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VITAMIN A DEFICIENCY IN INSECTIVOROUS LIZARDS
Galliprant® (grapiprant tablets) is an NSAID indicated for the control of pain and inflammation associated with osteoarthritis in dogs.

Select Important Safety Information
Do not use in dogs that have a hypersensitivity to grapiprant. Please see inside for additional important safety information.
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GALLIPRANT® (grapiprant tablets)

For oral use in dogs only

20 mg, 60 mg and 100 mg flavored tablets

A prostaglandin E2 (PGE2) EP4 receptor antagonist; a non-cyclooxygenase inhibiting, non-steroidal anti-inflammatory drug

Caution: Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian. Before using this product, please consult the product insert, a summary of which follows:

Indication: GALLIPRANT (grapiprant tablets) is indicated for the control of pain and inflammation associated with osteoarthritis in dogs.

Dosage and Administration: Always provide “Information for Dog Owners” Sheet with prescription. Use the lowest effective dose for the shortest duration consistent with individual response. The dose of GALLIPRANT (grapiprant tablets) is 0.9 mg/lb (2 mg/kg) once daily. GALLIPRANT tablets are scored and dosage should be calculated in half tablet increments. Dogs less than 8 lbs (3.6 kgs) cannot be accurately dosed. See product insert for complete dosing and administration information.

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

Warnings: Not for use in humans. Keep this and all medications out of reach of children and pets. Consult a physician in case of accidental ingestion by humans. For use in dogs only. Store GALLIPRANT out of reach of dogs and other pets in a secured location in order to prevent accidental ingestion or overdose.

Precautions: The safe use of GALLIPRANT has not been evaluated in dogs younger than 9 months of age and less than 8 lbs (3.6 kgs), dogs used for breeding, or in pregnant or lactating dogs. Adverse reactions in dogs receiving GALLIPRANT may include vomiting, diarrhea, decreased appetite, mucoid, watery or bloody stools, and decreases in serum albumin and total protein. If GALLIPRANT is used long term, appropriate monitoring is recommended. Concurrent use with other anti-inflammatory drugs has not been studied. Concomitant use of GALLIPRANT with other anti-inflammatory drugs, such as COX inhibiting NSAIDs or corticosteroids, should be avoided. If additional pain medication is needed after a daily dose of GALLIPRANT, a non-NSAID/non-corticosteroid class of analgesic may be necessary. The concomitant use of protein-bound drugs with GALLIPRANT has not been studied. Commonly used protein-bound drugs include cardiac, anticonvulsant and behavioral medications. Drug compatibility should be monitored in patients requiring adjunctive therapy. Consider appropriate washout times when switching from one anti-inflammatory to another or when switching from corticosteroids or COX-inhibiting NSAIDs to GALLIPRANT use. The use of GALLIPRANT in dogs with cardiac disease has not been studied. It is not known whether dogs with a history of hypersensitivity to sulfonamide drugs will exhibit hypersensitivity to GALLIPRANT. GALLIPRANT is a methylbenzenesulfonamide.

Adverse Reactions: In a controlled field study, 285 dogs were evaluated for safety when given either GALLIPRANT or a vehicle control (tablet minus grapiprant) at a dose of 2 mg/kg (0.9 mg/lb) once daily for 28 days. GALLIPRANT-treated dogs ranged in age from 2 years to 16.75 years. The following adverse reactions were observed:

<table>
<thead>
<tr>
<th>Adverse reaction*</th>
<th>GALLIPRANT (grapiprant tablets) N = 141</th>
<th>Vehicle control (tablets minus grapiprant) N = 144</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting</td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>Diarrhea, soft stool</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Anorexia, inappetence</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Lethargy</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Buccal ulcer</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Immune mediated hemolytic anemia</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

*Dogs may have experienced more than one type or occurrence during the study.

GALLIPRANT was used safely during the field studies with other concurrent therapies, including antibiotics, parasiticides and vaccinations. To report suspected adverse drug events and/or obtain a copy of the Safety Data Sheet (SDS) or for technical assistance, call 1-888-545-5973.

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

Information for Dog Owners: Owners should be advised of the potential for adverse reactions and be informed of the clinical signs associated with drug intolerance. Adverse reactions may include vomiting, diarrhea, decreased appetite, and decreasing albumin and total protein. Appetite and stools should be monitored and owners should be advised to consult with their veterinarian if appetite decreases or stools become abnormal.

Effectiveness: Two hundred and eighty five (285) client-owned dogs were enrolled in the study and evaluated for field safety. GALLIPRANT-treated dogs ranging in age from 2 to 16.75 years and weighing between 4.1 and 59.6 kgs (9-131 lbs) with radiographic and clinical signs of osteoarthritis were enrolled in a placebo-controlled, masked field study. Dogs had a 7-day washout from NSAID or other current OA therapy. Two hundred and sixty-two (262) of the 285 dogs were included in the effectiveness evaluation. Dogs were assessed for improvements in pain and function by the owners and evaluated for field safety. GALLIPRANT-treated dogs ranged in age from 2 years to 16.75 years. The dose of GALLIPRANT (grapiprant tablets) was 0.9 mg/lb (2 mg/kg) once daily for 28 days. GALLIPRANT-treated dogs ranged in age from 2 yrs to 16.75 years. The results of the field study compared to the vehicle control group (41/131 or 31.3%). GALLIPRANT demonstrated statistically significant differences in owner assessed pain and function. The results of the field study compared to the vehicle control group (41/131 or 31.3%). GALLIPRANT demonstrated statistically significant differences in owner assessed pain and function. The results of the field study demonstrated that GALLIPRANT, administered at 2 mg/kg (0.9 mg/lb) once daily for 28 days was effective for the control of pain and inflammation associated with osteoarthritis.

Storage Conditions: Store at or below 86° F (30° C)

Which of the following prostaglandin receptors is the primary mediator for canine osteoarthritis (OA) pain and inflammation?

A. EP2  B. EP4  C. TXA2

THINK YOU CAN GET ALL FIVE RIGHT?

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Indication

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

Important Safety Information

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  – Immune Health
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To share her dreams
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Vitamin A Deficiency in Insectivorous Lizards
Thomas H. Boyer, DVM, DABVP (Reptile & Amphibian)

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Dr. Anthony Caiafa
BVSc BDSc MACVSc (SA Surgery and Veterinary Dentistry)
QUIZ
PCR for the General Practitioner
Kyle Webb, DVM, DACVP
brief.vet/PCR-GP

QUIZ
Nutrition Facts & Fiction
Deborah E. Linder, DVM, DACVN
brief.vet/nutrition-facts-fiction
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Adverse Reactions: Field safety was evaluated in 244 dogs. The most common adverse reactions were diarrhea and vomiting. Of the dogs that received ENTYCE (n = 171), 12 experienced diarrhea and 11 experienced vomiting. Of the dogs treated with placebo (n = 73), 5 experienced diarrhea and 4 experienced vomiting.

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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

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US Patent: 6,673,929
US Patent: 9,700,591
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AT2-051-1
February 2018
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SHANNA HILLSMAN, LVMT, is a senior technician in the intensive care unit and emergency service at University of Tennessee Veterinary Medical Center, where she teaches technical skills and mentors veterinary technician interns. She is also a blood bank technician and was a speaker at the Veterinary Partners Appreciation Conference in Knoxville, Tennessee.

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M. KATHERINE TOLBERT, DVM, PhD, DACVIM (SAIM), is an assistant professor at University of Tennessee. Dr. Tolbert earned her DVM from University of Georgia, where she also completed a small animal internship. She earned her PhD in comparative biomedical sciences and completed an internal medicine residency at North Carolina State University. Her clinical research is focused on the investigation of gastroprotectants and the rationale for their use in the treatment of inflammatory, metabolic, and neoplastic diseases in small animals.

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LOOK FOR THESE ARTICLES IN FUTURE ISSUES

- Feline Constipation, Obstipation, & Megacolon
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- Phenylpropanolamine Snapshot
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1. Adequan Canine Prescribing Information, Rev. 1/18
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VITAMIN A DEFICIENCY IN INSECTIVOROUS LIZARDS

Thomas H. Boyer, DVM, DABVP (Reptile & Amphibian)
Pet Hospital of Penasquitos
San Diego, California
Vitamin A is an essential hormone that activates genes for maturation of immature epidermal cells (ie, keratinocytes). Without vitamin A, cells undergo hyperkeratosis (ie, an abnormal thickening of the stratum corneum, associated with excess keratin) and squamous metaplasia (ie, transformation of cuboidal, columnar, or ciliated glandular or mucosal epithelium into keratinizing stratified squamous epithelium), particularly in the respiratory, ocular, endocrine, GI, and genitourinary systems.  

1
Background & Pathophysiology

Vitamin A deficiency is common in all captive insectivorous reptiles, including leopard geckos (*Eublepharis macularius*), chameleons (most commonly panther [*Furcifer pardalis*], veiled [*Chamaeleo calyptratus*], and Jackson’s [*Trioceros jacksonii*]), and anoles. It occurs less often in wild reptiles, likely because of their varied diet, which typically includes other reptiles, mammals, birds, and invertebrates.

Vitamin A deficiency is thought to result from dietary deficiency; it is unknown if insectivorous lizards can synthesize vitamin A from carotenoids in their diet. Dietary history and multivitamin review may disclose a lack of vitamin A in the patient’s diet; for example, the patient may not be fed multivitamins that contain vitamin A or may be fed insects that do not receive gut-loading diets or other foods containing vitamin A. Feeder insects are generally deficient in vitamin A and often receive diets deficient in vitamin A. In addition, many food manufacturers omit vitamin A and substitute β-carotene in reptile multivitamins because of misinformation that vitamin A is toxic to insectivores.

Many patients with vitamin A deficiency have long-term ocular disease that is not responsive to multiple antibiotics. Both lacrimal and salivary glands are commonly affected, and patients may have blepharitis, blepharospasm (*Figure 1*), and cheilitis. These patients typically are anorexic and have difficulty shedding (ie, dysecdysis). Leopard geckos may be presented with mucoid-to-solid cellular debris under the eyelids (*Figures 2 and 3*), ulcerative keratitis, and/or abscessation of periorcular glands. Chameleons may have mucoid buildup in the eye, thickened conjunctiva, difficulty capturing prey with the tongue (possibly from dysfunction of sticky mucus glands in the tongue tip), and dull coloration (*Figure 4*, page 18), which can be difficult to identify on examination. Chronic cases may result in blindness.

Herbivores (eg, tortoises, green iguanas [*Iguana iguana*]) and omnivores (eg, bearded dragons [*Pogona vitticeps*]), along with carnivorous lizards and snakes that eat the entire body of an animal, generally are not affected by vitamin A deficiency. Omnivorous Emydidae turtles (eg, box turtles [*Terrapene*]

▲ **FIGURE 1** Healthy panther chameleon (*Furcifer pardalis*; A) with clear rounded eyelids as compared with a panther chameleon with vitamin A deficiency (B). Dull coloration, cheilitis, blepharospema, squinting, mucoid ocular buildup, and dysecdysis are visible over the head and eyelid openings.
spj) and red-eared sliders (*Trachemys scripta elegans*) can develop vitamin A deficiency.

**Diagnosis**
Diagnosis of vitamin A deficiency is based on dietary history and clinical signs. Because most vitamin A is stored in the liver and circulating levels do not fall until liver reserves are exhausted, circulating levels may not be an accurate indicator of overall vitamin A status.

Normal values for liver or circulating levels of vitamin A or retinol are often unknown. Required blood and liver biopsy sample sizes may be greater than can be obtained safely in small patients, and incorrect sample handling and assay techniques can alter values.

Differential diagnoses for ocular and gingival disease may have numerous causes, including infectious (eg, bacterial, fungal, parasitic,
viral), neoplastic, metabolic (eg, calcium deficiency [exposure gingivitis], uric acid deposits [conjunctivitis, retinal detachment, blepharospasm]), traumatic, and environmental (eg, from substrate, ultraviolet light, inappropriate humidity).

Fluorescein staining may reveal corneal ulcers. Corneal cytology may disclose secondary bacterial, fungal, parasitic, or neoplastic disease.

**Treatment**

A vitamin A supplement should be added to the patient’s diet. All vitamin A doses are empiric and range from 5000-66 666 IU vitamin A palmitate per kg IM, SC, or PO every 1 to 2 weeks for 2 treatments. Injectable vitamin A has been associated with hypervitaminosis A; oral supplementation is preferred. Fat-soluble vitamin A is much less toxic than water-soluble vitamin A.

Broad-spectrum ophthalmic antibiotic ointments or antibiotic drops should be administered to lubricate and prevent secondary bacterial infection of the cornea, if compromised. In leopard geckos, solid cellular debris should be moisturized under the eyelids with saline and removed with blunt probes, hemostats, or fine forceps. The patient should be checked for ulcers using fluorescein staining, and eyes should be flushed copiously with saline. Similarly, eyes of chameleons should be flushed with sterile saline to remove thickened mucus and accumulated cellular debris secondary to xerophthalmia. Retained sheds around the eyes and feet and retained hemipenial casts should be removed with the patient under anesthesia.

If the patient has not eaten recently, nutritional support should be provided via fluid therapy and oral caloric supplementation. If the patient is eating, the quality of its diet should be improved. Owners should be instructed to gut load feeder insects with a diet containing vitamin A, at least 8% calcium, multivitamins, trace minerals, proteins, carbohydrates, and fat; to dust all insects with calcium before each patient feeding; and to feed multivitamins containing vitamin A—rather than calcium—twice a month.

![FIGURE 4](panther-chameleon-with-vitamin-A-deficiency-and-blepharospasm-on-presentation(A)-and-2-weeks-after-a-single-injection-of-vitamin-A-palmitate(B).-The-eye-is-markedly-improved,-but-some-blepharedema-remains.)
Wild insectivorous reptiles eat hundreds of invertebrates (eg, insects, arachnids, mollusks, crustaceans), other lizards, mammals, and birds, so pet lizards should be fed as wide a variety of insects as possible; diet should not be restricted to crickets, mealworms, super or king mealworms, waxworms, and/or Dubia roaches. Reptile specialty stores and online vendors sell a wide variety of insects, including other cricket species (eg, black, field, banded), silkworms, black soldier fly larvae (sold as Phoenix worms), tobacco or tomato horn worms (sphinx or hawk moth larvae [sold as goliath worms or green giants]), butterworms, bean beetles, fruit flies, springtails, and wood lice, as well as wild-caught seasonally available insects (eg, moths, cicadas, flies, grasshoppers, katydids, bees [with stingers removed], cockroaches, crustaceans [eg, pill bugs, roly-poly bugs], mollusks [eg, snails, slugs]). Fireflies contain highly toxic lucibufagins and should never be fed to pet lizards. Some insectivorous reptiles will also eat neonatal mice, which are rich in vitamin A.

Patients should be re-evaluated every 1 to 2 weeks until they are eating readily and appear healthy. Body weight should be monitored to determine if nutritional supplementation is indicated, and dietary recommendations should be reviewed with the owners at each appointment to ensure they understand and have implemented the changes.

Precautions
In one study of cricket gut-loading diets, 3 of 4 diets did not improve the crickets’ calcium content because they were not calcium enriched. Feeder insects should be fed a gut-loading diet high in calcium. Calcium-fortified, high-moisture cricket wafers or high-moisture foods (eg, gel water cubes) are ineffective at increasing calcium or vitamin A content and are not recommended, even as a water source. Studies have shown that cubes decrease the effectiveness of gut-loading diets. Larvae will take water from damp paper towels, and other insects will drink from water-filled cotton balls in a bottle or syringe cap. Multivitamins should be discarded if no vitamin A is present, the supplement has expired, or the supplement is more than a year old.

Prognosis
Prognosis is poorer when clinical signs are more advanced or have been present for 6 months or longer. Patients with concurrent disease (eg, hepatic lipidosis, nutritional secondary hyperparathyroidism) also have a poor prognosis. If vitamin A deficiency is diagnosed early and treated appropriately, most patients will make a full recovery.

Patients with long-term vitamin A deficiency may be blind, and patients with severe cases may have corneal fibrosis similar to chronic canine keratoconjunctivitis (Figure 5). Patients with a history of anorexia lasting several months may have hepatic lipidosis and may be susceptible to refeeding syndrome.

▲ FIGURE 5 Corneal scarring in a leopard gecko as a sequela to chronic untreated vitamin A deficiency
**Conclusion**

Vitamin A deficiency in insectivorous reptiles is common and can result in severe epithelial disease, especially involving the eyes. Close attention to diet can prevent and diagnose this deficiency. Insectivores must be fed a varied diet, insects should be dusted with multi-vitamins containing vitamin A twice monthly, and, most importantly, feeder insects must be fed a balanced diet that contains vitamin A and 8% calcium. Clinicians should discuss these requirements in detail with all owners of insectivorous reptiles and amphibians.

**References**


**FIND MORE**

Read more about lizards and other reptiles at cliniciansbrief.com

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- Evaluating Blood Films in Reptiles
- Do Pet Reptiles or Amphibians Pose Any Health Risks to Humans?
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Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

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

Indication: OSURNIA is indicated for the treatment of otitis externa in dogs associated with susceptible strains of bacteria (Staphylococcus pseudintermedius) 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). If alternative otic therapies are required it is recommended to clean the ear(s) before application. 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.

See product insert for complete dosing and administration information.

Contraindications: Do not use in dogs with known tympanic perforation (see Precautions).
Do not use in dogs with a hypersensitivity to flufenicol, 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).
Use with caution in dogs with impaired hepatic function (see Animal Safety and Adverse Reactions).
The safe use of OSURNIA in dogs used for breeding purposes, during pregnancy, or in lactating bitches, has not been evaluated.

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.

Storage Conditions: OSURNIA should be stored under refrigerated conditions between 36° - 46° F (2° - 8° C). To facilitate comfort during administration, OSURNIA may be brought to room temperature and stored for up to three months.

How Supplied: OSURNIA is a gel in a single use tube with a flexible soft tip, supplied in cartons containing 2 or 20 tubes.

NADA # 141-437, Approved by FDA
Elanco, OSURNIA and the diagonal bar are trademarks owned or licensed by Eli Lilly and Company, its subsidiaries or affiliates.

Manufactured for: Elanco US Inc. Greenfield, IN 46140, USA
Product of Great Britain

10/16

Adverse Reactions:
The following adverse reactions were reported during the course of a US field study for treatment of otitis externa in dogs treated with OSURNIA with 1 tube per affected ear(s) and repeated after 7 days:

Frequency of Adverse Reaction by Treatment

<table>
<thead>
<tr>
<th>Adverse Reaction</th>
<th>OSURNIA (n=190)</th>
<th>Placebo (n=94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated Alkaline Phosphatase</td>
<td>15 (7.9%)</td>
<td>3 (3.2%)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>7 (3.7%)</td>
<td>1 (1.1%)</td>
</tr>
<tr>
<td>Elevated AST, ALT, ALP*</td>
<td>2 (1.1%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Weight loss (&gt;10% body weight)</td>
<td>1 (0.53%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Hearing Decrease/Loss</td>
<td>1 (0.53%)</td>
<td>1 (1.1%)</td>
</tr>
</tbody>
</table>

*Aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP). Two dogs with pre-existing elevations in ALP were reported to have an increase in liver enzymes (ALP, ALT and/or AST) at study exit. Subsequent clinical chemistries returned to pre-treatment levels in one dog, while no follow up was performed for the second dog.
APPLIES LIKE A LIQUID
STAYS LIKE A GEL

Choose the otitis externa solution that goes AND stays where you need it for increased contact time at the source of infection.

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

IMPORTANT SAFETY INFORMATION
OSURNIA® (florfenicol/terbinafine/betamethasone acetate) is for otic use only under veterinary supervision. Do not use in dogs with known tympanic perforation or a hypersensitivity to florfenicol, terbinafine or corticosteroids. Adverse reactions observed during clinical trials include vomiting, increased liver enzymes and transient loss of hearing. Please see Brief Summary of Full Prescribing Information on 22.
Fungal Dermatoses

Fungi are ubiquitous organisms that are classified as yeast (ie, unicellular), mold (ie, multicellular), or both. Fungi live in the soil but can also be pathogens of plants and animals. They are characterized by cell walls made of chitin, which can play a role in phenotypic expression. Like animals, fungi are heterotrophs and must ingest or absorb nutrients for energy. They are considered ecologically to be decomposers and important in the recycling of nutrients back to the environment. Many fungi can reproduce by either sexual or asexual reproduction.

Most fungi are opportunistic pathogens, meaning invasion requires compromised natural host defense mechanisms (eg, trauma to skin, underlying disease). Reaction patterns include acute suppurative inflammation and microabscess formation, chronic granulomatous or pyogranulomatous inflammation, and necrosis secondary to blood vessel invasion and subsequent tissue infarction. Most species carry risk for zoonosis.

Diagnostic methods include cytology (including lymph node aspirates), Wood’s lamp screening (useful for selecting hairs to sample for culture), dermatophyte test medium, macerated tissue culture, and histopathology (often with special stains). Serologic and immunodiagnostic testing are available through some universities. Topical antifungals (eg, lime sulfur, chlorhexidine, nystatin) can be useful adjunctive therapies. Systemic therapies, including azoles, griseofulvin, terbinafine, amphotericin B, and flucytosine, as well as immunotherapy, antifibrotics (eg, pentoxifylline), antibiotics, and/or anti-inflammatory drugs are often needed and may be used in combination. Surgical resection of granulomas may be needed in combination with systemic therapy. Infection relapse is common, and prognosis for recovery is guarded to poor in cases in which dermatosis has spread to other body sites.—White A

Ecology & Control of Ticks

In North America, there is only one predominant flea species of concern in dogs but at least 10 different tick species of concern. Marked regional differences exist among tick species, and some species have demonstrated shifting distribution patterns and numbers. Larval activity is generally highest in August and September. Larvae molt to nymphs in the spring and predominate in May through July in the north. Adults are most common from October through December but can be active from March to May. With fleas, control is generally targeted at the primary reproductive host (ie, the infested dog or cat); however, with 3-host ticks, most reproducing ticks are on wildlife hosts, necessitating the protracted use of acaricide preventives in many regions. Efficacy in most product studies has been high, but there is significant variation in efficacy in the natural environment, and 100% control is rare. The perceived efficacy of acaricides may be directly proportional to the volume of ticks encountered. Thus, with increasing and shifting tick populations, there may be a perception of decreased acaricide efficacy. Pet owners may view a product with 95% efficacy against ticks as a failure while considering a product with the same level of flea control as satisfactory. Management of owner expectations has become increasingly important. Additional control measures are sometimes warranted but should be carefully discussed with owners first. These measures may include increased application frequency, destruction of tick habitats, indoor acaricide sprays, and restricting pet access to tick-infested environments.—Dryden MW
Pemphigoid Diseases

All forms of pemphigus diseases develop intraepidermal blistering due to antidesmosomal autoantibodies and the resulting loss of cell-to-cell contact. Humans with pemphigus vulgaris exhibit skin erosion more than blistering, consistently have mucous membrane and sometimes skin involvement, and are identified mostly in Europe, the United States, and Japan, with older women overrepresented. ELISA testing for circulating antibodies against desmoglein 3 is a good diagnostic and monitoring test for pemphigus vulgaris.

In contrast to pemphigus vulgaris, pemphigus foliaceus is almost always erosive and does not affect the mucous membranes. It is the most common form seen in South America and North Africa. Testing focuses on circulating antibodies against desmoglein 1.

A third form of pemphigus, paraneoplastic pemphigus, is differentiated by the presence of a known- or occult-associated neoplasm (usually of lymphoid tissue) and is exceedingly rare. Immunoblotting tests for reactivity to envoplakin and perilipakin may aid diagnosis.

Although corticosteroids and corticosteroid-sparing immunosuppressive drugs (eg, azathioprine, mycophenolate mofetil) continue to be the treatments of choice, new therapies such as the anti-CD20 monoclonal antibody rituximab, immunoadsorption, and high-dose intravenous immunoglobulins are emerging.—Kasperkiewicz M

Hyperbaric Oxygen Therapy in Veterinary Dermatology

Hyperbaric oxygen therapy (HBOT) is used to achieve saturation of compromised tissue in nearly 100% oxygen under pressure. Oxygen subsequently exceeds the saturation point of hemoglobin, diffusing directly into plasma and absorbing directly into tissue across skin. Indications in humans include complicated diabetic wounds, necrotizing fasciitis, skin grafts, osteomyelitis, and crush injuries. Oxygen is an essential cofactor in nearly every aspect of wound healing, including fibroblast activity, collagen synthesis and formation, macrophage function, bacterial phagocytosis, angiogenesis, and epithelial cell division. In healthy humans, skin wounds generally have partial pressure of oxygen (PO2) levels 20 mm Hg below that of surrounding healthy tissue. Under standard atmospheric conditions, the PO2 in a wound can be as low as 20 to 40 mm Hg. Humans with impaired cardiorespiratory function, anemia, poor perfusion, thrombosis, or other vascular compromise can have even lower PO2 at the site of the wound. During HBOT, tissue PO2 can exceed 350 to 500 mm Hg. In one study in humans, HBOT increased wound healing time by a factor of up to 15. HBOT also has direct bactericidal effects on many gram-positive and gram-negative organisms.

On leaving the hyperbaric oxygen chamber, PO2 at the wound site remains above 40 mm Hg for up to 3 hours. Breaks are needed between therapy sessions, however, because prolonged hyperoxic states can delay healing. Complications of HBOT can include barotrauma of the middle ear, sinuses, or intestines; these typically occur as a result of failure to equalize pressure during ascent and descent. Seizures can occur with oxygen toxicity but are rare. Light sedation can help patients overcome fear of the chamber; however, opioids are contraindicated.—Angus JC

Oxygen is an essential cofactor in nearly every aspect of wound healing.
Approximately 38% of American households own cats, with an average of 2 per household.1 With cats now outnumbering dogs as pets, it comes as no surprise that improvements in feline care, specifically preventive medicine, are critical for the vitality of a veterinary practice. Improving feline flea and tick control is an opportunity to not only provide better patient care but also promote practice growth.
Prevention Is Better than Treatment
Parasitic infestation may be difficult to spot in cats as a result of their highly effective grooming habits (See Suggested Reading). Flea allergy dermatitis (the most frequently diagnosed hypersensitivity condition in cats) may also be misdiagnosed as psychogenic alopecia or other dermatopathies. Although parasitic infections can cause discomfort, they can also transmit fatal diseases. A recent study found that as many as 80% of fleas collected from cats contained at least 1 organism that could cause illness in cats. By the time these diseases are detected, the opportunity for prevention has passed.

Infestation can result in high treatment costs, inconvenience for clients, and additional concerns regarding the pet’s health.

Don’t Forget Ticks
Many current ectoparasite prevention products for cats do not provide protection against ticks. Tick-borne diseases in cats include cytauxzoonosis, tularemia, anaplasmosis, babesiosis, ehrlichiosis, and hemotrophic mycoplasmosis, also known as feline infectious anemia. Infections with these organisms can cause an array of clinical signs, ranging from mild to life threatening if untreated.

Yes, Even Indoor Cats Need Protection
Cats may be at an even greater risk for parasitic infection than owners expect. Some clients may consider their cat to be “indoor,” even if the pet occasionally goes outside. In addition, because there may be other animals in the house that go outdoors, it is crucial to treat all pets in the home. Owners may also be unaware their home is infested with mice, squirrels, or other animals that carry parasites into the home. Even still, fleas and ticks can hitchhike inside any time of the year (See Suggested Reading).

Make Flea & Tick Control Less Stressful for Clients
Cat owners are less likely to make regular veterinary visits for their cats if they find the experience difficult or stressful for them or their pet. The ability to dose less frequently translates to higher adherence and causes less stress for the client and patient. For the health of patients, their owners, and the practice, it is critical to ensure cats get the care they need to prevent parasites.

A recent study found that as many as 80% of fleas collected from cats contained at least 1 organism that could cause illness in cats or humans.

REFERENCES

SUGGESTED READING
Compounded Veterinary Medications

Veterinary medications are compounded for many reasons (eg, to improve ease of administration, because of a lack of availability of that drug in an approved form, because of an unsuitable original dosage formulation). Due to withdrawal of the “Compounding of Drugs for Use in Animals” Guide and the subsequent withdrawal of its replacement “Guidance for Industry,” no FDA policies are in place for compounded medications for veterinary use. However, there are restrictions in place.

The source of the drug should be a United States Pharmacopeia grade substance, drugs should be compounded from the original formulation (if one exists), and compounding from bulk drugs should be performed only with FDA-registered chemicals—and only if there is not a proprietary formulation available. Many drugs undergo changes in stability, efficacy, and potency when changed from their original formulation or when mixed with other ingredients, and certain drugs are not bioavailable when compounded from bulk chemicals instead of the name brand.

An additional compounding concern is that even slight changes in pH from mixing can affect a drug, thereby decreasing stability, increasing degradation time, and causing oxidation of the drug, rendering it inactive. In addition, compounding pharmacies have been known to extend the best-by-use date of aqueous solutions, potentially leading to the distribution of subtherapeutic medications. Voluntary accreditation by the Pharmacy Compounding Accreditation Board helps the pharmacy adhere to a high standard of quality.—Papich MG

Many drugs undergo changes in stability, efficacy, and potency when changed from their original formulation or when mixed with other ingredients.

For topical application in cats only. Not for oral or ophthalmic use.

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

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

INDICATION: Mirataz™ is indicated for the management of weight loss in cats.

DOSEAGE AND ADMINISTRATION: Administer topically by applying a 1.5-inch ribbon of ointment (approximately 2 mg/cat) on the inner pinna of the cat’s ear once daily for 14 days. Wear disposable gloves when applying Mirataz™. Alternate the daily application of Mirataz™ between the left and right inner pinna of the ears. See Product Insert for complete dosing and administration information.

CONTRAINICATIONS: Mirataz™ is contraindicated in cats with a known hypersensitivity to mirtazapine or to any of the excipients. Mirataz™ should not be given in combination, or within 14 days before or after treatment with a monoamine oxidase inhibitor (MAOI) (eg, selegiline hydrochloride [L-deprenyl], amitriptyline), as there may be an increased risk of serotonin syndrome.

HUMAN WARNINGS: Not for human use. Keep out of reach of children. Wear disposable gloves when handling or applying Mirataz™ to prevent accidental topical exposure. After application, dispose of used gloves and wash hands with soap and water. When application, care should be taken that people or other animals in the household do not come in contact with the treated cat for 2 hours because mirtazapine can be absorbed transdermally and orally. However, negligible residues are present at the application site and the body of intact skin exposure, wash thoroughly with soap and warm water. In case of accidental eye exposure, flush eyes with water. If skin or eye irritation occurs seek medical attention. In case of accidental ingestion, or if skin or eye irritation occurs, seek medical attention.

PRECAUTIONS: Do not administer orally or to the eye. Use with caution in cats with hepatic disease. Mirtazapine may cause elevated serum liver enzymes (See Animal Safety in the product’s insert). Use with caution in cats with kidney disease. Kidney disease may cause reduced clearance of mirtazapine which may result in higher drug exposure. Upon discontinuation of Mirataz™, it is important to monitor the cat’s food intake. Food intake may lessen after discontinuation of mirtazapine transdermal ointment. If food intake diminishes dramatically (>75%) for several days, or if the cat stops eating for more than 48 hours, reevaluate the cat. Mirataz™ has not been evaluated in cats < 2 kg or less than 6 months of age. The safe use of Mirataz™ has not been evaluated in cats that are intended for breeding, pregnant or lactating cats.

ADVERSE REACTIONS: In a randomized, double-masked, vehicle-controlled field study to assess the effectiveness and safety of mirtazapine for the management of weight loss in cats, 115 cats treated with Mirataz™ and 115 cats treated with vehicle control were evaluated for safety. The vehicle control was an ointment containing the same inert ingredients as Mirataz™ without mirtazapine. The most common adverse reactions included application site reactions, behavioral abnormalities (vocalization and hyperactivity), and vomiting. See Product Insert for complete Adverse Reaction information. To report suspected adverse events, for technical assistance or to obtain a copy of the SDS, contact Kindred Biosciences, Inc. at 888-608-2542. 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: The effectiveness of Mirataz™ (mirtazapine transdermal ointment) was demonstrated in a randomized, double-masked, vehicle-controlled, multi-site field study involving client-owned cats of various breeds. Enrolled cats were ≥ 1 year of age and had existing documented medical history of ≥ 5% weight loss deemed clinically significant. The most common pre-existing conditions included renal insufficiency, vomiting, and hyperesthesia. Some cats had more than one pre-existing condition. Cats were randomized to treatment groups in a 1:1 ratio of Mirataz™ to vehicle control. A total of 230 cats were enrolled and received either Mirataz™ (115 cats) or a vehicle control (115 cats) containing the same inert ingredients without mirtazapine. The cats were 2.8-24.6 years of age and weighed 2.1-9.2 kg. The dosage was a 1.5-inch ribbon (approximately 2 mg/cat) mirtazapine or vehicle ointment administered topically to the inner pinna of the cat’s ear. A total of 177 cats were determined to be eligible for the effectiveness analysis; 83 cats were in the Mirataz™ group and 94 cats were in the vehicle control group. The primary effectiveness endpoint was the mean percent change in body weight from Day 1 to the Week 2 Visit. At Week 2, the mean percent increase in body weight from Day 1 was 3.94% in the mirtazapine group and 0.41% in the vehicle control group. The difference between the two groups was significant (p<0.001) based on a two-sample t-test assuming equal variances. A 95% confidence interval on the mean percent change in body weight for the Mirataz™ group is (2.77, 5.11), demonstrating that the mean percent change is statistically different from and greater than 0.

STORAGE: Store below 25°C (77°F). Multi-use tube. Discard within 30 days of first use.

HOW SUPPLIED: Mirataz™ is supplied in a 5 gram aluminum tube.

MANUFACTURED FOR: Kindred Biosciences, Inc. 1555 Bayshore Highway, suite 200 Burlingame, CA 94010

NADA 141-481, Approved by FDA
Made in USA.
NDC 86078-668-01 REG-MTZBS-008 Rev. 26Apr2018
Mirataz™ is a trademark of Kindred Biosciences, Inc. ©2018 Kindred Biosciences, Inc. All rights reserved.
The FIRST AND ONLY FDA-approved transdermal medication for the management of weight loss in cats

For more information, contact your KindredBio Sales Specialist at 1-888-608-2542, your preferred Distributor Sales Representative, or go to kindredbio.com/Mirataz.

In clinical studies, Mirataz™ (mirtazapine transdermal ointment) resulted in significant weight gain in cats in as little as 14 days following topical application of 2 mg per day1.

Mirataz gives your clients a practical way to manage their cat’s weight loss without administration of oral medication and does not rely on the cat to eat to be medicated.

Due to proprietary Accusorb™ technology, Mirataz achieves measurable plasma concentrations of mirtazapine in cats2.

Mirataz was well tolerated both locally and systemically in clinical studies1.

✔ In clinical studies, Mirataz™ (mirtazapine transdermal ointment) resulted in significant weight gain in cats in as little as 14 days following topical application of 2 mg per day1.
✔ Mirataz gives your clients a practical way to manage their cat’s weight loss without administration of oral medication and does not rely on the cat to eat to be medicated.
✔ Due to proprietary Accusorb™ technology, Mirataz achieves measurable plasma concentrations of mirtazapine in cats2.
✔ Mirataz was well tolerated both locally and systemically in clinical studies1.

Important Safety Information

Mirataz™ (mirtazapine transdermal ointment) is for topical use in cats only under veterinary supervision. Do not use in cats with a known hypersensitivity to mirtazapine or any of the excipients. Do not use in cats treated with monoamine oxidase inhibitors (MAOIs). Not for human use. Keep out of reach of children. Wear gloves when handling/applying, wash hands after and avoid contact between the treated cat and people or other animals for 2 hours following application. Use with caution in cats with hepatic and kidney disease. Cat’s food intake should be monitored upon discontinuation. Safety has not been evaluated in cats less than 2 kg, less than six months of age or in breeding, pregnant or lactating cats. The most common adverse reactions observed during clinical trials were application site reactions, behavioral abnormalities (vocalization and hyperactivity) and vomiting. For additional safety information, see brief summary of prescribing information on page 26.

JumpStart antimicrobial surgical dressings generate microcurrents to reduce the risk of infection and support healing.\textsuperscript{1,2}

- Powered by Advanced Microcurrent Technology\textsuperscript{*}, an embedded matrix of moisture-activated islands designed to mimic physiologic currents creates an optimal environment for wound healing
- JumpStart dressings kill a broad spectrum of harmful pathogens including multidrug-resistant and biofilm-forming bacteria\textsuperscript{1,3,4}

References:

*Advanced Microcurrent Technology is a trademark of Vomaris Innovations, Inc.
Drug interactions can occur in the veterinary setting and may result in negative consequences to the patient. A *drug interaction* refers to a reaction between one or more drugs that alters the effect of or affects the properties of one or both drugs. Drug interactions can occur during or after administration and may be synergistic, antagonistic, or additive. Interactions between incompatible drugs are always antagonistic. Antagonistic interactions result in decreased drug effectiveness when one drug alters the absorption, distribution, metabolism, or excretion of another or when the interaction causes a direct pharmacodynamic effect that harms the patient. An *adverse drug event* (ADE) refers to patient injury related to a medical intervention involving a drug.

Critically ill patients are at increased risk for ADEs because they often receive multiple medications concurrently and have serious diseases that may be exacerbated by administration of these medications. The frequency and severity of drug interactions in veterinary intensive care units (ICUs) are unknown, as no standard reporting mechanisms are in place.
have been established. Reports in human medicine vary substantially: 8.5% to 15% (per 100 admissions) of patients admitted to an ICU may have an ADE,2-4 with up to 54% of patients having a potential drug–drug interaction.5 Adverse events have been associated with a more costly and longer ICU stay.2,4 Most reported ADEs in humans were considered significant or serious, with a smaller percentage being potentially life-threatening or fatal.3,6 Extra-label use of medications, a common practice in veterinary medicine, has been reported to increase ADEs in ICUs.7 Veterinary staff must be diligent in reviewing all medications prescribed to a patient, including reviewing each drug’s dosage, potential adverse effects, and known and potential interactions with other medications.1,8

Drug interactions come in many forms, including:

- Incompatibilities of drugs administered at the same time to the same patient
- Ineffectiveness of a single drug when a certain carrier or environment (eg, gastric acidity) is present
- Dosing errors that move outside the therapeutic dose (likely the most frequent)9-11
- Drugs or certain disease processes that alter a drug’s absorption, distribution, metabolism, or excretion
- Direct pharmacodynamic interactions
- Adverse effects1

This article presents the author’s top 5 potential mechanisms of ADEs in the ICU.

1 Incompatibility

Many drugs are chemically incompatible, often due to the pH or carrier molecules in the drug formulation. For example, diazepam is not compatible with many drugs because of the propylene glycol carrier, enrofloxacin may have decreased availability when administered with divalent cation (calcium or magnesium)-containing solutions, and the injectable forms of butorphanol and furosemide—both often administered to patients presented with respiratory distress from congestive heart failure—may form a precipitate if administered together.

Butorphanol (for sedation) and furosemide (a potent loop diuretic) are common initial treatment choices for patients presented with acute congestive heart failure. Both injectable medications can be given intravenously or intramuscularly, but they cannot be combined. Furosemide is a mildly alkaline, buffered product and should not be mixed with solutions that have a pH less than 5.5; the pH of butorphanol varies between manufacturers but may be between 3.0 and 5.5.8,12,13 When these drugs are allowed to interact through combination in a syringe or an IV line, a cloudy precipitate may form (Figure 1, previous page). This precipitate can damage tissue or occlude a vessel—particularly in the cerebral and pulmonary vasculature, which can be life-threatening—and one or both drugs may be ineffective. To prevent this interaction, drug compatibility should always be determined prior to combination (in a syringe) or coadministration of drugs in any fluid lines; in addition, the fluid line should be thoroughly flushed with a compatible solution between administration of each drug.

2 Related Mechanisms of Action & Additive Effect

Critically ill patients are susceptible to GI ulceration (Figure 2) because of many factors, including primary or secondary GI disease, surgery, hypoperfusion, and mechanical ventila-
Corticosteroids and NSAIDs typically should not be used together, as their combined actions are likely to cause severe GI ulceration. Corticosteroids exert their anti-inflammatory effect in part through inhibition of several enzymes in the arachidonic acid cascade (eg, phospholipase A2, cyclooxygenase); NSAIDs also inhibit cyclooxygenases.\textsuperscript{14} The arachidonic acid cascade is important for maintaining normal GI mucosa and renal perfusion. Inhibition of prostaglandin production results in poor GI blood flow and poor mucosal barrier function, exposing the mucosa to the low pH of gastric acid and causing development (and poor healing) of gastric and intestinal ulcers.\textsuperscript{15,16}

When a patient requires a change in anti-inflammatory medication, a “washout” period between medications should be observed. The ideal washout period has not been established for all drugs, but a period of 4 to 5 half-lives of the individual drug (resulting in a time frame of 3-5 days for many drugs) has been suggested anecdotally.\textsuperscript{17-19} When a washout period is not possible, a patient has inadvertently been administered more than one anti-inflammatory drug, an overdose is suspected, or a patient is known or suspected to have GI ulceration, gastroprotective medications should be started, and the anti-inflammatory drug should be discontinued, if possible. Medications that may treat or prevent gastric ulcer formation include H\textsubscript{2}-receptor antagonists, proton pump inhibitors, sucralfate, or prostaglandin analogues.\textsuperscript{20} Although proton pump inhibitors are more effective as acid reducers than are H\textsubscript{2}-receptor antagonists, their onset of action may be prolonged.

**Inhibition of Absorption**

GI ulceration is common in critically ill patients and can cause protein and blood loss, poor appetite, pain, poor nutrition, vomiting, and sepsis. Sucralfate is a sucrose-sulfate-aluminum complex that in the acidic environment of the stomach is converted into a paste to provide a physical barrier over an ulcer. It adsorbs pepsin and bile acids, prevents diffusion of hydrogen ions into the gastric mucosa, and may stimulate the production of prostaglandin E,\textsuperscript{21} all of which promote an environment for GI ulcers to heal.

Sucralfate interferes with the absorption of many drugs, such as antibiotics and antifungal drugs.\textsuperscript{22-24} Because it has the potential to decrease absorption and the effectiveness of other orally administered medications,\textsuperscript{21,25-27} sucralfate should be administered at least 2 hours before or after other oral medications. This separation has resulted in improved absorption of some drugs; however, ideal time frames for all drugs have not been determined.

**Neurologic Side Effects**

Many ICU patients may have either an existing primary neurologic disease or have a condition that secondarily affects the neurologic system (eg, hypoglycemia, hypokalemia, hypernatremia). In addition, ICU patients are commonly exposed to a variety of medications.
that can affect the neurologic system, such as analgesics (eg, opioids, tramadol), prokinetic medications (eg, metoclopramide), antibiotics (eg, metronidazole), and sedatives (eg, acepromazine, trazodone, benzodiazepines, α2 agonists).

Trazodone and tramadol are commonly used drugs for which use has increased substantially in the last several years. Trazodone is a serotonin antagonist and reuptake inhibitor and has several reported mechanisms of action.28 When combined, these drugs can cause serotonin syndrome (Figure 3), a condition characterized by GI signs (eg, vomiting, diarrhea), cardiorespiratory signs (eg, dyspnea, arrhythmias), and neurologic signs (eg, seizures, hyperthermia, hyperesthesia, depression, vocalization, ataxia, coma). Although serotonin syndrome has not been reported with coadministration of trazodone and tramadol in animals, it has been observed in humans when both trazodone and tramadol are used in combination with opioids and other serotonin and norepinephrine reuptake inhibitors—occasionally with lethal consequences.29-31

Any medications with a similar mechanism of action should be prescribed together cautiously; if adverse effects are noted, both drugs should be discontinued and appropriate supportive care initiated.

5 Effects on Potassium

ICU patients often require treatment for conditions that affect serum potassium concentration, including urinary tract disease, toxicities, diabetes, adrenal gland disease, abdominal effusions, and nutritional deficiencies. Potassium concentration should be monitored closely in these patients, as severe hyperkalemia can lead to altered cardiac function and death (Figure 4), and severe hypokalemia can cause muscle weakness, poor GI function, hypoventilation, and death.

Many drugs can alter potassium levels and exacerbate many of these conditions. Hyperkalemia can occur after administration of potassium-containing fluids, potassium supplementation (eg, potassium
chloride, potassium phosphate, potassium acetate, NSAIDs, ACE inhibitors, and spironolactone. Hypokalemia may occur following administration of IV fluids, insulin, sodium bicarbonate, dextrose, diuretics, and β agonists (eg, epinephrine, terbutaline). Any patient that is hospitalized and receiving any of these medications, particularly if any of the conditions noted in this article are present, should have serum potassium concentration monitored closely and corrected if necessary.

References
Applications are now open for the drive in Goa, India.

OCTOBER 2018

APPLY TODAY!

MISSION RABIES HELPS MORE THAN JUST ANIMALS.

“The work was very rewarding and very appreciated. The Mission Rabies project has made a tremendous impact on the reduction of rabies in Malawi. I am thankful to have been a volunteer. I would recommend this project to anyone interested in a global, humanitarian, animal welfare project.”

— Karen Taylor-Sorenson, DVM

For more information about the Mission Rabies projects, visit missionrabies.com
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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Transitioning Cats from Lente Insulin to Protamine Zinc Insulin

Andrew C. Bugbee, DVM, DACVIM
University of Georgia

In the Literature

FROM THE PAGE …

This study* assessed a protocol for transitioning cats from a porcine-source lente insulin (LI) to a human-recombinant protamine zinc insulin (PZI). Although both insulin formulations have been shown to be efficacious in the management of feline diabetes mellitus, PZI has been reported to exhibit a longer duration of action in a model of healthy cats.1-3

Inclusion criteria included diagnosis of diabetes mellitus within the previous 5 months, twice-daily LI injections for at least 6 weeks, and eating a low-carbohydrate, high-protein diet for at least 10 days. Cats (n = 22) were screened for concurrent conditions and underwent a 24-hour glucose curve to assess response to LI (median dose, 0.5 U/kg). A validated clinical scoring system (Diabetic Clinical Score) and patient and owner quality-of-life (QOL) assessments were serially evaluated at set time points over the study period. Following determination of glycemic responses to LI, patients were transitioned to twice-daily PZI at manufacturer-recommended starting doses (median dose, 0.5 U/kg). Glucose curves were serially assessed over a 12-week period, with PZI doses adjusted using a preinsulin and nadir glucose concentration-based protocol.

After the 12-week PZI period, diabetic cats had statistically significant reductions in serum fructosamine, lower clinical scores, and lower administered insulin doses; QOL scores were indicative of improved QOL. Although true duration of action is difficult to define when insulin is administered twice daily, 6 LI-treated cats were documented to have short durations of action (<9 hours); only 2 PZI cats were found to have an action duration <9 hours. All cats noted to have durations of insulin action <9 hours were found to experience improved durations when treated with the opposite formulation.

Periods of subclinical and clinical hypoglycemia were uncommon (15.8%) but were noted with both insulin formulations. Although the study was not designed to prove superiority of one insulin formulation, 22.7% of cats entered remission within 12 weeks of being transitioned to PZI, which suggests that PZI is a viable treatment option for diabetic cats.

… TO YOUR PATIENTS

Key pearls to put into practice:
1. PZI may result in improved diabetic outcomes in cats as compared with LI, which is likely attributable to a consistently more appropriate duration of insulin action.
2. In cases of poor duration of insulin action, cats may exhibit more favorable responses when transitioned to a different insulin type.
3. Transition to PZI can be safely accomplished using manufacturer-recommended starting doses, with subsequent dose titrations directed by serial glycemic monitoring of the patient’s insulin response.

*This study was supported by Boehringer Ingelheim.

References
Immune-Mediated Neutropenia

Shawn Kearns, DVM, DACVIM
Angell Internal Medicine
Boston, Massachusetts

In the Literature

FROM THE PAGE …

This retrospective study examined records of a cohort of dogs with presumed primary immune-mediated neutropenia. Included in the study were 35 dogs with neutrophil concentrations <1.5 × 10⁹ cells/L (based on a minimum of 2 CBCs) and for which other causes of neutropenia or secondary immune-mediated neutropenia were excluded. The authors sought to describe presenting clinical characteristics, CBC results, bone marrow characteristics, therapies used, clinical response to treatment, and outcomes at 6 months and one year.

The most common presenting clinical complaints included lethargy and anorexia (63%); 46% of dogs had increased body temperature. Neutropenia was <0.5 × 10⁹ cells/L in 60% of dogs; 8 had thrombocytopenia, which was severe in 3 dogs. Twenty-three dogs had myeloid hyperplasia, 10 had myeloid hypoplasia, and 2 had normal myelopoiesis. Serum chemistry results included elevated liver values and various electrolyte abnormalities. Abdominal ultrasonographic images and thoracic and abdominal radiographs were unremarkable in most cases; splenomegaly was the most common finding. Dogs were started on a corticosteroid initially; 43% required adjunctive treatment using either azathioprine or cyclosporine. Neutropenia resolved in 32 of 33 dogs within 2 weeks of beginning treatment and in all dogs within 1 month.

Although response rates for resolution of neutropenia were rapid in this report, other cytopenias may take longer to resolve or may require additional treatment. In addition, relapse was common in this study (34.3%), emphasizing the need for consistent patient follow-up and the need for further studies to determine optimal therapy—in particular, steroid doses, treatment duration, and secondary immunosuppressive drugs.

A diagnosis of immune-mediated neutropenia remains a diagnosis of exclusion. Because it is considered an uncommon cause of neutropenia, testing to exclude other causes should include urine culture, abdominal ultrasonography, thoracic radiography, and vector-borne disease testing. Other infectious disease (eg, fungal, parvovirus) testing may be warranted depending on the patient’s geographic location, age, and vaccination status. In one retrospective evaluation of neutropenia, nonbacterial infectious diseases were found most commonly.

… TO YOUR PATIENTS
Key pearls to put into practice:

1. Because immune-mediated neutropenia remains primarily a diagnosis of exclusion, ancillary testing is important to exclude other causes of neutropenia.

2. Although the initial response to treatment appears favorable and fast, owners should be educated about the need for follow-up due to potential relapse during drug tapering or treatment cessation.

3. Although the ideal secondary immunosuppressive drug remains unknown, additional therapies beyond glucocorticoids can be considered to maintain remission.

References
LOVE at one dose

Meet Claro®
The only FDA-approved, single-dose canine otitis externa treatment regimen.

Claro® is indicated for the treatment of otitis externa in dogs associated with susceptible strains of yeast (*Malassezia pachydermatis*) and bacteria (*Staphylococcus pseudintermedius*).

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

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**INDICATIONS:** Claro® Otic Solution is indicated for the treatment of otitis externa in dogs associated with susceptible strains of yeast (*Malassezia* spp.), *Pseudomonas* spp., and *Staphylococcus* spp.

**CONTRAINDICATIONS:** Do not use in dogs with known tympanic membrane perforation. Claro® is contraindicated in dogs with known or suspected hypersensitivity to florfenicol, terbinafine hydrochloride, or mometasone furoate.

**WARNINGS:**

**Human Warning:** Not for use in humans. Keep this and all drug products out of reach of children. In case of accidental ingestion by humans, contact a physician immediately. In case of accidental skin contact, wash area thoroughly with water. Avoid contact with eyes. Humans with known hypersensitivity to florfenicol, terbinafine hydrochloride, or mometasone furoate should not handle this product.

**PRECAUTIONS:**

Do not administer orally.

The use of Claro® in dogs with perforated tympanic membranes has not been evaluated. The integrity of the tympanic membrane should be confirmed before administering the product. Permeability of the dog's ear may result in ototoxic, vestibular, or cochlear dysfunction.

**ADVERSE REACTIONS:**

1. In a field study conducted in the United States (see EFFECTIVENESS), there were no directly attributable adverse reactions in 146 dogs administered Claro®. For additional information, contact Bayer HealthCare at 1-800-422-9874.

**PHARMACOLOGY:**

Claro® Otic Solution is a fixed combination of three active substances: florfenicol (antibacterial), terbinafine hydrochloride (antifungal), and mometasone furoate (steroidal anti-inflammatory). Florfenicol is a bacteriostatic antibiotic which acts by inhibiting protein synthesis. Terbinafine is an antifungal agent which selectively inhibits the early synthesis of ergosterol. Mometasone furoate is a glucocorticoid with anti-inflammatory activity.

**MICROBIOLOGY:**

The compatibility and additive effect of each of the components in Claro® Otic Solution was demonstrated in vitro. Florfenicol and terbinafine hydrochloride inhibit the growth of bacteria and yeast commonly associated with otitis externa in dogs. No consistent synergistic or antagonistic effect of the two antimicrobials was demonstrated. The addition of mometasone furoate to the combination did not impair antimicrobial activity in any clinically significant extent.

**EFFECTIVENESS:**

In a well-controlled, double-blind field study, Claro® was evaluated against a vehicle control in 221 dogs with otitis externa. One hundred and forty-one dogs were treated with Claro® and 75 dogs were treated with the vehicle control. All dogs were evaluated for safety. Treatment (1 ml) was administered once on Day 1 to the affected ear(s). Prior to treatment, the ear(s) was cleaned with saline. The dogs were evaluated on Days 0, 7, 14, and 30. Blood work and urinalysis were obtained on Day 0 pre-treatment and Day 30 post study completion. Four clinical signs associated with otitis externa were evaluated: erythema, oozing, crusting, and pruritis. Success was based on clinical improvement at Day 30. Of the 183 dogs included in the effectiveness evaluation, 72.5% of dogs administered Claro® solution were successfully treated, compared to 11.1% of the dogs in the vehicle control group (p<0.001).

**ANIMAL SAFETY:**

In a labeled animal study, Claro® was administered orally to 12-week-old beagle puppies (4 dogs/group) at 0X, 10X, and 100X the recommended dosage for 2 weeks during a 30-day dosing period of 4 weeks. The lower treatment dosage, no clinically relevant treatment-related findings were noted (including weight, body weight, body weight gain, or food consumption). Claro® administration was associated with post-treatment ear oozing or aural raw or tender, increased discrete epidermis erosion, decreased dermal lymphocytes and mononuclear cells, suppression of the auricular capsular response to ACTH stimulation, decreased auricular weight and length of the auricular cartilage, increased ear weight with hyperemia and engorgement, and decreased thymus weight. Other post-treatment treatment-related effects included mild changes in ALT, total protein, uric acid, phosphates, creatinine, and calcium.

**STORAGE INFORMATION:**

Store between 2ºC-25ºC (36ºF-77ºF), excursions permitted 15ºC-30ºC (59ºF-86ºF).

**HOW SUPPLIED:** Claro® solution is supplied in a single-use dropperette in a blister. Each dropperette contains 1.0 mL of solution. Claro® is available in cartons of two, ten, or twenty dropperettes.

Short-Term Anxiolysis for Feline Visits

Glenn A. Olah, DVM, PhD, DABVP (Feline)
Winn Feline Foundation
Albuquerque Cat Clinic
Albuquerque, New Mexico

In the Literature

FROM THE PAGE …
Stress associated with transportation, examination, and diagnostic procedures often deter owners from bringing their cats to the clinic to receive regular veterinary care. Multiple strategies have been explored to reduce stress and increase cat cooperation during veterinary visits.

Gabapentin has traditionally been prescribed as an adjuvant for seizure control and chronic or neuropathic pain.1-4 Its exact mechanism is not entirely clear. Studies on gabapentin’s efficacy as an anxiolytic agent and its safety in cats are scant, limited to only one recent study.5

A random, blinded crossover study was conducted to determine whether a single 100-mg oral dose of gabapentin would be effective in reducing signs of stress and aggression during travel and improving cooperation during physical examination. Twenty clinically healthy cats with a history of fractious behavior or signs of stress during veterinary examination were included. Cats were randomly assigned to receive 100-mg gabapentin (13-29.4 mg/kg PO) or placebo prior to a veterinary visit; the opposite treatment was given prior to a second visit one week later. The assigned capsule was orally administered by owners 90 minutes prior to placing the cat in a carrier and transporting it to the veterinary clinic.
Owner-assessed cat stress scores during transportation and veterinary examination, as well as veterinarian-assessed cooperation (compliance) scores, were significantly lower in cats that received gabapentin as compared with cats that received placebo. Owner-perceived peak effect of gabapentin occurred approximately 2 to 3 hours postadministration. Adverse effects occurred in 6 cats and included vomiting (n = 2), hypersalivation (n = 1), muscle fasciculation (n = 2), and anisocoria (n = 1). Follow-up with owners regarding their continued observations upon returning home was available for 15 cats; sedation was reported in 12 (80%) and ataxia (concurrent with sedation) in 6 (40%). All effects resolved within 8 hours of gabapentin administration.

The authors concluded that oral administration of 100-mg gabapentin to cats 90 minutes before travel led to a significant reduction in stress-related behaviors during transportation and examination and in attenuated aggression, thereby increasing cooperation during examination. The study authors further recommended that gabapentin at 20 mg/kg PO (vs 100 mg/cat) be given approximately 2 to 3 hours before transportation to the clinic for short-term anxiolysis. Owners should be warned about the potential for ataxia, and cats should be confined indoors until the effects resolve.

This study did not include additional diagnostics to assess each cat’s health (eg, urinalysis, FeLV/FIV status); thus, stable systemic disease may have been missed. In mice, rats, monkeys, and humans, gabapentin is not metabolized or protein-bound and is cleared via renal excretion; thus, it is reasonable to consider a dose reduction in cats with kidney disease.6,7

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Administering gabapentin at 20 mg/kg PO approximately 2 to 3 hours before placing cats in a travel carrier may reduce stress. A dose reduction in cats with kidney disease (or possibly liver disease) should be considered until further gabapentin metabolism data in cats are available.

2. Fear Free methods and minimum, low-stress, gentle handling are recommended (see Suggested Reading).

3. Common side effects include ataxia, so cats should be kept indoors for at least 6 to 8 hours postadministration.

References


Suggested Reading

Craniocervical Junction Abnormalities in Chihuahuas

Erin Y. Akin, DVM, DACVIM (Neurology)
Bush Veterinary Neurology Service
Woodstock, Georgia

In the Literature

FROM THE PAGE …

Chiari-like malformation (CM) is a multifactorial craniocervical junction (CCJ) abnormality in dogs in which a portion of the cerebellum is herniated through the foramen magnum secondary to congenital hypoplasia of the supraoccipital bone. Syringomyelia (SM) is the development of fluid-filled cavities in the spinal cord parenchyma.1 These malformations have been widely reported in Cavalier King Charles spaniels, Brussels Griffons, and other small-breed dogs.2 This prospective study investigated the presence of SM and CCJ abnormalities and their associated clinical signs and neurologic deficits in 53 Chihuahuas.

The study found CM, SM, and other CCJ abnormalities to be prevalent in Chihuahuas. CM/SM-related clinical signs such as facial rubbing, spinal pain, vocalization, incoordination, weakness, and persistent scratching of the ears, shoulders, or cranial thoracic spinal area were observed in dogs with SM and other CCJ abnormalities such as atlanto-occipital overlapping.
Neurologic deficits, most commonly decreased postural reactions and ataxia, were noted in >50% of study subjects. The presence of postural reaction deficits was predictive of the presence of syringomyelia grade 2.

CM was observed in all 53 Chihuahuas. The presence of SM is thought to predispose animals to neuropathic pain, as pain correlates to syrinx width on MRI; however, the CM/SM-related clinical signs, most commonly scratching and facial rubbing, were detected in dogs with and without SM. The large number of dogs that did not have SM but did have CM/SM-related clinical signs suggestive of neuropathic pain (ie, scratching, facial rubbing) may indicate that other CCJ abnormalities play an important role in the development of neuropathic pain. Seventy percent of study dogs had presence of atlanto-occipital overlap, but this was not associated with CM/SM-related clinical signs, presence of SM, or severity of CM. Other CCJ abnormalities included medullary kinking and dorsal spinal cord compression.

**TO YOUR PATIENTS**

Key pearls to put into practice:

1. CM and SM have been reported in many breeds, most notably Cavalier King Charles spaniels, Brussels Griffons, and Chihuahuas.

2. SM, CM, and other CCJ abnormalities appear to be prevalent in Chihuahuas. These conditions should be considered in Chihuahuas with scratching of the ears, shoulders, or cranial thoracic area; facial rubbing; vocalization; spinal cord pain; ataxia; and/or postural reaction deficits.

3. Advanced imaging (eg, MRI, CT) is necessary to achieve diagnosis; thus, referral may be necessary.

**References**


Potential Biomarkers of Systemic Inflammatory Response

Kendall Taney, DVM, DAVDC
Center for Veterinary Dentistry and Oral Surgery
Gaithersburg, Maryland

In the Literature

FROM THE PAGE …
Periodontal disease and oral neoplastic conditions can exhibit both local and systemic effects. A systemic inflammatory response can be elicited by dissemination of bacterial metabolic products in the case of periodontal disease or by secretion of proinflammatory and anti-inflammatory cytokines/chemokines by tumors, thus attracting leukocytes.

This retrospective study aimed to identify potential systemic inflammatory markers within the parameters of the different cell types measured on a CBC. In humans, the neutrophil:lymphocyte ratio (NLR), platelet:lymphocyte ratio (PLR), mean platelet volume:platelet ratio (MPV/PLT), and platelet large cell ratio index (PLCRi) have been identified as biomarkers of systemic inflammatory response and potentially as prognostic/diagnostic biomarkers in both inflammatory and neoplastic conditions, including those of the head and neck region.

Neutrophils are the first leukocytes to circulate in response to systemic inflammation, and lymphopenia has been accepted as a negative prognostic indicator in humans with some types of cancer. A high NLR, another negative biomarker in human cancer patients, demonstrates an enhanced neutrophil response and relative lymphopenia.

Platelets play a role in biologic progression and metastatic spread of tumors; PLR, MPV/PLT, and PLCRi are all biomarkers of platelet activation. The potential value of these indices in companion animals has yet to be determined.

Three populations of dogs were evaluated in this study: healthy dogs, dogs with periodontal disease, and dogs with oral tumors. The results ultimately were not supportive of systemic inflammatory response assessment by CBC indices in dogs with periodontal disease. However, 2 indices (ie, NLR and PLCRi) were associated with oral neoplastic conditions and could potentially be used as biomarkers of systemic inflammatory response if given further investigation.

… TO YOUR PATIENTS
Key pearls to put into practice:

1. Periodontal disease and oral tumors can elicit both local and systemic inflammatory responses.

2. Understanding how CBC parameters in conjunction with other diagnostics may indicate systemic inflammation can be useful in developing a list of differential diagnoses.

3. The conclusions of this study are limited by the retrospective design. Prospective studies are needed before these results can be clinically applied. Further studies could support the use of CBC evaluation as a cost-effective tool for therapeutic decision-making and identification of prognostic biomarkers.
External skeletal fixators (ESFs) are commonly used by surgeons to correct bone fractures in cats. Common complications of ESFs include infection, pin loosening, and pin breakage. The incidence of complications in dogs is relatively high, but few studies have examined this in cats.

This retrospective study of 140 cats treated with ESF had an overall complication rate of 19% at a median time to diagnosis of 43 days postoperation. All fixators had a mean of 6 pins placed to secure the bone. Superficial pin tract infections \( (n = 13) \) were most often observed in humeral and femoral fractures; implant failure \( (n = 12) \) occurred more often in tibial and tarsal fractures. Together, these complications accounted for 86% of all reported problems. Serious complications of bone fracture \( (n = 2) \) or osteomyelitis/bone sequestrum \( (n = 2) \) were uncommon, accounting for 14.8% of all reported complications. The only significant association between complications and ESF frame feature was the use of intramedullary pins.

Higher rates of infection in the femur and humerus were suspected to occur due to discomfort, joint stiffness, and decreased use of the limb caused by interference of regional tendons and musculature. Pin failures in the tarsus were attributed to the ESF crossing a joint and use of smaller pins for these smaller distal bones.

**FULL TEXT**

In the Literature


**FROM THE PAGE …**

ESF appears to be a safe method for correcting feline fractures, as 81% percent of fractures corrected via ESF in this study healed without complication. Superficial infections and pin loosening or breakage may occur with ESF. Infection may occur more commonly with fractures of the femur and humerus, whereas pin failure may occur more often with fractures of the tarsus and femur.
Topical Antimicrobial Therapy with Fusidic Acid

Alison Diesel, DVM, DACVD
Texas A&M University

In the Literature

FROM THE PAGE …
Increased isolation of resistant organisms from skin infections—particularly methicillin-resistant Staphylococcus pseudintermedius and other staphylococci—in veterinary patients is resulting in intensified concern due to the potential impact of these organisms in both veterinary and human medicine. This concern has led to several studies evaluating topical therapeutic options for superficial infections in companion animals with the goal of decreasing the chance for development of resistance.

In vitro study aimed to determine the depth of penetration of fusidic acid (FA) in canine skin. FA is a lipophilic antibiotic with activity against coagulase-positive staphylococci, including methicillin-resistant.
resistant *S. pseudintermedius*. Skin biopsy samples were obtained from the dorsum and groin of canine cadavers to evaluate body regions with different hair follicle density. The samples were either left untreated or repeatedly tape-stripped to mimic skin damage often seen with inflammatory skin disease. Skin samples were assembled into Franz diffusion cells, and a 10-mg/g FA suspension was applied to the surface. After 24 hours, receptor fluid and cryosectioned skin samples from various depths were evaluated for FA concentration. FA was detected only in samples in which the follicular infundibulum and more superficial structures (e.g., surface epidermis, hairs) were present. The antibiotic did not penetrate past the isthmus of the hair follicle, thus supporting the potential use of FA for the treatment of both surface and superficial bacterial infections in dogs.

### TO YOUR PATIENTS

Key pearls to put into practice:

1. Although FA appears to be a viable treatment option for surface and superficial bacterial skin infections in dogs, this antibiotic is not currently available in any formulations in the United States for either human or veterinary use.

2. Due to the concern about increased isolation of resistant organisms from bacterial skin infections in veterinary patients, clinicians are encouraged to employ appropriate antimicrobial stewardship when recommending specific therapy.

3. Increased use of topical antimicrobial therapy in veterinary patients may help decrease the chance for development of resistance. Bacteria are less likely to develop resistance to an antiseptic (e.g., chlorhexidine, sodium hypochlorite) than to an antibiotic. Continued evaluation of novel antimicrobial agents will likely remain a focus in veterinary dermatology in the coming years.

### References


Xylazine & Induction of Emesis in Cats

Edward Cooper, VMD, MS, DACVECC
The Ohio State University

In the Literature

FROM THE PAGE …

There are important differences between dogs and cats with regard to inducing emesis for suspected toxin or foreign body ingestion. Although apomorphine or hydrogen peroxide are often used in dogs, these are generally ineffective in cats and may be harmful. Based on relative receptor density in the chemoreceptor trigger zone, α2-adrenergic agonists (eg, xylazine, dexmedetomidine) have been recommended instead, although there is relatively little clinical evidence supporting their use. This retrospective study sought to assess the efficacy of xylazine for inducing emesis in cats and determine the rate of complications associated with administration.

Medical records from a referral center from 2006 to 2015 reviewed clinical characteristics of cats receiving xylazine for emesis induction after known or suspected toxin or foreign body ingestion. Forty-eight cats were included in the study, with an even split between known/suspected toxin exposure (n = 24) versus foreign body ingestion (n = 24). Xylazine was administered at a median dose of 0.49 mg/kg IM. Emesis was achieved in 60% (29/48) of patients; the aim of emesis (ie, recovery of foreign body or decontamination) was successful in 72% of these patients. Adverse effects were noted in 33% (16/48) of cats, with sedation being the most common (15/16); one of these cats also experienced pytalism. Another cat experienced bradycardia alone. Almost all (46/48) of the cats received a reversal agent; most (37/46) received yohimbine, whereas the remainder (9/46) received atipamezole. No differences were found with regard to age, sex, breed, reason for induction of emesis, or the occurrence of adverse effects between those that successfully vomited and those that did not.

… TO YOUR PATIENTS
Key pearls to put into practice:

1. Xylazine at 0.5 mg/kg may be effective in inducing emesis in approximately 50% of feline foreign body or intoxication cases, with approximately three-fourths of those patients successfully expelling the ingested toxin or foreign body. Dexmedetomidine has also been shown to be effective in this regard and, in one study, was found to be superior to xylazine.1

2. The most common adverse effect to be expected is sedation, which can be reversed using an α2-adrenergic antagonist (eg, yohimbine, atipamezole).

3. Age, breed, sex, or reason for emesis induction did not appear to impact whether xylazine is effective in inducing vomiting in cats.

Reference
Surveillance of Surgical Site Infections

Kristy Broaddus, DVM, MS, DACVS
Virginia Veterinary Centers
Fredericksburg, Virginia

In the Literature

FROM THE PAGE …

Surgical site infections (SSIs) are infections present at a surgical site within 30 days of surgery or within a year of surgery if the patient has implants. SSIs can result in increased owner costs and patient morbidity and, although rare, may even result in patient death. The incidence of SSIs may be underestimated by surgeons due to lack of appropriate surveillance and documentation. In human medicine, active surveillance occurs routinely, improving patient outcomes.

This study sought to document the incidence of SSIs that occurred postoperatively at a veterinary teaching hospital via prospective and retrospective means. SSIs from soft tissue, orthopedic, and neurologic surgeries were documented through repeat presentation to the surgeon, pet owner questionnaires, review of medical records, and/or communication with primary veterinarians. The study found that, if the medical record had been the sole source of surveillance, 27.8% (10/36) of infections would have gone unidentified. Active postdischarge surveillance increased known incidence of infection that would have otherwise been missed. Culture testing was not performed in approximately two-thirds of suspected SSIs to confirm infection versus inflammation.

The most effective means of surgical follow-up is direct observation through recheck examination, including culture and susceptibility testing if SSI is suspected. This direct observation occurs frequently with the patient’s primary veterinarian. If an infection is noted by the primary veterinarian, this information should be reported to the surgeon to improve awareness of SSI incidence. With this proactive team approach, infections may be minimized and patient health improved.

… TO YOUR PATIENTS
Key pearls to put into practice:

1. Communication between primary veterinarians and referral centers is critical for optimal patient care.

2. Culture and susceptibility testing of surgical sites suggestive of infection before administration of antibiotics is warranted to document and treat SSIs. If cost is a limiting factor, compromised patients and patients with implants must be prioritized.

3. Culture testing allows for identification of the offending bacteria and helps define its prevalence. Through identification of the offending bacteria, SSIs can be accurately classified and managed as nosocomial infections versus infections caused by incisional disruption from patients or lack of owner compliance.
Brief Media, publisher of Clinician’s Brief, partnered with Mission Rabies (missionrabies.com) for a third year to participate in its vaccine drive in Zomba, Malawi, where Mission Rabies has worked to eliminate rabies since 2016.

Increased education in Zomba on the need to vaccinate animals against rabies has led to significantly higher rates of vaccination in the area. During the drive, which took place in June 2018, the Brief Media team administered 8967 vaccinations, 8600 of which were administered to dogs, breaking the previous 2016 record of 8100 vaccines administered to both dogs and cats. These vaccinations help eliminate rabies at the source, which is an integral part of Mission Rabies’ goal to save human and animal lives.

Six Brief Media participants—4 volunteers and 2 company team members—joined a team of about 40 additional workers, including both headquartered and local Malawian Mission Rabies staff and education and sensitization officers.

Over the course of 2 weeks, the participants held static rabies vaccination clinics at schools and community buildings, educated the public about the dangers of rabies, and traveled door to door throughout Zomba to deliver rabies vaccinations. Brief Media volunteers were sponsored by Merck Animal Health, manufacturers of Nobivac.
Read a personal account of the team’s experience in Malawi and see more photos at cliniciansbrief.com/mission-rabies

ABOUT RABIES

► Rabies kills approximately 59,000 humans every year, the majority of which are children under 15.
► More than 99% of human rabies cases are caused by dog bites.

A MEMORABLE MISSION

► 8,967 vaccines administered
► 25,499 children educated
► Approximately 960 miles walked

2018 VOLUNTEERS

► Tonya Curtis, DVM, of Florida
► Jessie Foley, Brief Media Mission Rabies project leader, veterinary nurse, of Oklahoma
► Anna Formstone, BVM&S, MRCVS, of the United Kingdom
► Shelley Hurley, Brief Media revenue operations director, of Oklahoma
► Allen Putzig, BVM&S, MRCVS, of the United Kingdom
► Leslie Wereszczak, LVMT, VTS (ECC), of Tennessee

Editor’s note: Although it is ideal to wait to vaccinate until a puppy is 3 months of age, when access to vaccination is sporadic and rabies is endemic, young puppies are often vaccinated. There is evidence that young puppies in endemic regions will respond well to vaccination. Even if response to vaccination was unpredictable, it might be the only chance they have for rabies vaccination, so vaccination is recommended.—J. Scott Weese, DVM, DVSc, DACVIM, Clinician’s Brief editor in chief

Reference


Pictured from left to right: Leslie Wereszczak, Anna Formstone, Jessie Foley, Shelley Hurley, Allen Putzig, and Tonya Curtis

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Diet + Rehabilitation Increases Speed to Improvement from TPLO Surgery

Q You recently published a study comparing the effects of diet and rehabilitation on dogs following orthopedic surgery. Why did you undertake this research?

A As a specialist in both surgery and sports medicine, I have been disappointed in recovery rates of canine patients following orthopedic surgery. Studies have shown that dogs consistently require approximately five to seven months of recovery following a tibial plateau leveling osteotomy (TPLO) surgery. Because I find this recovery time to be too prolonged, I wanted to explore ways to reduce it.

I approached Nestlé Purina about sponsoring a double-blinded study on dogs that had undergone TPLO surgery, with a goal of evaluating how an anti-inflammatory diet and rehabilitation might affect recovery, both separately and together. In the study, 48 dogs were randomly assigned to one of four groups:
1. Adult maintenance diet (control diet)
2. Dry Omega-3- and protein-enriched diet (Purina Pro Plan Veterinary Diets JM Joint Mobility Canine Formula)
3. Adult maintenance diet (control diet) + rehabilitation
4. Dry Omega-3- and protein-enriched diet (Purina Pro Plan Veterinary Diets JM Joint Mobility Canine Formula) + rehabilitation

Dogs in the study were followed for six months, with assessments conducted at 2 weeks, 8 weeks, 16 weeks and 24 weeks post-surgery. Among the outcomes evaluated were gait analysis, as measured by ground reaction force data; progression of osteoarthritis, as measured via radiography and synovial fluid evaluation; and daily activity (as measured via accelerometer).

Q What were the study results?

A This study shattered the myth around the impact of surgery on dogs. By looking at all four groups, we also learned how diet and rehabilitation exercise work individually and together.

• Compared to the control diet + rehabilitation group, when the JM diet and rehabilitation were used together, dogs experienced significant improvement in ground reaction forces, as measured by peak vertical force (PVF) at 8 weeks and vertical impulse (VI) by 16 weeks post-surgery.

• Rehabilitation therapy, which included sit-stand exercises and underwater treadmill therapy, was associated with significant increases in time spent in light-to-moderate activity.

Q What did you learn about diet and OA management?

A The results of the study indicated that JM played an important role in reducing inflammation and the progression of OA by reducing production of inflammatory mediators such as PGE, in the synovial fluid. This is likely due to the higher levels of omega-3 fatty acids from marine sources in the diet—specifically high levels of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Unfortunately, many diets and supplements contain insufficient levels of EPA and DHA and/or contain alpha-linolenic acid, a fatty acid found in sources such as flaxseed, which is less efficient in being converted to EPA and DHA.

While owners were blinded to which diet they were feeding, those whose dogs were fed the JM diet observed reduced frequency in lameness over time when trotting or running.

Conclusion: According to this study, the combined effects of diet and rehabilitation offered significant benefits for both surgical and OA patients. The latter group is especially important, since OA is believed to affect ~20 percent of dogs over the age of 1 year.

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Palmerston North, New Zealand

1 Baltzer WI, Smith-Ostrin S, Warnock JJ, Ruaux CG. Evaluation of the clinical effects of diet and physical rehabilitation in dogs following tibial plateau leveling osteotomy. JAVMA 2012 May;34(5).
OA Nutrition: Harnessing Gene Expression to Reduce Inflammation

To truly understand osteoarthritis (OA), we need to understand the changes that occur at the cellular and molecular level, where inflammation begins. These changes take place in cartilage cells called articular chondrocytes and can be triggered by the expression of pro-inflammatory genes. Purina researchers began studying gene expression in canine arthritis in the 1990s. We surveyed more than 90 percent of all the gene products produced, identified more than 1,000 expressed gene products, and ultimately whittled that number down to about 500 genes associated with OA. Along the way, we learned a lot about how the inflammatory process works, and how it can be influenced by nutrition.

Our goal was to nutritionally manage dogs with OA with long-chain omega-3 fatty acids, which are found in fish oil. Through in vitro studies in our laboratories, we documented that eicosapentaenoic acid (EPA), an omega-3 fatty acid, could down-regulate the expression of genes involved in the inflammatory process.

Omega-3 fatty acids vs. the 1-2-3s of arthritis inflammation

1. One culprit in the development of arthritis inflammation is an omega-6 fatty acid known as arachidonic acid (AA). AA is released from cell membranes and produces inflammatory series 2 prostaglandins. EPA in the diet competes for the same enzymes, but produces less-inflammatory series 3 prostaglandins.

2. Another culprit is a cytokine called interleukin-1, a molecule that is reduced when we feed those cells omega-3 fatty acids. This further confirmed that we could reduce inflammation in chondrocytes through nutrition.

3. Finally, we were able to link matrix metalloproteinases (MMP) molecules, which can destroy cartilage, to inflammation. Specifically, we showed that the expression of MMP-3—the major MMP involved in OA—could be reduced by feeding omega-3 fatty acids. This was very exciting, because we could reduce pro-inflammatory molecules and the expression of the protein that contributes to breaking down collagen, a component of cartilage, in OA.

Multimodal Approach to Joint Health Management Provides Optimal Results

My goal as a veterinarian is to strengthen and prolong the bonds between people and their pets. Patient quality of life is a major part of that, which is why I am a staunch advocate of proactive, multimodal joint health management for dogs with orthopedic issues.

Maintain healthy body condition

I believe weight management is the single most important component of both preventing and managing osteoarthritis. I let my clients know that the more weight a dog carries, the more pressure those inflamed joints have to withstand—and all the medication in the world will be ineffective if a dog’s weight isn’t under control. Body condition scoring is a useful way to assess and track weight.

When combined with calorie control, exercise and rehab can improve mobility and achieve weight loss. When I tell clients to start with low-impact exercise, I compare it to getting in shape before running a marathon. Even walking out to the mailbox twice a day can be a simple first step for dogs with severe muscle atrophy. For many post-orthopedic surgery pets, I encourage clients to take their pets swimming—it’s enjoyable and generates minimal pressure on achy joints.

Manage inflammation with omega-3 fatty acids

Generally, it’s a matter of when—not if—large-breed dogs develop arthritis. This makes the right diet all the more important, as proper nutrition can impact the progression of arthritis and relieve symptoms. When arthritis is diagnosed or suspected, I advise pet owners to feed a high-quality diet rich in omega-3 fatty acids—such as Purina® Pro Plan® Veterinary Diets JM Joint Mobility® Canine Formula. A diet rich in EPA and DHA eliminates the hassle of feeding fish oil and other joint supplements separately.

If nonsteroidal anti-inflammatory drugs (NSAIDs) are needed to relieve pain and inflammation, I counsel clients on potential side effects, discuss the patient’s history of GI sensitivity, check comprehensive bloodwork before use and regularly check bloodwork during long-term use. When presented with a patient who is healthy enough to take NSAIDs, I usually start at a dose high enough to reduce pain so the patient can perform physical therapy. Once their mobility and strength have improved significantly, I recommend administration at the lowest effective dose.

Follow multimodal approach for best results

The goal of arthritis management is to have a healthy pet for as many years as possible. There is no single cure-all for this inevitable disorder, which makes a multimodal approach the most effective strategy.

Key Takeaways

- A double-blind, placebo-controlled study demonstrated a synergistic effect between diet and rehabilitation exercise in improving speed to improvement for dogs recovering from TLP and arthroscopic surgery.
- The same study indicated that Purina® Pro Plan® Veterinary Diets JM Joint Mobility® Canine Formula played an important role in reducing inflammation and the progression of OA in the 6 months following TLP surgery.
- An understanding of osteoarthritis needs to begin with comprehending the changes that occur at the cellular and molecular level, where inflammation starts.
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JM contains targeted levels of EPA and DHA that have been shown to reduce the levels of inflammatory mediators such as PGE1.

High levels of EPA and DHA result in the production of the less inflammatory PGE3.

Our research efforts inspired the creation of Purina® Pro Plan® Veterinary Diets JM Joint Mobility® Canine Formula. With a high level of omega-3 fatty acids, glucosamine and a high protein-to-calorie ratio, JM has helped improve the lives of thousands of dogs. We know because their owners have told us, and it’s the most satisfying thing in the world.

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Key Takeaways

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• The same study indicated that Purina® Pro Plan® Veterinary Diets JM Joint Mobility® Canine Formula played an important role in reducing inflammation and the progression of OA in the 6 months following TPLD surgery.1

• An understanding of osteoarthritis needs to begin with comprehending the changes that occur at the cellular and molecular level, where inflammation starts.
A landmark study shows that after TPLO surgery, combining rehabilitation with Purina® Pro Plan® Veterinary Diets JM Joint Mobility® significantly improved ground reaction force from an estimated 5-7 months to 8 weeks.

And who doesn’t want faster recovery for their patients?

1 as measured by peak vertical force


Epistaxis

Shanna Hillsman, LVMT
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Following are differential diagnoses, listed in order of likeliness, for patients presented with epistaxis.

- Nasal tumor
- Trauma
- Idiopathic rhinitis
- Periapical abscess
- Fungal rhinitis
- Nasal foreign body
- Oronasal fistula
- Leishmaniasis

**References**


PREGNANCY IN DOGS

Bruce W. Christensen, DVM, MS, DACT
Kokopelli Assisted Reproductive Services
Woodland, California

Breeding purposeful or accidental?

**Purposeful (see Purposeful Breeding Options)**

**Accidental**

INVESTIGATION
Perform early pregnancy (30 days gestation) diagnostics:
- Palpation: may be challenging until fetal skeletons ossify, starting at 45 days
- Serum relaxin: hormone in dogs made exclusively by the placenta; reliable at 30 days
- Ultrasonography: reliable at 30 days
- Radiography not useful for pregnancy diagnosis at this stage of gestation

INVESTIGATION
Perform late pregnancy (55-60 days gestation) diagnostics:
- Ultrasonography to assess fetal viability and estimate gestational age
- Radiography to count fetuses

Terminate potential pregnancy or wait to confirm pregnancy

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AI = artificial insemination
TCI = transcervical insemination

Wait for diagnosis
After 30 days, perform early pregnancy diagnostics:
- Palpation: may be challenging until fetal skeletons ossify, starting at 45 days
- Serum relaxin: hormone in dogs made exclusively by the placenta; reliable at 30 days
- Ultrasonography: reliable at 30 days
- Radiography not useful for pregnancy diagnosis at this stage of gestation

Pursue immediate treatment options:
- Spay (best option if no planned breeding future)
- Medical treatment/resorption via estradiol cypionate or estradiol benzoate**
Pregnancy confirmed?

**YES**
- Termination via ovariohysterectomy (best option if no planned breeding future)
  - Discuss responsible breeding options or future spay with owner

**NO**
- Termination via medical treatment/resorption:
  - Glucocorticoids
  - Prostaglandins (eg, cloprostenol)
  - Dopamine agonists (eg, cabergoline)
  - Prostaglandin + dopamine agonist
  - Aglepristone (not available in North America)

Perform follow-up:
- Recheck serum progesterone 4 days after starting mismating treatment; should be baseline
- Recheck ultrasonography 4-8 days after starting mismating treatment to document termination of pregnancy

*Although negative predictive value of vaginal cytology within the first 24 hours of mating has been reported to be as great as the positive predictive value, the possibility of a false negative still warrants confirming pregnancy later. Therefore, the value of performing vaginal cytology is questionable.*

**PURPOSEFUL BREEDING OPTIONS**

Breeding should be timed and managed using vaginal cytology, vaginoscopy, and progesterone to determine luteinizing hormone surge, ovulation date, fertile period, and estimated whelping date. Insemination options include:

- Fresh semen (natural mating, vaginal AI, TCI)
- Chilled/shipped semen (vaginal AI, TCI)
- Frozen semen (TCI, surgical AI)

**Reference**

Appetite and Its Impact

Causes of Decreased Initiation.

but it plays a critical role in appetite mechanism of action is short-lived, ghrelin by inhibiting appetite. is released and opposes the action of and uremic toxins that affect the CNS.

Heart disease: Inappetence associated with chronic kidney disease is likely multifactorial, including an increase in inflammatory cytokines and systemic inflammation and adrenergic stimulation, thus resulting in azotemia and progressive kidney disease, pulmonary edema, ascites, and medication-related effects.

GI disorders: Inappetence associated with GI disorders is likely attributed to a variety of mechanisms, including persistent inflammation damaging the mucosal lining of the GI tract, changes in gastric acidity, and nonspecific abdominal pain.

Respiratory disease: Inappetence associated with respiratory disease is likely attributed to significant pulmonary disease (eg, pneumonia, cancer) interfering with normal functions.

Consequences

Practitioners must remember that the consequences of prolonged inappetence may be more detrimental to patient status than the actual underlying condition, regardless of chronicity. Prolonged decreased nutritional intake leads to immune suppression with secondary organ dysfunction, poor wound healing, and overall increased morbidity and mortality. Ensuring proper caloric intake is critical to prevent a patient from entering a cachetabol state, which could lead to cachexia or the loss of lean body mass and inappropriate protein metabolism.

Conclusion

To the client, inappetence (hyporexia, anorexia, dysrexia) can be the first—or only—sign that something is wrong with their pet. Early identification and intervention can help minimize the risk for continued inappetence that may further complicate underlying conditions. In selecting methods to correct an altered appetite, appetite physiology and underlying disease pathology should be viewed cohesively to create the best treatment plan and yield the most positive clinical outcome.

See page 57 for product information summary.
Cheyletiellosis, also known as walking dandruff, is an uncommon, contagious dermatosis caused by an infestation of the surface-dwelling Cheyletiella spp mite. Cheyletiellosis may occur in dogs (caused by C yasguri), cats (caused by C blakei), or rabbits (caused by C parasitivorax) and can also cause a transient infestation in humans that come in contact with pets carrying the mites. An increased incidence of mites may be observed in immunocompromised patients, in geographic regions where routine flea prevention is not practiced, or following exposure to high-volume housing situations (eg, catteries, breeding facilities).

Cheyletiella spp mites have a standard life cycle of egg, larva, nymph, and adult that can be completed in roughly 21 days. Mite life stages can be identified via direct examination of collected debris using a powerful magnifying lens or via microscopic examination of superficial skin scrapings, acetate tape impressions, and fecal flotation specimens. Cheyletiella spp mites are obligate parasites, as larvae, nymph, and adult male mites die soon after leaving the host; however, adult female mites are more robust and may survive up to 10 days off the host.

Clinical Signs
Clinical signs are highly variable, and subclinical carriers may be encountered. The most common clinical findings include mild-to-intense pruritus,
Adult mites can be easily identified by the presence of prominent hooks on their accessory mouthparts.
excessive scaling (particularly over the dorsum), and erythema (Figures 1, page 55, and 2). In addition, cats may be presented with barbering alopecia or mililiary dermatitis.1

Diagnosis
Diagnosis is confirmed via visualization of the mite or ova, which may be difficult to recover from some patients with low-grade infestations. Adult mites can be easily identified by the presence of prominent hooks on their accessory mouthparts (Figures 3 and 4). Cheyletiella spp ova appear similar to louse eggs but are nonoperculated, smaller, and loosely attached to hairs (Figures 5 and 6).

Cheyletiellosis should be considered a differential diagnosis in patients with pruritus and excessive scaling; other ectoparasites, poor nutrition, intestinal parasitism, and primary seborrhea would also be considered differential diagnoses. In addition, Cheyletiella spp infestation should be eliminated as a potential cause in any patient presented for evaluation of a suspected allergic hypersensitivity (eg, atopy, food allergy).

Treatment
No licensed products are indicated specifically for the treatment of cheyletiellosis. Therapeutic protocol and medication selection primarily depend on the species of the animal affected and clinician preference. Most acaricidal flea preventive products and lime sulfur are effective, provided all in-contact animals are treated, the patient is treated for 6 weeks to disrupt the parasite’s life cycle, and conventional environmental treatment—similar to what is recommended for flea infestation—is performed to prevent reinfection.

Reference
CASE IN POINT

THORACIC LIMB LAMENESS IN A DOG

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Maggie, a 5-year-old, 79.4-lb (36-kg), spayed golden retriever crossbreed, was presented to a specialty practice with chronic right-sided thoracic limb lameness of one month’s duration that began acutely soon after a rigorous hike in the mountains. She had no prior medical history and had not limped on the limb previously. She was active and athletic and exercised with her owner on a regular basis. The limping was initially subtle and intermittent but progressed to an obvious and persistent lameness that worsened with activity.
Maggie was initially examined by her primary veterinarian, who localized discomfort to her elbow, recommended 4 weeks of exercise restriction, and initiated subcutaneous polysulfated glycosaminoglycan injections and carprofen for pain. Despite these efforts, the limping continued for 3 weeks and worsened. Maggie was then referred to the specialty practice for further evaluation and a diagnostic investigation.

**Physical Examination Findings**

On presentation, Maggie was bright and alert. Subjective gait evaluation revealed moderate right-sided thoracic limb lameness. Objective gait analysis was not performed due to the obvious lameness observed on initial presentation. Maggie was observed circumducting her right thoracic limb and abducting her elbow during the swing phase of her stride. Orthopedic examination revealed palpable elbow effusion, pain on direct palpation of the medial compartment of the right elbow, and significant discomfort when this elbow was hyperflexed, extended, and supinated. There was no evidence of chronic thickening or reduced range of motion affecting either elbow joint. Goniometry of both elbows revealed flexion and extension angles of 37° and 167°, respectively. Although differences in range-of-motion values likely exist between breeds, Maggie’s range of motion was consistent with
that found in a study of healthy Labrador retrievers.\(^1\) The remainder of the orthopedic examination, including that of the left thoracic limb, was unremarkable.

**Diagnosis**

Following examination, Maggie was sedated with dexmedetomidine (3 \(\mu\)g/kg IM) and butorphanol (0.1 mg/kg IM), and orthogonal radiographs of both elbows were obtained. The left elbow appeared radiographically normal on the lateral view, whereas the right elbow had mild subtrochlear sclerosis subjacent to the trochlear notch and apparent loss of detail of the coronoid process (Figure 1). No abnormalities were detected on the craniocaudal view (Figure 2).

Because Maggie’s injury was acute and had no historic, radiographic, or physical signs of chronicity, a traumatic fragmented medial coronoid process (TFMCP) was suspected as the cause of elbow effusion and pain. Because CT imaging provides excellent visualization of medial coronoid pathology and correlates well with arthroscopic findings,\(^2\) a CT scan of both elbows was offered before surgery for further diagnostic evaluation but was declined by the owner due to financial constraints. Thus, arthroscopy was elected as a single diagnostic and potentially therapeutic approach to reduce the overall cost of the treatment plan.

**DIAGNOSIS:**

**TRAUMATIC FRAGMENTED MEDIAL CORONOID PROCESS**

**Discussion**

TFMCP, also referred to as jump down syndrome, is a condition in the elbow joint of dogs that has only recently been described, with limited literature available on the topic.\(^3\)\(^-\)\(^7\) Whereas the classic condition of fragmented medial coronoid process (FMCP) is thought to be a component of developmental elbow dysplasia, TFMCP appears to be potentially traumatic in nature and is not thought to be caused by developmental or genetic abnormalities.\(^3\)\(^-\)\(^7\) The true etiology of TFMCP is unknown, and it is unclear if it is related to elbow dysplasia or a separate entity.

Although unproven, it has been suggested that medial coronoid disease or fragmentation, whether traumatic in nature or not, may occur as the result of repetitive or acute loading of the joint during activity, causing microfractures or microcracks in the subchondral bone that result in eventual fatigue fracture and fragmentation.\(^8\) TFMCP is different from FMCP due to elbow dysplasia in that TFMCP is thought to occur in dogs with previously normal elbows; however, it has been proposed that dogs with elbow dysplasia may also be prone to TFMCP due to elbow incongruity.\(^7\)

**TREATMENT AT A GLANCE**

- Arthroscopy with fragment removal is considered the gold standard treatment for surgical management of TFMCP and FMCP.\(^3\)\(^-\)\(^7\),\(^10\),\(^11\)
- Adjunctive pain management with oral analgesics (eg, NSAIDs, gabapentin, amantadine) can be beneficial to the patient postoperatively.
- Rehabilitation therapy to promote and maintain elbow range of motion and limb strength and function may optimize outcome in all patients with conditions localized to the medial compartment of the elbow caused by TFMCP or elbow dysplasia.\(^7\),\(^11\)
- If evidence of osteoarthritis is observed on arthroscopy, long-term management with joint injections (eg, hyaluronic acid, cortisone), platelet-rich plasma or stem cell injections, chondroprotective agents, and long-term NSAIDs may be beneficial.\(^7\),\(^11\)
CASE IN POINT

ORTHOPEDICS

PEER REVIEWED

TAKE-HOME MESSAGES

- TFMCP should be suspected in adult (ie, older than 2 years) dogs with acute unilateral elbow pain if no signs of chronicity of the condition are present (ie, joint thickening, reduced range of motion, evidence of osteoarthritis on imaging).3-7

- Elbow dysplasia should be suspected as the inciting cause of FMCP if the patient is younger than 2 years, has a history of chronic lameness affecting the leg, has evidence of significant developmental abnormalities (eg, elbow incongruity, humeral osteochondritis dissecans, ununited anconeal process), or has evidence of chronicity on physical examination or imaging of the joint.7,8,11

- Radiographs of dogs with acute-stage TFMCP are often unremarkable, making a thorough physical examination and advanced imaging via CT scan or arthroscopy vital to proper diagnosis.3-7,9

- Prognosis is thought to be good to excellent if the injury is noted early before the onset of osteoarthritis.3-7

Treatment

Short-term management of TFMCP typically involves arthroscopy to remove the abnormal bone fragment, followed by pain medication, joint supplements, and physical rehabilitation during postoperative recovery (see Treatment at a Glance, previous page).3-7,9

Both elbows were prepared for surgery. Maggie was premedicated with hydromorphone (0.1 mg/kg IM) and dexmedetomidine (3 μg/kg IM), and anesthesia was induced with propofol (4 mg/kg IV) and ketamine (1 mg/kg IV). A traditional brachial plexus block was performed on both thoracic limbs using a nerve locator and 0.5% bupivacaine (2 mg/kg). Bilateral elbow arthroscopy was performed to remove the suspected TFMCP in the right elbow and examine the left elbow for subclinical disease. The right elbow was found to have minimal signs of osteoarthritis. Fibrillation, which is characterized by splitting of the superficial layers of cartilage (modified Outerbridge system, grade 2), was the only observed cartilage abnormality and was localized to the region of the medial coronoid process. A large osteochondral fragment arising from the medial coronoid process was identified in the right elbow and removed (Figure 3), and an abrasion arthroplasty of underlying subchondral bone was performed using a mechanical shaver. Elbow incongruity was not appreciated on full arthroscopic examination. The left elbow appeared arthroscopically normal, with no cartilage abnormalities or signs of osteoarthritis. No additional abnormalities were observed.

Maggie was discharged the following day with instructions for strict rest for 8 weeks, which included no running, jumping, playing, or leash walks longer than 5 to 10 minutes, to allow her joint surface to heal. She
was prescribed gabapentin (5 mg/kg PO q8h) and carprofen (2.2 mg/kg PO q12h) for 2 weeks to control discomfort. It was recommended that Maggie also receive an oral chondroprotective supplement and continue the weekly polysulfated glycosaminoglycan injections for 4 weeks postsurgery. Rehabilitation therapy was instituted several days postoperatively and involved cryotherapy, manual therapies (eg, soft tissue massage, mobilization exercises, passive range-of-motion exercises, stretching), laser treatments, and strength-building exercises.

**Prognosis & Outcome**
Maggie was evaluated at the end of the 8-week rehabilitation period. Lameness had completely resolved. No effusion was appreciated, and she did not appear painful. The owner was instructed to slowly return her to normal activity over an additional 6 weeks and reported that Maggie was able to return back to athletic activities after 4 months. She did not require any long-term treatment.

Although limited reports are available, the prognosis for dogs with TFMCP treated prior to the development of osteoarthritis appears to be good to excellent. However, further research is needed to further clarify the causes, treatment strategies, and prognosis for dogs with TFMCP.

**References**

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2017 BENCHMARKS STUDY AVAILABLE AT WMPB.VET
Ocular perforations can occur for a variety of reasons, and their appearance can vary significantly depending on size, etiology, and chronicity.

It is important to recognize when an eye has ruptured or perforated, as surgical correction may be required to maintain the integrity of the eye and ensure the best prognosis for long-term vision and comfort.

**FIGURE** Corneal perforation in a dog with corneal degeneration, most likely calcific degeneration (red arrows). A fibrin plug, with pigment likely from secondary iridal prolapse/anterior synechiae (yellow arrow), is visible. There is conjunctival hyperemia but no obvious keratitis or neovascularization. In addition, except for the degenerative change, the cornea is largely clear. The degenerative changes to the cornea are chronic and progressive, but the perforation is acute.

Calcific degeneration of the cornea occurs due to older age or results from previous corneal inflammation or injury. As calcium builds up, it can slough, resulting in an ulcer. Deep ulcers have the potential to perforate.
GuardianVets Launches After-Hours Service Platform

New telehealth platform GuardianVets (guardianvets.com) is now available to veterinary practices. GuardianVets provides veterinary practices with the opportunity to:

- Improve client service by offering triage support after-hours, including nights, weekends, and holidays
- Generate new business by scheduling appointments after-hours (if issues are nonemergent) through both existing and new clients
- Improve work-life balance by preventing the need for on-call veterinary staff
- Track after-hours pet owner activity, as well as obtain reports on nonemergent issues and cases sent to an emergency room for follow-up—Press Release 5/2018

First Feline-Specific Anesthesia Guidelines Published

The American Association of Feline Practitioners (AAFP; catvets.com) has released the first feline-specific anesthesia guidelines, which were published in the Journal of Feline Medicine and Surgery. The guidelines aim to make anesthesia and sedation safer for cats and address specific causes of disparities and ways of avoiding perioperative complications associated with monitoring, airway management, fluid therapy, and recovery. The guidelines include visuals and other information designed to minimize risks associated with anesthesia, including tables, charts, and algorithms. The associated client brochure provides caregivers with information that enables them to understand anesthesia, know what to expect, properly prepare their cat for a procedure, and care for their cat during recovery. The guidelines, client brochure, and supplemental materials can be found at catvets.com.—Press Release 7/2018

Alfaxan Multidose Product Receives Approval

The FDA Center for Veterinary Medicine has approved all technical sections for a new Alfaxan Multidose (alfaxan.co.uk) product registration in the United States. Multidose is an injectable anesthetic with the same formulation attributes as original Alfaxan but with an added preservative system to extend product shelf-life to 28 days after the vial has been broached. The active pharmaceutical ingredient, alfaxalone, is a progesterone analog and neurosteroid with a 5× margin of safety across all species. Alfaxan’s formulation is an aqueous solution with a pH of 7, which is suggestive of tissue safety. The product will be available in 10-mL and 20-mL vials.—Press Release 7/2018
**Midmark Lends Support for Veterinary Nurse Initiative**

Animal health solutions provider Midmark (midmark.com) has announced its support for the effort to make registered veterinary nurse (RVN) the standard credential in the US veterinary technician profession. Launched in 2016 by the National Association of Veterinary Technicians in America (NAVTA; navta.net), the initiative aims to drive passage of legislative amendments in every state to establish the RVN credential as a substitute for the current titles of registered veterinary technician (RVT), licensed veterinary technician (LVT), certified veterinary technician (CVT), and licensed veterinary medical technician (LVMT). NAVTA seeks to unite the profession under a single set of credentialing requirements and scope of practice, which NAVTA believes will promote a higher standard of care. In addition, the alignment of current veterinary technician titles under a single credential may open avenues for better reciprocity across the nation and allow technicians to work outside of the state where they were originally credentialed.—Press Release 5/2018

**Nutramax Announces Support of Project GO**

Nutramax Laboratories (nutramaxlabs.com) has announced its support of the nonprofit organization Project GO (project-go.org; Global Orthopedics for Animals). Project GO was founded to provide necessary, but often unavailable, care for injured service animals, exotic animals, and rescue animals. Project GO’s mission is to provide funding for cutting-edge clinical care to injured animals worldwide via orthopedic and neurologic services; education and training of veterinary healthcare professionals; injury prevention coaching for owners, handlers, and trainers; and cultivation of lifesaving breakthroughs.

Nutramax and its joint health supplements Dasuquin and Cosequin have offered support in several ways; Dasuquin was a sponsor of the inaugural Project GO Working Dog Conference, at which working dogs and their handlers from law enforcement agencies and fire departments and independent working dog owners gathered to learn about extending and maintaining the quality of life of these animals through injury prevention, identification, and care.—Press Release 5/2018

**New Resource for Veterinary Students & Professionals**

As part of its ongoing commitment to veterinarians at all stages of their career, the AVMA (avma.org) has launched a new website to help guide veterinary students and early-career veterinarians with the transition from veterinary school to their professional career. MyVeterinaryLife.com (myveterinylife.com) was developed to gather, organize, and share information and resources addressing the specific needs of students and early-career veterinarians. Website visitors can find resources and tools to help develop their career, maintain their well-being, and manage the financial stresses of personal and professional life.

MyVeterinaryLife.com organizes information into 3 career stages: current student, new veterinarian, and rising professional. Visitors can select the stage that applies to them, then access relevant resources in 3 categories: career, financial health, and well-being. Veterinary students can also locate externships through AVMA’s Student Externship Locator or learn more about the internship experience. Early-career veterinarians will have access to resources such as a salary estimator, webinars on client communication, and self-care tips to sustain a fulfilling career.—Press Release 7/2018

**SEND INFORMATION FOR PRACTICE HOTLINE TO editor@cliniciansbrief.com**
Baby Girl, a 12-year-old spayed female domestic shorthair feline, presented to our South Florida practice for recurrent otitis externa. Previous otic aerobic cultures were submitted and treated appropriately. The otitis would subside for a short period and then recur.

Due to the severity of the otitis externa, along with swelling and bleeding, it was difficult to fully evaluate the suspected ear polyp within the ear canal without sedation.

**First Steps**
The patient was sedated with butorphanol, propofol and isoflurane anesthesia after preoperative ECG, abdominal and chest radiographs, and CBC/Biochem/UA/T4 were found to be acceptable for anesthesia.

Video otoscopy, performed with an OtoPet MedRX unit, allowed full visualization of the ear canal and aural polyp (Figure 1).

For the surgery, we used an Aesculight flexible-fiber CO₂ laser (model AE-2010). The laser was equipped with a 180-millimeter-by-0.8-millimeter metal laser tip (Figure 2), which facilitated the laser ablation of the polyp. The laser was set to 8 watts, with repeat pulsing at a 20-millisecond pulse width and 20-Hz repetition rate (Figure 3).

The flexible hollow fiber allowed us to easily maneuver the laser and effectively ablate only the abnormal aural polyp formation in the ear canal.

Figure 4 shows an intraoperative view of the laser polyp removal. Note the great visualization of the surgical site. The ear’s high fat content typically results in the formation of heavy char, which should be removed using ear flushes or a saline-soaked swab (Figure 5).

**Laser Surgery Benefits**
The primary benefit of the laser ablation procedure includes virtual elimination of bleeding while ensuring full visualization of the polyp and confirmation of the successful ablation.

Without laser hemostasis, the polyp vasculature would produce considerable hemorrhage.

Additionally, the ear canal’s integrity is safely protected from traumatic manipulation from an otherwise blind procedure. In these cases, surgical time is reduced, which provides for an improved anesthetic experience and shorter anesthetic recovery period.

**After Surgery**
The pet owner declined an analysis of the suspected polyp as well as an aerobic culture. The patient was given an injection of Metacam and Convenia, and was sent home with oral Buprenex for pain control.

Postoperatively, the ear canal was treated with a 14-day time-released otic suspension of Baytril, triamcinolone and ketoconazole. The progress exam 27 days after the laser ablation of the polyp showed good healing (Figure 6).
Watch CO₂ laser surgery videos at www.Aesculight.com

About Dr. Man:
Dr. Boaz Man is the medical director and owner of Boca Midtowne Animal Hospital in Boca Raton, Fla. He received his DVM from Ross University in 2004 after completing his clinical training at Oklahoma State University. He has special interests in dermatology, internal medicine and surgery.
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NexGard (afoxolaner) Chews

NexGard® can be administered orally with or without food. Care should be taken that the dog consumes the complete chewable, and treated animals should be observed for a few minutes to ensure that part of the dose is not lost or refused. If it is suspected that any of the dose has been lost or if vomiting occurs within two hours of administration, re-dose with another full dose. A full 100 mg dose of the chewable is administered to the designated body weight range.

Aflatoxin: Treatment and Prevention

Treatment with NexGard may begin at any time of the year. In cases where fleas are common year-round, monthly treatment with NexGard should continue the entire year without interruption.

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

Tick Treatment and Control

Treatment with NexGard may begin at any time of the year (see Effectiveness).

Contraindications:

There are no known contraindications for the use of NexGard.

Warnings:

Not for use in humans. Keep this and all other products out of the reach of children. In case of accidental ingestion, contact a physician immediately.

Precautions:

The safety of NexGard in breeding, pregnant or lactating dogs has not been evaluated. Use caution with dogs with a history of seizures (see Adverse Reactions).

Adverse Reactions:

In a 90-day US field study conducted in households with existing flea infestations of varying severity, the effectiveness of NexGard was assessed in dogs for 30 days. At 72 hours post-infestation, NexGard demonstrated >97% effectiveness against Ixodes scapularis, >94% effectiveness against Dermacentor variabilis, and >93% effectiveness against Rhipicephalus sanguineus (Amblyomma americanum), and Brown dog tick (Rhipicephalus sanguineus) infestations in dogs and pups weekly 8 weeks of age and older, weighing 4 pounds of body weight or greater, for one month.

Protection: Treatment with NexGard may begin at any time of the year (see Effectiveness).

Treatment:

NexGard may be administered orally with or without food. A full 100 mg dose of the chewable is administered.

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

Effectiveness:

NexGard was administered orally to 90-94 week-old Beagle puppies at 1.3 to 5.0 times the maximum exposure dose (63 mg/kg for three treatments every 28 days, followed by three treatments every 14 days, for a total of six treatments). Dogs in the control group were sham-dosed. There were no clinically-relevant effects related to treatment on physical examination, body weight, food consumption, clinical pathology (hematology, clinical chemistries), or organ weights. There was no histopathologic growth in testicular germ cells, testis, prostate, and pituitary. Tumors were observed in the control group, including tumors in the treated and control groups. There were no differences in the incidence of tumors in the NexGard and control groups.

In the US field study, one dog with a history of seizures experienced a square on the same day after receiving the first dose. The dog remained enrolled and completed the study. Another dog with a history of seizures had a seizure 7 days after the first dose of NexGard. NexGard demonstrated adequate control of flea infestations on the skin and paws of the dog, indicating the continued effectiveness of the control mechanism system. Body weight and blood pressure remained stable throughout the study. The two dogs treated with NexGard had no adverse reactions as defined by the ISO 2005 definition. The two dogs treated with NexGard had no adverse reactions as defined by the ISO 2005 definition.

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1. **CONSULT THE EXPERT PAGE 14**
   Which of the following statements regarding supplementation to treat vitamin A deficiency in insectivorous lizards is false?
   A. Doses are empiric.
   B. Supplementation is given every 1 to 2 weeks for 2 treatments.
   C. Fat-soluble vitamin A is much less toxic than water-soluble vitamin A.
   D. Parenteral administration is preferred.

2. **TOP 5 PAGE 29**
   Drug interactions between incompatible drugs are always:
   A. Antagonistic
   B. Synergistic
   C. Additive
   D. All of the above

3. **DIAGNOSTIC/MANAGEMENT TREE PAGE 52**
   Which canine hormone is made exclusively by the placenta and can be used as a reliable indicator of pregnancy at 30 days gestation?
   A. Estrogen
   B. Relaxin
   C. Progesterone
   D. Oxytocin

4. **CLINICAL VIEW PAGE 55**
   The standard life cycle of *Cheyletiella* spp mites can be completed in approximately how many days?
   A. 2
   B. 7
   C. 14
   D. 21

5. **CASE IN POINT PAGE 58**
   Short-term management of traumatic fragmented medial coronoid process typically includes:
   A. Arthroscopy and bone fragment removal
   B. Pain medication and joint supplements
   C. Physical rehabilitation
   D. All of the above

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**THIS MONTH’S QUESTION …**

Which of the following low-stress options for cats do you use in your practice?

- A. Cat-exclusive examination rooms
- B. Cat-friendly techniques (eg, nonslip table mats, pheromone diffusers, minimal restraint)
- C. Providing hiding boxes for boarding and hospitalized cats
- D. More than one of the above
- E. None of the above

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IMPORTANT SAFETY INFORMATION:
NexGard® (afoxolaner) is for use in dogs only. The most frequently reported adverse reactions included pruritus, vomiting, dry/flaky skin, diarrhea, lethargy, and lack of appetite. The safe use of NexGard in pregnant, breeding, or lactating dogs has not been evaluated. Use with caution in dogs with a history of seizures. For more information, see full prescribing information or visit www.NexGardForDogs.com.

Preferred by dogs¹ and dog owners² –
NexGard® (afoxolaner) makes it easy to protect your canine patients against fleas and four of the most common species of ticks in North America.

¹Data on file at Merial.
²Data on file at Merial. Based on veterinary dispensed dose data.

NexGard is a Merial product.
Merial is now part of Boehringer Ingelheim.