, and disposition of zonisamide. Despite the recent popularity of zonisamide, clinicians should continue to disclose its limitations to owners until more data are available. Regardless of the anticonvulsant chosen, appropriate monitoring and awareness of clinical adverse effects are critical for long-term management of epileptic patients.
References

New Genetic Analyzer
LexaGene Holdings (lexagene.com) has announced the launch of their new product, MiQLab. MiQLab is a fully automated genetic analyzer designed to deliver reference-quality data at the point-of-need. MiQLab’s technology screens samples for up to 27 different targets (ie, pathogens and/or antimicrobial resistance factors) simultaneously and returns results in ≈1 hour. The analyzer is designed to operate at the sample collection site, thus avoiding delays associated with shipping and manually processing samples, and for use in multiple markets, including human and veterinary diagnostics, as well as food safety testing.

MiQLab is open-access, allowing users to customize tests. Three sets of chemistries will be offered: a COVID-19 test, a bacterial and antimicrobial panel for veterinary diagnostics that screens for 8 pathogens (ie, Escherichia coli, Proteus spp, Klebsiella spp, Enterobacter spp, Pseudomonas spp, Staphylococcus spp, Streptococcus spp, Enterococcus spp) and 12 antibiotic resistance factors (including methicillin and vancomycin resistance), and an open-access panel to facilitate customized genetic testing.

LexaGene has submitted a preliminary plan for COVID-19 testing to the FDA. Until the FDA grants LexaGene’s instrument emergency use authorization for COVID-19 testing, all work using LexaGene instruments is classified as Research Use Only and cannot be used for human clinical diagnostics.

—Press Release 8/20

Pet Owners Surveyed on Importance of Pet Nutrition
The results of a DSM (dsm.com) survey of 500 pet owners included 72% dog, 48% cat, 5% bird and 1% reptile owners. Nearly three-fourths of owners indicated they believe immunity is important and pet food helps ensure pets receive their necessary vitamins and minerals. In addition, 69% of owners stated they are more likely to purchase pet food that offers optimal levels of vitamins and nutrients to help boost their pet’s immunity. Dog and cat owners were similar in their attitudes about the importance of providing their pet with the right vitamins and minerals; however, dog owners were somewhat more likely to purchase pet food containing nutrients sufficient to boost immunity.

—Press Release 8/20
Zoetis Encourages Discussion of Osteoarthritis in Dogs and Cats

Zoetis (zoetisus.com) is sponsoring the International Veterinary Academy of Pain Management (IVAPM; ivapm.org) Animal Pain Awareness Month to help pet owners learn about osteoarthritis (OA), a degenerative and progressively painful joint disease found in at least 1 of 4 dogs and 1 of 3 cats. Zoetis has created OA checklists for dogs and cats to help owners identify signs of OA that can be difficult to detect at home. It is critical that owners understand signs and behaviors commonly associated with OA and know when to discuss the disease with their veterinarian, as the number of pets diagnosed or suspected to have OA continues to rise. For more information, visit bit.ly/32BV6B2.—Press Release 9/20

New Point-of-Care Hematology Analyzer

The IDEXX Laboratories (idexx.com) ProCyte One Hematology Analyzer provides point-of-care hematology with reference laboratory-quality results, reticulocyte counts with each CBC, workflow simplicity with automatic quality control and load-and-go components, a pay-per-run and auto-replenishment model, a small footprint, clinical decision support tool, and a sustainable design that features recyclable containers. For more information, visit idexx.com/ProCyteOne.—Press Release 8/20

Royal Canin Partners with the WSAVA Global Nutrition Committee

Royal Canin (my.royalcanin.com) has partnered with WSAVA (wsava.org) to support the Global Nutrition Committee (GNC), which provides nutritional information and recommendations to help veterinary healthcare teams and the public understand the importance of nutrition in companion animal health. The GNC offers regularly updated resources for veterinary teams, including educational content for pet owners, and promotes performing nutritional assessments at each examination. The committee also advocates for the inclusion of nutrition as a component in all veterinary medicine curricula.—Press Release 9/20

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Publication title: Clinician’s Brief
Publication number: 1542-4014
Filing date: 10/1/20

Issue frequency: Monthly
Number of issues published annually: 11
Annual subscription price: $65

Complete mailing address of known office of publication:
2021 S Lewis Ave, Suite 760, Tulsa, OK 74104

Contact person: Natalie Williams
Telephone: 918-710-4631

Full name and complete mailing address of Publisher, Editor, & Managing Editor:
Elizabeth Green, 2021 S Lewis Ave, Suite 760, Tulsa, OK 74104; Indu Mani, 2021 S Lewis Ave, Suite 760, Tulsa, OK 74104; Samantha Farley, 2021 S Lewis Ave, Suite 760, Tulsa, OK 74104—Owners: Siegfried Ventures, 1924 S Utica Ave, Tulsa, OK 74104; Elizabeth Green, 2021 S Lewis Ave, Suite 760, Tulsa, OK 74104; John O’Brien, 12118 Nieman Rd, Overland Park, KS 66213; Antoinette Passaretti, 3936 Sawmill Rd, Doylestown, PA 18902; James D. Zielinski, 2403 High Hammock Rd, Seabrook Island, SC 29455; Natalie Williams, 9936 South 86th East Ave, Tulsa, OK 74133; Donald C. Plumb, N 1782 Bogus Rd, Stockholm, WI 54769

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1. **CONSULT THE EXPERT PAGE 12**

Which of the following is the recommended confirmatory test for positive p27 antigen test results and the test of choice to detect regressive infection?

A. Immunofluorescence assay to detect intracellular FeLV antigen  
B. Virus isolation to detect replicating virus  
C. PCR to detect proviral DNA  
D. FeLV antibody detection test

2. **CASE IN POINT PAGE 27**

Which of the following breeds is predisposed to exocrine pancreatic insufficiency?

A. German shepherd dogs  
B. Jack Russell terriers  
C. Standard poodles  
D. Keeshonds

3. **TOP 5 PAGE 32**

Neurologic signs associated with macroadenoma syndrome occur in approximately what percentage of dogs with pituitary-dependent HAC?

A. <1%  
B. 1% to 3%  
C. 5% to 7%  
D. 10% to 30%

4. **CONSULT THE EXPERT PAGE 55**

Approximately what percentage of cats with clinical hemotropic mycoplasmosis are positive for FeLV?

A. 1% to 5%  
B. 10% to 20%  
C. 40% to 50%  
D. 70% to 80%

5. **CONSULT THE EXPERT PAGE 61**

_________________________ has been associated with renal tubular acidosis, a rare adverse effect in dogs.

A. Phenobarbital  
B. Zonisamide  
C. Potassium bromide  
D. Levetiracetam

**Answer Key:**

1. C  
2. A  
3. D  
4. C  
5. B
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