STEP-BY-STEP WOUND THERAPY FOR ELBOW HYGROMA

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*Bottls and controls roundworms, hookworms and whipworms in dogs and roundworms and hookworms in cats.

CAUTION: Advantage Multi® is only available from a licensed veterinarian. Dogs: WARNING: DO NOT ADMINISTER THIS PRODUCT ORALLY. For the first 30 minutes after application, ensure that dogs cannot lick the product from application sites on themselves or other treated animals. Children should not come in contact with the application sites for two (2) hours after application. (See Contraindications, Warnings, Human Warnings and Adverse Reactions for more information.) Cats: Do not use on sick, debilitated, or underweight cats. Avoid oral ingestion.

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Advantage Multi® for Dogs and for Cats
(imidacloprid + moxidectin)

BRIEF SUMMARY: Before using Advantage Multi® for Dogs (imidacloprid + moxidectin) or Advantage Multi® for Cats (imidacloprid + moxidectin), please consult the product insert, a summary of which follows.

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

Advantage Multi for Dogs:

 WARNING
• DO NOT ADMINISTER THIS PRODUCT ORALLY.
• Do not exceed the first 30 minutes after application, that dogs cannot lick the product from application sites on themselves or other treated animals.
• Children should not come in contact with the application sites for two (2) hours after application.

 INDICATIONS: Advantage Multi for Dogs is indicated for the prevention of heartworm disease caused by Dirofilaria immitis and the treatment of Dirofilaria immitis circulating microfilariae in heartworm-positive dogs. Advantage Multi for Dogs kills adult fleas and is indicated for the treatment of flea infestations. (Ctenocephalides felis). Advantage Multi for Dogs is indicated for the treatment and control of sarcoptic mange caused by Sarcoptes scabiei var. canis. Advantage Multi for Dogs is also indicated for the treatment and control of the following intestinal parasites species: Hookworms (Ancylostoma caninum) (Uncinaria stenocephala), Roundworms (Toxocara canis) (Toxascaris leonina) and Whipworms (Trichuris vulpis).

 Advantage Multi for Cats is indicated for the prevention of heartworm disease caused by Dirofilaria immitis. Advantage Multi for Cats kills adult fleas (Ctenocephalides felis) and is indicated for the treatment of flea infestations. Advantage Multi for Cats is also indicated for the treatment and control of ear mite (Otodectes cynotis) infestations and the intestinal parasites species Hookworm (Ancylostoma tubaeforme) and Roundworm (Toxocara cati). Ferrets: Advantage Multi for Cats is indicated for the prevention of heartworm disease in ferrets caused by Dirofilaria immitis. Advantage Multi for Cats kills adult fleas (Ctenocephalides felis) and is indicated for the treatment of flea infestations in ferrets.

 CONTRAINDICATIONS: Do not administer this product orally. (See WARNINGS). Do not use the Dog product (containing 2.5% moxidectin) on Cats.

 WARNINGS: Advantage Multi for Dogs: For the first 30 minutes after application: Ensure that dogs cannot lick the product from application sites on themselves or other treated dogs, and separate treated dogs from one another and from other pets to reduce the risk of accidental ingestion. Ingestion of this product by dogs may cause serious adverse reactions including depression, salivation, dilated pupils, incoordination, panting, and generalized muscle tremors. In aminopyrine sensitive dogs, the signs may be more severe and may include coma and death.

 Some dogs are more sensitive to averticin due to a mutation in the MDRI+ gene. Dogs with this mutation may develop signs of severe averticin toxicity if they ingest this product. The most common breeds associated with this mutation include Collies and Collie crosses.

 Although there is no specific antagonist for avermectin toxicity, even severely affected dogs have completely recovered from avermectin toxicity with intensive supportive care.

 Advantage Multi for Cats: Do not use on sick, debilitated, or underweight cats. Do not use on cats less than 9 weeks of age or less than 2 lbs. body weight. Do not use on sick or debilitated ferrets.

 HUMAN WARNINGS: Not for human use. Keep out of the reach of children. Dogs: Children should not come in contact with the application sites for two (2) hours after application. Cats: Children should not come in contact with the application site for 30 minutes after application.

 Causes eye irritation. Harmful if swallowed. Do not get in eyes or on clothing. Avoid contact with skin. Wash hands thoroughly with soap and warm water after handling. If contact with eyes occurs, hold eyelids open and flush with copious amounts of water for 15 minutes. If eye irritation develops or persists, contact a physician. If swallowed, call poison control center or physician immediately for treatment advice. The safety data sheet (SDS) provides additional occupational safety information. For a copy of the safety data sheet (SDS) or to report adverse reactions call Bayer Veterinary Services at 1-800-422-9874. For consumer questions call 1-800-255-6826.

 PRECAUTIONS: Do not dispense dose applicator tubes without complete safety and administration information. Use with caution in sick, debilitated or underweight animals. The safety of Advantage Multi for Dogs has not been established in breeding, pregnant, or lactating dogs. The safe use of Advantage Multi for Dogs has not been established in puppies and dogs less than 7 weeks of age or less than 3 lbs. body weight. Advantage Multi for Dogs has not been evaluated in heartworm-positive dogs with Class 4 heartworm disease.

 Cats may experience hypersalivation, tremors, vomiting and decreased appetite if Advantage Multi for Cats is inadvertently administered orally or through grooming/licking of the application site. The safety of Advantage Multi for Cats has not been established in breeding, pregnant, or lactating cats. The effectiveness of Advantage Multi for Cats against heartworm infections (D. immitis) after bathing has not been evaluated in cats. Use of this product in general veterinary care has not been established in breeding, pregnant, or lactating ferrets. Treatment of ferrets weighing less than 2 lbs. (0.9 kg) should be based on a risk-benefit assessment. The effectiveness of Advantage Multi for Cats in ferrets weighing over 4.4 lbs. (2.0 kg) has not been established.

 ADVERSE REACTIONS: Heartworm Negative Dogs: The most common adverse reactions observed during field studies were pruritus, residue, medicinal odor, lethargy, inappetence and hyperactivity. Heartworm Positive Dogs: The most common adverse reactions observed during field studies were cough, lethargy, vomiting, diarrhea (including hemorrhagic), and inappetence. Cats: The most common adverse reactions observed during field studies were pruritus/scratching, scabbing, redness, wounds, and inflammation at the treatment site; lethargy; and chemical odor.

 For a copy of the Safety Data Sheet (SDS) or to report adverse reactions call Bayer Veterinary Services at 1-800-422-9874. For consumer questions call 1-800-255-6826.

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(florfenicol, terbinafine, mometasone furoate) Otic Solution

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Treat your patients’ most common otitis externa infections with one dose administered by you.

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. 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.

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See page 2 for product information summary.
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Providing small animal practitioners and their teams with practical, relevant information on the latest topics in veterinary medicine

May 2020 cliniciansbrief.com 1
CLARO® Otic Solution (florfenicol, terbinafine, mometasone furoate)

INDICATIONS:
CLARO® is indicated for the treatment of otitis externa in dogs associated with susceptible strains of yeast, Microsporum canis, Malassezia pachydermatis, Staphylococcus pseudointerdium, and Staphylococcus intermedius.

DOSAGE AND ADMINISTRATION:
Shake before use.

CLARO® should always be administered by veterinary personnel. Administer one dose (1 dropperette) per affected ear. The duration of effect should last 30 days.
1. Clean and dry the external ear canal before administering the product.
2. Verify the tympanic membranes are intact prior to administration.
3. Remove single dose dropperette from the package.
4. While holding the dropperette in an upright position, remove the cap from the dropperette.
5. Turn the cap over and push the other end of the cap onto the dropperette.
6. Squeeze the applicator handle onto the dropperette.
7. Insert the tapered tip of the dropperette into the affected external ear canal and squeeze to instill the entire contents (1 mL) into the affected ear.
8. Insert the tapered tip of the dropperette into the ear canal and apply gentle pressure onto the tympanic membrane.
9. Gently massage the base of the ear to allow distribution of the solution.
10. Repeat with other ear as prescribed.

CONTRAINDICATIONS:
Do not use in dogs with known or suspected hypersensitivity to florfenicol, terbinafine, or mometasone furoate.

WARNINGS:
Human Warning: Not for use in humans. Keep this and all drugs out of reach of children.

PRECAUTIONS:
Use with caution in dogs with impaired hepatic function (see WARNINGS), as clinically significant laboratory changes may be observed.

ADVERSE REACTIONS:
In a field study conducted in the United States (see EFFECTIVENESS), there were no directly attributable adverse reactions in 146 dogs administered CLARO®.

HOW SUPPLIED:
CLARO®Otic Solution contains one 1 mL dose.

STORAGE INFORMATION:
Store at 59°F – 86°F.

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

EFFECTIVENESS:
In a field study conducted in the United States (see EFFECTIVENESS), 72.5% of dogs administered CLARO® solution were successfully treated.

ANIMAL SAFETY:
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.

SHIORI ARAI, DVM, MS, DACVS (Small Animal), is an assistant professor of small animal surgery at University of Minnesota. She earned her DVM from Azabu University in Sagamihara, Japan, and her PhD from Colorado State University. Dr. Arai completed a small animal rotating internship at University of Pennsylvania and a residency in small animal surgery at University of Prince Edward Island in Charlottetown, Canada.

PROCEDURES PRO PAGE 14

MELISSA A. KENNEDY, DVM, PhD, DACVM, is an associate professor in the department of biomedical and diagnostic sciences and the director of the clinical virology laboratory at University of Tennessee, where she also earned her DVM and PhD in comparative and experimental medicine. She is certified by the American College of Veterinary Microbiologists in virology, immunology, and bacteriology. Her research has focused on feline coronavirus, feline calicivirus, and viral pathogens affecting domestic dogs in sub-Saharan Africa.

SPECIAL NOTE PAGE 12

JULIE ALLEN, BVMS, MS, MRCVS, DACVIM (SAIM), DACVP, is a former clinical assistant professor of clinical pathology at Cornell University. She earned her veterinary pathology degree from University of Glasgow and her MS from Iowa State University, where she completed a rotating internship in small animal medicine and surgery and a residency in small animal internal medicine. She also completed a residency in clinical pathology at North Carolina State University. Dr. Allen focuses on cachexia/anorexia, endocrinology, and hepatobiliary and pancreatic diseases in small animals.
PHILIP KRAWEC, DVM, is a resident in emergency and critical care at University of Tennessee. He earned his DVM from The Ohio State University and, after working in private practice, completed an internship in emergency and critical care at Lakeshore Veterinary Specialists in Glendale, Wisconsin.

PROCEDURES PRO PAGE 61

SHAYLAN MEYER is working to complete her DVM at University of Minnesota. She completed her pre-clinical veterinary studies at Ross University and plans to become a board-certified small animal surgeon specializing in orthopedics.

PROCEDURES PRO PAGE 14

JONATHAN MILLER, DVM, MS, DACVS (Small Animal), is a surgeon at Oradell Animal Hospital in Paramus, New Jersey. He earned his DVM from University of Illinois and completed a small animal surgical residency at Virginia Tech. Dr. Miller has written numerous articles and book chapters and is active in the provision of continuing education.

CONSULT THE EXPERT PAGE 27

ADESOLA ODUNAYO, DVM, MS, DACVECC, is a clinical associate professor of emergency medicine and critical care at University of Tennessee. She earned her DVM from Oklahoma State University and completed a residency in emergency medicine and critical care at University of Missouri.

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ANDREW ROSENBERG, DVM, DACVD, is the practice owner of Animal Dermatology & Allergy Specialists and practices in both the Riverdale, New Jersey, and Westchester County, New York, locations. He earned his bachelor’s degree with distinction in research and his DVM from Cornell University and completed a residency with Animal Dermatology Clinic in Tustin, California. Dr. Rosenberg received the ACVD Resident Research award for his work in cyclosporine-associated gingival overgrowth and currently serves as the chair for the ACVD education committee. His clinical interests include allergies and autoimmune skin diseases. Dr. Rosenberg also treats skin conditions of animals in zoos and wildlife centers on a volunteer basis.

CASE IN POINT PAGE 33

STAN VEYTSMAN, DVM, is completing a small animal surgery residency at University of Minnesota. He earned his DVM from St. George’s University in True Blue, Grenada. His interests are soft tissue reconstruction and surgical oncology.

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No More Double Plating

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- Proximal screw trajectory to optimize bone purchase safely for TPLO and TPLO with InternalBrace augmentation
From Clinician’s Brief on Social Media

WE ASKED …

Who is your favorite fictional veterinary character?

“Dr. Dolittle; so quick and simple!”—Alex C
“Dr. Liz Wilson, Garfield’s vet.”—Greg E
“DJ Tanner from Fuller House.”—Deanne M
“Hershel from The Walking Dead!”—Ben J
“Dr. Google is my least favorite.”—David E

For how long do you typically recommend patients be fasted prior to surgery?

“I advise patients be fed a meal as close as possible to midnight, with water available all night. I explain why the meal should be fed so late, but many pet owners still provide food on their normal schedule. Some owners will listen, but others will not, so we have to keep strongly advising when to feed and explaining the risks.”—Sam B

“Fasting should begin 8 to 12 hours before surgery, and water should be removed 4 to 6 hours before surgery.”—Kovács M

“No fasting of water, and a small snack can be given the morning of surgery (ideally 2+ hours before premedication). Premedicating with maropitant and new research on the cons of prolonged fasting are changing ‘hard and fast’ fasting rules.”—Natasha R

Will you vaccinate a patient presented for an illness like otitis externa?

64% Yes
36% No

How do you prepare for surgery?

66% Conventional surgical scrub
34% Alcohol-based hand rub

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Hyperglobulinemia

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

Following are differential diagnoses for patients presented with hyperglobulinemia. Hyperglobulinemia can be caused by monoclonal or polyclonal gammopathies; serum electrophoresis is required for differentiation and can help prioritize possible diagnoses. Polyclonal gammopathies are composed of nonalbumin proteins (ie, globulins) and are typically caused by inflammation, infection, or immune stimulation. Monoclonal gammopathies typically result from production of a single type of globulin protein and are most commonly associated with neoplastic causes, although rare non-neoplastic causes have also been described.

- Acute-phase reactant response (ie, tissue injury of any cause [eg, inflammation, acute bacterial or viral infection, necrosis, neoplasia, trauma]; typically mild)*
- Chronic antigenic stimulation/inflammation*
  - Bacterial endocarditis
  - Chronic skin disease
  - Immune-mediated disease (eg, systemic lupus erythematosus, immune-mediated hemolytic anemia)
  - Infectious disease (eg, FIP, leishmaniasis, heartworm disease, coccidiodomycosis, ehrlichiosis, hepatozoonosis, pythiosis, bartonellosis)
  - Liver disease (eg, lymphocytic cholangitis)
  - Severe dental disease
- Hemoconcentration (concurrent increase in albumin)
- Nephrotic syndrome*
- Paraproteinemia (due to abnormal immunoglobulin production resulting in a monoclonal gammopathy)
  - Infectious disease-associated monoclonal gammopathies (usually immunoglobulin G; eg, *Dirofilaria immitis*, *Ehrlichia canis*, visceral leishmaniasis)
  - Inflammatory disease (eg, lymphoplasmacytic enteritis, cutaneous amyloidosis; rare)
  - Neoplasia
    - Chronic lymphocytic leukemia
    - Extramedullary plasmacytoma that affects the skin (dogs), GI tract, or liver
    - Lymphoma
    - Multiple myeloma
    - Waldenström macroglobulinemia

**References**


*Usually polyclonal gammopathies*
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*Treats and controls roundworms, hookworms and whipworms in dogs and roundworms and hookworms in cats.

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See page 13 for product information summary.
Comparing Coronaviruses in Veterinary Medicine

Melissa A. Kennedy, DVM, PhD, DACVM
University of Tennessee

Clinicians are often at the forefront of interaction with emerging pathogens, and COVID-19 is no exception. All clinicians—from academia to industry to general practice—are important sources of information for the public regarding this emerging virus.

SARS-CoV-2 is responsible for the global COVID-19 disease pandemic. The Coronaviridae virus family includes many important veterinary pathogens classified as alphacoronaviruses (eg, transmissible gastroenteritis virus, FIP, canine enteric virus) and betacoronaviruses (eg, SARS-CoV-2, bovine coronavirus, canine respiratory coronavirus). Companion animal coronaviruses are common pathogens and appear to be species-specific. Infection of respective hosts typically does not cause severe disease; most cases are mild or subclinical, except in the very young. These companion animal coronaviruses do not share antigenicity with SARS-CoV-2; thus, current vaccines for feline, canine, and bovine coronaviruses do not provide protection against SARS-CoV-2.

Feline coronavirus (FCoV) is also associated with FIP, which is a serious disease in cats that demonstrates a complex pathogenesis involving virus, host, and environmental factors. Although FCoV infection is not uncommon, FIP is rare and affects a minority of cats infected with FCoV. Neither FIP nor its causative virus (ie, FCoV) share pathogenic or antigenic properties with SARS-CoV-2.

SARS-CoV-2 is believed to have originated in bats and infected an intermediate host(s); this is similar to the association between civets and SARS-CoV-1. SARS-CoV-2 uses angiotensin-converting enzyme 2 to attach to and enter the cell. This molecule is potentially recognized by SARS-CoV-2 in a range of animal species (eg, palm civets, pigs, cats, ferrets, nonhuman primates), suggesting the virus may infect these animals and warranting further study.1 It is therefore important that clinicians exercise precautions with any animal that has been in contact with an infected human.²
It is also important for clinicians to reassure patients that the risk for contracting COVID-19 disease from their pet is currently determined to be low and that pets should not be euthanized, abandoned, or otherwise removed from households. Current recommendations for owners include:

- Companion animals should be kept with owners who are self-quarantining.
- Good hygiene practices, including regular hand washing, should be maintained when interacting with pets.
- Care for companion animals with family or friends should be arranged if owner hospitalization is required.
- If owners have questions or concerns, a veterinarian should be contacted immediately.

In addition, clinicians must protect their clinic and staff, including implementing strict protective practices, as with any respiratory disease patient. It is also important that disseminated information be valid and accurate. There is currently no evidence that domestic animals (eg, dogs, cats) can transmit COVID-19 to uninfected humans, and limited reports exist regarding clinical infection in dogs and cats.

The public will continue to look to the veterinary community for information and recommendations, and it is imperative that veterinarians remain informed and serve as a resource for owners with concerns about pet-associated risks for infection. The veterinary community must provide reassurance and support for the welfare of patients and their owners. Objectivity and equanimity are of critical importance in times of stress.

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**References**


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NEGATIVE PRESSURE WOUND THERAPY FOR COMPLICATED ELBOW HYGROMA

Shaylan Meyer
Stan Veytsman, DVM
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A hygroma is a nonepithelial-lined cavity or sac filled with serous fluid surrounded by a dense wall of fibrous tissue that develops over a bony prominence.1 Serous fluid is not absorbed during hygroma development, and previously formed skin callus fails to protect the underlying tissue as inflammation increases; a fibrous capsule can form in an attempt to wall off the area.2,3
This condition is commonly seen in large- and giant-breed dogs (eg, German shepherd dogs, Great Danes, mastiffs, Saint Bernards, Newfoundlands, Irish wolfhounds) that are 6 to 18 months of age.\(^4\)-\(^7\) Hygromas can occur over any bony prominence (eg, greater trochanter, ischiatic tuberosity) but most commonly occur over the olecranon of the elbow.\(^2\),\(^3\),\(^8\)

Elbow hygromas can be classified as uncomplicated or complicated based on clinical appearance.\(^9\) Uncomplicated elbow hygromas are small, painless, and nonulcerated and can progress in severity as trauma occurs and continues, resulting in cellular death, ischemia, and edema. Complicated elbow hygromas are typically recurrent, large, painful, ulcerated, and/or infected.\(^6\)

Calcinosis cutis circumspecta-type lesions appearing secondary to chronic hygromas have also been described.\(^10\) Other classification schemes for elbow hygromas based on the mechanisms of development have been reported.\(^5\)

**Treatment & Management**

**Conservative Management**

Conservative management of uncomplicated elbow hygromas aims for resolution in 2 to 3 weeks; fibrous connective tissue can develop during this healing process.\(^3\),\(^4\) Aspiration of the hygroma fluid may be attempted using an aseptic technique, but recurrence and infection are common sequelae.\(^3\),\(^4\) Intralesional corticosteroid administration is not recommended because of the risk for acute infection following injection.\(^8\)

Conservative management
includes educating pet owners about at-risk breeds and emphasizing the importance of maintaining the patient’s ideal body weight, protecting elbows from hard surfaces using soft bedding, and maintaining loose padding of the elbows, especially in the early stage of elbow hygroma development. Although neoprene/polyester-padded elbow sleeves are commercially available, their clinical efficacy has not been evaluated.

Surgical Correction

Surgical correction should be reserved for complicated elbow hygromas and can include:

- Passive or active drainage of cavitated lesions with external coaptation
- Releasing incisions or using tension-relieving closing techniques
- Ostectomy of the olecranon to decrease pressure on the overlying skin
- Reconstruction after excision of the hygroma using single pedicle advancement flaps, single pedicle direct flaps, and axial pattern flaps (eg, superficial brachial artery, thoracodorsal artery, or rectus abdominis free muscle flaps)
- The microvascular free muscle transfer technique
- Surgical repair with commercially available foam pipe insulation for the protection of elbows
- Surgical debridement and vacuum-assisted closure with application of negative pressure wound therapy (NPWT)

Postoperative external coaptation with soft padded bandaging or splinting is commonly used to immobilize the elbow joint, regardless of surgical technique. NPWT has been used in wound management in small animal patients and can be useful for large unhealthy wound beds. NPWT aids in closing wounds through development of healthy granulation tissue, which enables later primary wound closure. NPWT has been shown to improve the wound healing process, decrease the frequency of bandage changes, and decrease the risk for contamination. Limitations include equipment, labor costs, and the need to train staff members, including clinicians.

Complications reported with surgical correction of elbow hygromas include skin dehiscence associated with tension, surgical site infection, splint- and bandage-related lesions, seroma formation, pain, delayed healing, and, with NPWT, loss of the periwound seal.

Orthogonal elbow radiography is recommended prior to surgery to rule out osteomyelitis, periostitis, and neoplasia as possible causes of hygroma formation. Sedation may be required for tissue biopsy and deep cultures prior to surgery if the hygroma is complicated and ulcerated (Figure 1).

Clinical Monitoring & Follow-Up

Postoperatively, the patient should be hospitalized for 3 to 4 days and monitored at least every 2 hours for fluid production and to ensure consistent negative pressure. Alternatively, the patient can be discharged with the unit for at-home monitoring.

Surgical correction should be reserved for complicated elbow hygromas.

NPWT = negative pressure wound therapy
Owners should be educated about the unit so they can troubleshoot if necessary and be provided with multiple canisters so they can change the canister as it fills.

NPWT can be discontinued 3 to 4 days postoperatively with the patient under general anesthesia (Figure 3). The resultant wound bed may have evidence of stimulated and evenly distributed granulation tissues, allowing for delayed primary closure with interrupted and tension-relieving (near-far-far-near pattern) skin sutures (3-0 nylon).

External coaptation should be performed for an additional 10 to 14 days until the incision heals (Figure 4). Bandages should be changed every 3 to 5 days to assess the wound for complications. As an alternative to external coaptation, foam insulation can be applied to protect the elbow.\(^\dagger\) Once the surgical site heals, the owner should be advised of the necessary lifelong changes to care, including providing soft bedding, padding the elbows if erythema is observed (usually the first sign of pressure sores), and maintaining an ideal body condition.

\(^\dagger\) NPWT = negative pressure wound therapy
STEP-BY-STEP NEGATIVE PRESSURE WOUND THERAPY FOR COMPLICATED ELBOW HYGROMA

WHAT YOU WILL NEED

- Standard surgical pack with #10 or #15 scalpel blades
- Sterile isotonic saline
- Monopolar electrocautery or Mayo or Metzenbaum scissors
- Polyurethane ether foam dressing and vacuum pad
- Vacuum-assisted closure system, including canisters with attached tubing
- Semipermeable adhesive drapes
- Antimicrobial incise drapes or transparent film dressing
- Medical adhesive spray or stoma paste
- Nylon suture (3-0)
- Bandaging material and tape

STEP 1

Clip the affected thoracic limb from mid-dorsum of the cervical region distally to the digits. Position the patient in lateral recumbency with the affected limb isolated and the lateral side exposed. Aseptically prepare the limb while it is hung from the ceiling or other device. Perform standard draping.

Author Insight

Avoid incising over the olecranon region, as a pressure point will form when the incision is closed, increasing the risk for dehiscence. When trimming, preserve as much skin and cutaneous callus as possible for closure.

STEP 2

Administer perioperative IV antimicrobials (eg, cefazolin) 30 minutes prior to making an incision; re-administer every 90 minutes. Make a proximal-to-distal incision using a #10 or #15 scalpel blade over the wound, incorporating the open ulcerated wounds. Carefully dissect the SC and/or necrotic tissue directly and sharply with monopolar electrocautery or Mayo or Metzenbaum scissors. Simultaneously perform surgical debridement of any necrotic tissue.

Author Insight

Avoid incising over the olecranon region, as a pressure point will form when the incision is closed, increasing the risk for dehiscence. When trimming, preserve as much skin and cutaneous callus as possible for closure.
**STEP 3**

Copiously lavage the wound site with warm sterile isotonic saline prior to closure. Obtain a tissue sample for bacterial culture and susceptibility testing if needed.

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**STEP 4**

Apply foam dressing to the wound bed; avoid overlapping skin to prevent skin maceration and damage. Apply adhesive spray or stoma paste 3 to 5 cm around the periwound skin as needed. Next, apply a semipermeable adhesive drape to the entire wound bed, covering the skin and foam. Using a #10 scalpel blade, make a 2-cm slit through the drape over the foam, remove the protective covering from the vacuum pad, and attach the vacuum pad to the slit area. Direct the tubing toward the dorsum, not distally. Cover the pad with another layer of semipermeable adhesive draping.

**Author Insight**

Antimicrobial incision drapes or transparent film dressing can be used if there is limited availability of semipermeable adhesive drapes.

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**STEP 5**

Attach the suction tubing to the collection canister and initiate the pump unit. Maintain pressure at -125 mm Hg. After the pump is activated, confirm successful dressing placement through visualization of shriveling, hardening, and wrinkling of the foam and drapes.

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**References**

Flea and tick prevention is an essential part of veterinary medicine and pet care, but despite clinicians’ best efforts, owner compliance continues to be an issue. Although cost and frequency of administration can affect owner compliance, lack of owner knowledge regarding the dangers of fleas and ticks and when their pets are at risk may play an even larger role in compliance failures. To turn compliance expectations into reality, clinicians must recognize the barriers to compliance and find ways to meet these challenges.

Compliance Barriers
Evaluation of pet owner purchasing patterns of flea and tick prevention has shown that owners rarely purchase enough medication to provide consistent, year-round coverage for their pet. In a recent study, >500 dog owners in 24 clinics across the United States were surveyed; despite recommendations for year-round prevention, only 73% of owners believed that year-round prevention was necessary. The average owner bought only 6.1 months of prevention, with only 13% of owners purchasing a year’s supply of medication.

Even after purchasing medications with the best of intentions, owners may fail to administer preventives, which may occur for many reasons (eg, forgetfulness, confusion regarding flea and tick seasonality, difficulty administering medication).

Turning Expectations into Reality
Educating owners on the importance of regular, consistent flea and tick prevention is an essential step to achieving compliance and overcoming purchasing barriers. Proper education, including messaging from the entire practice team, can be built into routine appointments to reinforce the importance of flea and tick prevention. Perception of necessity, along with cost, has been shown to be vital to follow-through in human medication purchases. Successful education efforts should be followed up by sending owners home with preventives after every routine appointment.

Convenience can address key barriers to administration. Studies have shown that inconvenient routes of administration and more frequent administration are associated with poor compliance, whereas less frequent administration has been associated with higher compliance rates. Preventive products that have convenient dosing and administration may promote successful and timely administration, improving compliance once the medication is purchased.

Seresto®, a slow-release imidacloprid/flumethrin collar that provides flea and tick prevention for 8 months, can help break the barriers of cost, convenience, and ease of administration, all while maintaining high standards of efficacy. Collar placement is simple and can be done during the appointment, eliminating any potential owner concerns regarding proper placement. Mid-year rechecks can also be encouraged to alleviate owner concerns regarding potentially missing prevention doses and help owners feel confident that prevention is under the supervision of the clinician.

Conclusion
Clinicians must recognize that compliance barriers may cause flea and tick prevention to fall short of their expectations and that these barriers will vary among pet owners. Clinicians should communicate with owners to identify the individual barriers and tailor their recommendations to overcome them. By employing concerted education efforts and preventive products that remove the guesswork of compliance, clinicians may turn their compliance expectations into realities.

References

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At-Home Medications to Smooth the In-Hospital Experience

Stressed patients may demonstrate severe fear, anxiety, and/or aggression when visiting the clinic. At-home administration of oral medication prior to examination can help reduce the sympathetic fear response. The sympathetic nervous system response to threatening stimuli causes increases in circulating epinephrine and norepinephrine, which can lead to increased blood pressure, muscle blood flow, metabolic rate, oxygen demand, blood glucose, and liver glycolysis. Patients may also show unpredictable aggressive behavior when placed under a perceived threat from which they cannot escape. With maximal stimulation, epinephrine may ultimately lead to hypertension, cardiac arrhythmia, tissue ischemia, and/or, possibly, cardiac arrest. Previsit behavior modification, low-stress visitations, and previsit sedation may mitigate these effects.

Oral sedatives can help prevent the fight-or-flight response. Oral acepromazine has poorly predictable, variable to poor sedation and, because of the relative lack of evidence for its use, is not strongly recommended. Benzodiazeines provide unreliable, poor sedation in cats and carry a high risk for dysphoria, excitement, and aggression; therefore, they are not recommended for home use.

Dexmedetomidine can provide reliable sedation in dogs and cats, but its cardiovascular effects (eg, vasoconstriction, hypertension, bradycardia) may preclude its use in cats that have significant heart disease or when a physical examination cannot be performed premedication.

Gabapentin can be safe and effectively mediate signs of stress and/or excitement with minimal adverse effects in cats; human products containing xylitol should be avoided.

Trazodone is an antidepressant and anxiolytic that mediates stress in dogs and cats and facilitates handling; peak sedation occurs at 2.5 hours postadministration in cats.

Oral sedatives can be an effective means of providing sedation to decrease the stress response and improve visits to the clinic.

—Congdon J
**Living with Retroviruses: New Ideas on How FeLV & FIV Affect Cats**

FeLV spreads vertically and horizontally from queen to kittens and horizontally through close contact among cats; kittens have the highest risk for becoming progressively affected. FeLV infection outcomes are stratified into categories determined by infection pressure and host immune status. In abortive infections, an effective immune response restricts viral replication to oropharyngeal tissue, preventing established bone marrow infection. In regressive infections, transient viremia is either never present or eliminated after 2 to 16 weeks. Cats with regressive infection have high levels of virus-neutralizing antibodies and are at low risk for FeLV-related diseases but at risk for reactivation of disease, particularly cats that are immunocompromised. Proviral DNA can be detected by some PCR tests, and although regressively infected cats do not shed the virus, proviral DNA is infectious via blood transfusions. Progressive infections involve persistent viremia, insufficient specific immunity, and, typically, undetectable neutralizing antibodies. These cats have shorter survival times and often die from FeLV-related disease within several years after infection. Median survival time after diagnosis for progressively infected cats has been reported to be 2.4 years.

FIV is spread mainly through bite wounds. High concentrations of FIV can be detected through blood culture and PCR in the acute phase, although clinical signs may go unnoticed. A subsequent subclinical phase can last for years, during which progressive dysfunction of the immune system can occur, making these cats susceptible to infection. Although these cats are also more susceptible to neoplasia, minimal decreases in survival time in FIV-infected cats have been shown, unless coinfection with FeLV was present. In some circumstances, FIV-infected cats may be housed with FIV-negative cats with little risk; however, transmission of FeLV in the home appears to be more common, suggesting these cats should be adopted only into homes with other FeLV-infected cats or as a single household cat.—*Little S*

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**Serum Bile Acids in Everyday Diagnosis**

Bile acids are synthesized from cholesterol in mammalian hepatocytes; bile collects and becomes concentrated in the gallbladder. Gallbladder contraction is stimulated by a fatty meal and moves bile into the small intestines, where the bile acids emulsify fat. Bile acids can be absorbed in the ileum and undergo enterohepatic circulation, whereby hepatocytes extract the bile acids from portal blood. Serum bile acid concentrations can help clinicians assess global hepatic function, and as a paired dynamic test (ie, pre- and postprandial levels), the pattern of serum bile acid concentrations can provide further information regarding definitive diagnosis.

In healthy patients, gallbladder stimulation should cause bile acid concentrations to rise slightly above baseline, although the change may be minor. However, in ~20% of dogs and cats, the postprandial measurement is lower than the baseline measurement, which is likely secondary to interdigestive, intermittent gallbladder contractions. In patients with liver failure, bile acids are not extracted from the portal blood by damaged hepatocytes and instead leave the liver through the hepatic vein. This typically results in significantly increased baseline and postprandial bile acid concentrations. With portosystemic vascular abnormalities, blood can circulate back through the liver via the hepatic artery, enabling bile acid extraction by the hepatocytes; therefore, baseline bile acid concentrations may be only slightly elevated, with significant elevation in postprandial measurements. Of note, intestinal microbiota can affect the metabolism of bile acids in the intestinal tract, and intestinal dysbiosis can cause a mild increase in serum bile acid concentration.—*Steiner JM*
Exercise Testing: A New Tool for Your Respiratory Toolkit

Exercise testing to monitor presence and progression of exercise intolerance in human medicine could be valuable in veterinary patients with respiratory disease. The 6-minute and 1000-meter walk tests have been tested in dogs and may be useful in dogs with respiratory, neurologic, and/or cardiovascular disease and in obese dogs. Neither test requires specialized equipment, and both can be easily performed in the clinic. The patient’s pre- and posttest temperature, heart and respiratory rates, and SpO2 should be recorded. The 6-minute walk test involves walking the patient around a predetermined course and calculating the distance walked over 6 minutes. The 1000-meter test consists of recording the time it takes the patient to walk 1000 meters. These tests should be discontinued if the patient is uncooperative or unable to complete them. To interpret the results, the patient’s scores should be compared with published scores for healthy dogs and dogs with respiratory disease. Subsequent tests can be compared with the patient's baseline to track disease progression or response to therapy. Patient compliance and some comorbidities (eg, neurologic, orthopedic, and cardiovascular diseases) may affect or negate test results. These tests have been used to determine the severity of several respiratory conditions, including idiopathic pulmonary fibrosis and brachycephalic obstructive airway syndrome, and may be helpful in improving brachycephalic breeding programs.—Lee-Fowler T

Food Trial Nuggets

Strict adherence is necessary for elimination diet trials to be effective; however, poor pet owner compliance can be an issue in most cases, and owners educated about food allergy and diets are more likely to follow recommendations. Owners should understand the principles and practice of the diet trial; detailed handouts, regular follow-up, and communication are needed. Case selection is also important; success will not be achieved if an owner is unwilling or unable to perform the food trial.

Diet trials should last a minimum of 8 weeks and involve removing all possible allergenic foods and food ingredients—including those in treats, supplements, and medications—to determine if pruritus resolves. A thorough dietary history is important when choosing an elimination diet; most patients are allergic to 1 or 2 protein or carbohydrate ingredients in their food. Over-the-counter novel protein formulas are not recommended, as trace contamination with multiple ingredients may be present. Rabbit and kangaroo can be good novel protein choices because they avoid potential cross reactivity seen with other ingredients (eg, duck, bison). If owners prefer to feed a home-cooked diet, a nutritionist or nutrition reference should be consulted. Evidence strongly suggests that prescription diet trials lead to diagnosis for most patients. Hydrolyzed diets are good in theory; however, almost half of patients may not respond because they are sensitive to the source protein (ie, chicken or soy), which may lead to a missed diagnosis of food allergy. Ultra-hydrolyzed diets show promise. Managing pruritus and secondary bacterial infection throughout the diet trial is essential.—Schissler J
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✓ A lipidated form of OspA has been shown to be more immunogenic than a nonlipidated form of OspA1

✓ Effective protection that blocks Borrelia burgdorferi while it’s still in the tick2


Jaw Fractures

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

Background & Pathophysiology
Facial trauma from motor vehicles, bites, or falls can result in maxillary and/or mandibular fractures. These fractures represent 2% of all fractures in dogs and 15% of those in cats.1,2 In older patients, bone resorption can lead to self-induced or iatrogenic fractures with minimal trauma during dental procedures.

History & Clinical Signs
Patients with jaw fractures have typically experienced recent motor vehicular trauma, animal bites, blunt force trauma, or falls (including high-rise syndrome). Some fractures may not be evident to the pet owner until food prehension difficulties arise. Many fractures are discovered based on the patient’s inability to close the mouth, visible malocclusion, pytalism, and/or bleeding from the mouth.

Diagnosis
A thorough oral examination with the patient under general anesthesia is the most straightforward diagnostic technique. Palpation of the symphysis, horizontal body of the mandible, vertical ramus, temporomandibular joint, maxillary arcade, and hard palate is the first step to determine further diagnostics. Whereas open fractures can usually be observed, more caudally located fractures can be difficult to observe; presence of blood in the mouth should raise suspicion. Symphyseal separation is typically straightforward to palpate; however, the clinician should always look for a second fracture using general or dental radiography. Standard orthogonal views may be supplemented with oblique views to reduce confusion due to superimposition of teeth and bones. The maxilla can be assessed with these methods but is often best evaluated with CT if multiple fracture areas are suspected. Radiography can be used to evaluate fracture orientation, fracture number, tooth viability, bone quality, osteomyelitis, and tumor formation.

Other body systems should be assessed for damage secondary to any primary trauma. Common injuries include brain trauma, cranial nerve damage, and pneumothorax;
thus, a thorough physical examination and cardio-pulmonary stabilization should be performed prior to treatment for facial fractures.

**Treatment**

General anesthesia is required for fracture treatment, and local anesthetic blocks are advantageous. IV antibiotics should be administered in patients that have open fractures. Intubation with a short endotracheal tube and pharyngostomy are useful for evaluating occlusion during fracture surgery; in the former, the connection between the tube and anesthesia hose is located in the mouth, allowing for brief, intermittent disconnection with closure of the mouth to assess interdigitation of the maxillary and mandibular teeth. A pharyngostomy tube can be placed caudal to the mandible through a separate skin and pharyngeal incision (Figure 1, previous page) or through an incision ventrolateral to the tongue.

Symphyseal separation can be repaired by passing 22- to 18-gauge wire through a hole in the ventral midline skin to encircle the base of the mandibular canine teeth (Figure 2). The wire should be tightened to ensure stability of the symphysis while occlusion is observed to maintain proper spacing between the mandibular and maxillary canine teeth. The cerclage wire should be cut with sufficient wire protruding to enable removal after 6 to 8 weeks. The metal twist may be covered by a dollop of bone cement, acrylic, or a pencil eraser to prevent self-trauma.

When managing fractures of the mandibular body, the surgeon’s goal is to provide stability to achieve bone union, whereas the dentist’s goal is to maintain tooth viability and proper occlusion. For example, a surgeon may want to place cerclage wires near the tooth root in the ventral mandible to secure good-quality bone at the tension surface, whereas a dentist might prefer an intra-oral technique to preserve the root and relinquish a biomechanically superior location for implant placement. With proper planning, these goals can be balanced with a variety of methods. Interfrag-
mentary wiring can be performed by placing 24- to 18-gauge wire throughout the length of the mandibular body; typically, >1 wire should be placed perpendicular to the fracture line for stability (Figure 3). Simple straight-line fracture configurations are best for this technique. In cases involving comminution of the mandible, plates or external fixators can be useful (Figures 4 and 5). These are typically placed on the lateral aspect of the mandible with careful avoidance of the tooth roots.

When fracture lines between intact teeth are observed, interdental wiring with 26- to 20-gauge wire at the gingival line of each tooth can be useful as a supplement to other techniques. Acrylic is commonly added over the teeth–wire construct. The teeth should first be scaled, polished, and acid etched, then acrylic should be applied over the teeth–wire construct while ensuring occlusion (Figure 6, next page). Bone healing may be prolonged if tooth extraction or root canal is required. The acrylic and wires can be removed once bone healing is evident, typically 6 to 8 weeks after injury.

In cats and small dogs with caudal body or ventral ramus fractures, bonding of the 4 canine teeth is a viable treatment option. Bonding prevents the entire mandible from moving so that a fracture in any location will heal. It is most often used with caudally located fractures for which there are fewer repair options. However, the application often gets overpowered and fails in medium and large dogs, for which other methods are needed. The canines should be scaled, polished, and acid etched, then acrylic should be applied while the mouth is open in a manner that would enable intake of gruel. The acrylic should be removed in 6 to 8 weeks. In older dogs with small rostral mandibular fractures, partial mandibulectomy is an excellent treatment strategy with no potential for nonunion or bone infection.

When financial considerations preclude the fracture assessment and treatment plan, a tape muzzle can be used. The face should be cleaned and dried...
and any open fractures sutured closed. Tape should then be applied in a circular pattern over the muzzle to allow an oral opening sufficient for intake of gruel. Another piece of tape should be placed under the ears and around the back of the head and secured to the muzzle tape (Figure 7). An Elizabethan collar should be used to prevent the patient from removing the muzzle. Pet owners should be advised to clean the tape muzzle, although it can be easily replaced if necessary. A sufficiently large nylon muzzle may alternatively be used.

**Prognosis & Clinical Follow-Up**

Postoperative treatment includes pain management (eg, fentanyl or hydromorphone immediately, followed by an oral NSAID with tramadol or gabapentin) and 1 to 2 weeks of antibiotic treatment (eg, amoxicillin/clavulanic acid, clindamycin) for open fractures. In addition, the patient should be provided soft food for 2 to 4 weeks, during which time toys and hard treats should be withheld. Follow-up radiography should be performed 6 to 8 weeks posttreatment to assess fracture healing. Jaw fracture treatment has a complication rate of 34% to 60%.

Malocclusion and infection are the most common complications; implant failure, malunion, and nonunion may also occur. Nonunion can be treated with further stabilization surgery and bone grafting.

**References**

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Warsaw, Poland

Early Bird Registration Deadline: 1 July 2020
Trooper, a 3-year-old 67-lb (30.5-kg) intact male Siberian husky, was presented to the dermatology clinic for skin lesions around the eyes. Lesions were first appreciated ≈4 months prior to presentation and showed no response to amoxicillin/clavulanic acid or cefpodoxime, which were prescribed by the primary veterinarian. Treatment with combined trimeprazine/prednisolone twice daily and tapered over 1 month resulted in partial improvement. The affected areas were only mildly pruritic. According to the owner, the lesions around the eyes had worsened, and the scrotum had become inflamed in the previous 4 months.

Physical Examination
On examination, Trooper was bright, alert, and responsive. All peripheral lymph nodes were normal. Periocular regions were alopecic with mild to moderate crusting (Figure, next page). The pinnae were moderately erythematous on the concave surface with mild adherent scaling. The scrotum was severely erythematous. All paw pads were crusted. The remainder of the examination was unremarkable.

Diagnosis
Evaluation of an impression smear of the periocular region revealed numerous coci with streaming neutrophils. A deep skin scrape was negative for ectoparasites. Skin biopsies were discussed with Trooper’s owner; however, superficial pyoderma was initially treated prior to biopsy to ensure accurate results. Bacterial culture and susceptibility testing was performed on the lesions to guide therapy.
Four days after initial presentation, culture results revealed methicillin-resistant *Staphylococcus schleiferi* (*Table*). Treatment with chloramphenicol (40 mg/kg every 8 hours) was initiated. In addition, the owner was instructed to bathe Trooper weekly using a 3% chlorhexidine/phytosphingosine shampoo. Due to the location of the periocular lesions, topical therapy did not seem appropriate as the sole means of eliminating pyoderma.

Infection had improved significantly 2 weeks after initial presentation, and Trooper was returned to the clinic for punch biopsies (6 mm) of the affected areas, performed while he was under sedation. The specimens were submitted for histopathology, which confirmed zinc-responsive dermatosis (see *Histopathology Results of Punch Biopsies Indicating Marked Parakeratotic Hyperkeratosis*).

**HISTOPATHOLOGY RESULTS OF PUNCH BIOPSIES INDICATING MARKED PARAKERATOTIC HYPERKERATOSIS**

Three specimens of haired skin obtained via punch biopsy were evaluated histologically. In all biopsy samples, marked parakeratotic hyperkeratosis that expanded to the follicular infundibula and into the intrafollicular stratum corneum was apparent. The epidermis was moderately spongiosis, and mild acanthosis and leukocyte exocytosis were observed. The superficial dermis was markedly expanded by edema and a mild interstitial chronic inflammatory infiltrate of small lymphocytes, plasma cells, and fewer granulocytes. Many superficial dermal fibroblasts were plump and reactive; this type of superficial dermal expansion can give the skin surface a papillated appearance. Multifocal small inflammatory aggregates associated with adnexa were observed in 2 sections throughout the dermis; these inflammatory cells included epithelioid macrophages, lymphocytes, plasma cells, and neutrophils. Free keratin (ie, furunculosis) was observed in one of these foci.

Hyperkeratosis, especially of the superficial follicular infundibula, was striking andsuggestive of zinc-responsive dermatosis. The superficial dermal edema and foci of furunculosis were suggestive of resolving pyoderma.
**TABLE**

**AEROBIC CULTURE & SUSCEPTIBILITY RESULTS FOR STAPHYLOCOCCUS SCHLEIFERI 4+ BACTERIAL GROWTH**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin G</td>
<td>Resistance ≥0.5</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>Resistant</td>
</tr>
<tr>
<td>Amoxicillin/clavulanic acid</td>
<td>Resistant</td>
</tr>
<tr>
<td>Oxacillin†</td>
<td>Resistance ≥4</td>
</tr>
<tr>
<td>Cephalaxin</td>
<td>Resistant</td>
</tr>
<tr>
<td>Cefovecin</td>
<td>Resistance ≥8</td>
</tr>
<tr>
<td>Cefpodoxime</td>
<td>Resistance ≥8</td>
</tr>
<tr>
<td>Cefiofur</td>
<td>Did not report</td>
</tr>
<tr>
<td>Imipenem</td>
<td>Resistant</td>
</tr>
<tr>
<td>Amikacin</td>
<td>Susceptible</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>Susceptible</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>Did not report</td>
</tr>
<tr>
<td>Neomycin</td>
<td>Did not report</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>Resistant</td>
</tr>
<tr>
<td>Enrofloxacin</td>
<td>Resistance ≥4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marbofloxacin</td>
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<tr>
<td>Moxifloxacin</td>
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<tr>
<td>Azithromycin</td>
<td>Resistant</td>
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<td>Erythromycin</td>
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<tr>
<td>Clindamycin</td>
<td>Resistant</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>Did not report</td>
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<tr>
<td>Doxycycline</td>
<td>Resistant</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>Resistance ≥16</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>Did not report</td>
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<tr>
<td>Mupirocin</td>
<td>Susceptibility ≤1</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>Susceptibility ≤4</td>
</tr>
<tr>
<td>Rifampin</td>
<td>Susceptibility ≤0.5</td>
</tr>
<tr>
<td>Trimethoprim/sulfamethoxazole</td>
<td>Resistant</td>
</tr>
<tr>
<td>Sulfoxazole</td>
<td>Did not report</td>
</tr>
</tbody>
</table>

*S. schleiferi is resistant to oxacillin and therefore is methicillin-resistant. All staphylococci are screened for methicillin resistance.

†Oxacillin can be used to predict methicillin sensitivity. Oxacillin-resistant staphylococci are resistant to all cephalosporins, including cefpodoxime and cefovecin.

**Staphylococcus schleiferi is resistant to oxacillin and therefore is methicillin-resistant.**
Cytologic impression smears should be performed and any secondary infections (eg, Malassezia pachydermatis, bacteria) treated.

Zinc-responsive dermatosis syndrome I should be treated through long-term supplementation with zinc sulfate, zinc gluconate, or zinc methionine, and doses should be based on elemental zinc (initial dose, 2-3 mg/kg once daily or split and given every 12 hours). Zinc sulfate may have lower bioavailability and can cause gastric irritation.

Supplemental therapies (eg, omega fatty acids, corticosteroids, antibacterial topical medications) may be helpful and can be used as warranted.

Trooper was rechecked 1 month after zinc therapy was initiated; lesions showed some improvement, and evaluation of an impression smear confirmed the absence of bacteria. Low-dose methylprednisolone (initial dose, 0.7 mg/kg once daily) was initiated and tapered over 1 month. In many cases, low-dose corticosteroids can be beneficial for treatment of dogs that do not respond to zinc alone, as corticosteroids are known to increase zinc absorption from the GI tract.

Trooper was presented 6 weeks later for a recheck examination. He had not received methylprednisolone for 2 weeks, and all lesions were resolved. Zinc methionine supplementation was continued, and Trooper was free of lesions. Lifelong zinc supplementation is typically needed. Long-term prognosis is favorable as long as zinc supplementation is maintained.

Zinc-responsive dermatosis syndrome I is a condition that occurs primarily in Alaskan malamutes, Siberian huskies, and other arctic breeds and may be associated with defective intestinal absorption of zinc.
Syndrome II occurs in dogs fed a zinc-deficient diet.1,2,6 The author has anecdotally seen an increase in the number of syndrome II cases that may be a result of an increase in dogs being fed home-prepared and alternative diets. Lesions are typically located at mucocutaneous junctions and paw pads and appear as areas of erythema with scaling, crusts, and hyperkeratosis.

Zinc-responsive dermatosis should be on the differential diagnosis list for crusted skin disease in any northern- or arctic-breed dog (see Take-Home Messages). Diagnosis is made through history and biopsy. Serum or hair levels of zinc may be low in affected patients; however, proper analysis can be difficult due to a variety of factors, so biopsy is the recommended diagnostic test if zinc-responsive dermatosis is suspected.7

REFERENCES
IMMITICIDE® STERILE POWDER (MELARSMINE DIHYDROCHLORIDE)

Brief Summary: Before Using IMMITICIDE, please consult the product insert, a summary of which follows.

CAUTION

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

WARNING

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

INDICATIONS

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

CONTRAINdications

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

WARNINGS

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

HUMAN WARNINGS

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

PRECAUTIONS

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

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

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

DOSAGE AND ADMINISTRATION

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

Disease Classification: It is vital to classify the severity of heartworm disease to apply the appropriate dosage regime for IMMiticide. See full product insert for Heartworm Disease Classification criteria.

Class 1 and 2: IMMiticide should be given in two intramuscular injections of 2.5 mg/kg, 24 hours apart. Four months following treatment, a second treatment series (2.5 mg/kg twice, 24 hours apart) can be elected.

Class 3: Alternate Dosing Regime: Dogs with severe (Class 3) heartworm disease should be stabilized prior to treatment and then dosed intramuscularly in the lumbar (L3 - L5) muscles with a single injection of 2.5 mg/kg then approximately 1 month later with 2.5 mg/kg administered twice, 24 hours apart.

SAFETY

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

In Case of Overdosage:

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

ADVERSE REACTIONS (SIDE EFFECTS)

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

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

The information provided here is not comprehensive. The full FDA-approved product insert is available at http://www.merial.us/SiteCollectionDocuments/Immiticide_PI_8.5x11_version.pdf. Consult your veterinarian for further information. For technical assistance, to request a Safety Data Sheet or to report suspected adverse events, call 1-888-637-4251. For additional information about adverse event reporting for animal drugs, contact FDA at 1-888-FDA-VETS, or http://www.fda.gov/AnimalVeterinary. NADA 141-042 Marketed by Merial, Inc.
Melarsomine dihydrochloride, the active ingredient in IMMITICIDE, is the ONLY FDA-approved heartworm adulticide. Give your canine patients the future they deserve with IMMITICIDE.

To get your supply of IMMITICIDE, call Boehringer Ingelheim Customer Care at 1-888-637-4251, contact your sales representative, or order instantly at BI-CONNECT.com

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

For more information, please see full prescribing information.

See page 38 for product information summary.
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Meloxicam & Robenacoxib in Cats with Chronic Kidney Disease

Michael W. Wood, DVM, PhD, DACVIM (SAIM)
University of Wisconsin–Madison

In the Literature

FROM THE PAGE …

Osteoarthritis (OA) and chronic kidney disease (CKD) are common in older cats. It has been suggested that OA-associated pain and reduced mobility cause decreased water consumption, leading to worsening prerenal azotemia, constipation, and, ultimately, CKD progression. NSAIDs can decrease lameness in cats with OA; however, use of NSAIDs to manage OA pain in cats with CKD has historically been discouraged. NSAID administration reduces the renal production of prostaglandins, which are important regulators of glomerular pressure, sodium reabsorption, and renal perfusion. Blocking their production may precipitate renal injury, particularly if a cat is hypovolemic or dehydrated.
This article review by the WSAVA Global Pain Council evaluated recent studies that examined whether meloxicam and robenacoxib can be safely administered to cats with CKD. The 3 clinical studies referenced had generally favorable outcomes, although limited study duration, reduced drug dosages, and case selection biases limit the broad application of the results. In the studies, adverse event frequency and lifespan were similar between the meloxicam/robenacoxib-treated and control groups.\textsuperscript{4-6} In one study, cats receiving meloxicam experienced a slower increase in median serum creatinine over time;\textsuperscript{4} it is unclear whether this effect was due to increased mobility and reduced pain, allowing for increased water and food consumption, or possibly due to reduced tubulointerstitial inflammation. These study conclusions are also supported by a cat remnant kidney model study in which euvolemic cats with experimentally induced azotemia did not experience changes in glomerular filtration rate after short-term meloxicam administration.\textsuperscript{7}

Despite these findings, NSAID administration in cats with CKD requires careful consideration based on patient stability and owner education. In cats, NSAIDs can cause acute kidney injury, and, in hypovolemic dogs, their administration decreases renal function.\textsuperscript{3,8} To mitigate these risks, the WSAVA Global Pain Council recommends NSAID doses be tapered to the minimal effective dose. In addition, NSAIDs should be avoided in cats with progressive azotemia or weight loss and used cautiously, if at all, in cats with International Renal Interest Society stage 3 or 4 CKD, considering the lack of clinical data in this patient population. Before and during therapy, comorbidities (eg, dehydration, proteinuria, hypertension, hyperphosphatemia) must be carefully managed and regularly monitored. At home, owners must continually assess their cat’s water and food intake, changes in weight, and clinical signs. Optimizing care with alternative therapies (eg, environmental enrichment, physical therapy, acupuncture, and nutraceuticals, including chondroprotective agents) is recommended.

\begin{center}
\underline{\textbf{References}}
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Pelvic Fractures in Cats

Armi Pigott, DVM, DACVECC
Lakeshore Veterinary Specialists
Glendale, Wisconsin

In the Literature

The pelvis is the second most common fracture site in cats, with ≈25% of all reported fractures occurring in the pelvis.¹ ² The most common causes include falls from a tall height and vehicular trauma.² Concurrent extra-pelvic injuries are also reported in 58% to 72% of cats with traumatic pelvic fractures, as large impact forces tend to be involved with these injuries.² ³

In humans with traumatic pelvic fractures, the mortality rate is 5% to 50%,⁵ depending on overall severity of injury; ≈33% of patients with traumatic pelvic fractures require blood transfusion as part of resuscitation.⁶ Most occurrences of hemorrhage in humans are believed to stem from concurrent injuries, not from fractured bone.⁵ ⁷ ⁸

The need for transfusion and hemorrhage-control interventions in humans can be predicted by the pattern of pelvic fractures, the presence of shock on admission, and the Injury Severity Score.⁹ ¹⁰ This retrospective study evaluated whether characterization of transfusion requirements and outcomes could be similarly predicted in cats presented with traumatic pelvic fractures. Of the 112 cats included in the study, 21 received a blood transfusion, 84 required surgical fracture stabilization, 25 required surgery for other injuries (ie, skin wounds, urinary tract trauma, ocular trauma), and 102 (91.1%) survived to discharge. Only half of the cats requiring a transfusion needed it preoperatively, and none received the transfusion as part of initial resuscitation.

Cats with sacroiliac luxation or pubic fractures were more likely to receive blood transfusions; however, these fractures were also the most common, so further evaluation in a different population of cats is needed to determine if these fracture types can truly predict the need for transfusion. Of note, 8% of cats in this study required surgery to repair disruption of the urinary tract, a rate much higher than previously reported in either dogs or cats.² ⁷ ⁸
Approximately 1 in 5 cats with pelvic fractures may require a blood transfusion during hospitalization.

Because cats with traumatic pelvic fractures often have additional injuries, any cat with a pelvic fracture should have a thorough, whole-body-systems evaluation.

Urinary tract injury may be more common in cats with traumatic pelvic fracture than previously thought. Contrast cystourethrogram and/or serial ultrasonography may be helpful for early identification of cats requiring intervention for this problem.

References
In cases of severe hypoxemia, use of a traditional nasal cannula or oxygen-enriched environment may not be sufficient to support oxygenation, in which case mechanical ventilation may be necessary. However, given the need for specialized equipment and expertise, mechanical ventilation may not be practical in many clinical situations. The opportunity to provide higher levels of supplemental oxygen and continuous positive airway pressure (CPAP) may allow for respiratory support without mechanical ventilation.

High-flow nasal cannula (HFNC) oxygen delivery systems have been developed and used in human medicine with the goal of delivering much higher flows of oxygen, which are better tolerated than traditional flows as the systems heat and humidify the air. In addition, the tight seal and high flow of oxygen allow the generation of CPAP, which mimics the effects of positive end expiratory pressure achievable with mechanical ventilation. Both CPAP and positive end expiratory pressure can help improve pulmonary function by decreasing atelectasis and promoting lung recruitment. This research study sought to determine the safety and efficacy associated with application of an HFNC system to dogs.

A total of 8 healthy dogs were included in this randomized crossover study. Study groups included traditional nasal cannula (at 0.1, 0.2, and 0.4 L/kg/min flow rates) and HFNC with subjects either awake or sedated (at 0.4, 1, 2, and 2.5 L/kg/min flow rates). Measured parameters included inspiratory and expiratory airway pressure, fraction of inspired oxygen (FiO₂), partial pressure of oxygen, partial pressure of carbon dioxide, temperature, heart and respiratory rate, arterial blood pressure, and pulse oximetry. Complications and predefined tolerance and respiratory scores were also assessed.
The HFNC junior interface fit well on 3 dogs; however, the adult interface had to be modified to fit well on the other 5 dogs. No differences were found with regard to vital parameters between the traditional nasal cannula and HFNC groups. The HFNC group showed good tolerance at 0.4 and 1 L/kg/min, acceptable tolerance at 2 L/kg/min, and poor tolerance at 2.5 L/kg/min, with CPAP being achieved at flows ≥1 L/kg/min. Dogs in the traditional nasal cannula group receiving 0.1 L/kg/min failed to have an increase in FiO₂ but achieved an average of 50% at 0.2 L/kg/min and 72% at 0.4 L/kg/min. With HFNC, FiO₂ averaged 72% at 0.4 L/kg/min and 95% for all other flow rates assessed, with minimal impact on ventilation. Dogs receiving HFNC showed radiographic evidence of aerophagia, but no other complications were noted.

… TO YOUR PATIENTS
Key pearls to put into practice:

1. Although previously reported to be effective,¹ traditional nasal oxygen supplementation with 0.1 L/kg/min failed to achieve FiO₂ statistically different from room air in this study. Target levels of 0.2 to 0.4 L/kg/min should be considered.

2. HFNC oxygen therapy is well-tolerated at rates of 0.4 L/kg/min to 2 L/kg/min and can achieve CPAP at flows ≥1 L/kg/min with no significant complications. Nasal cannulas may need to be modified for medium- to large-sized dogs to achieve an appropriate fit/seal.

3. The dogs in this study had normal lungs. How these results extrapolate to patients with pulmonary compromise remains to be determined.

Reference

Research Note: Once-Monthly Treatment for Feline Diabetes

Glucagon-like peptide-1 receptor agonists (GLP-1RAs) such as exenatide show promise in the treatment of feline diabetes. GLP-1RAs stimulate insulin secretion by pancreatic β cells in the presence of high glucose levels. The investigators in this study developed a delivery system that allowed the slow release of a stable GLP-1RA analog, [Gln28]exenatide. The study first validated the pharmacokinetics and pharmacodynamics of exenatide vs [Gln128]exenatide in cats, after which the conjugate compound consisting of [Gln28]exenatide bonded to hydrogel microspheres was evaluated. The plasma half-life of the SC administered microsphere-[Gln28]exenatide conjugate was ≈40 days as compared with 40 minutes with the injected free peptide. The investigators concluded that GLP-1RA in this formulation is suitable for once-monthly SC administration in cats.

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Relevance of Anatomy in High-Quality Medicine

Adolf K. Maas III, DVM, DABVP (Reptile & Amphibian Practice), CertAqV
ZooVet Consulting
Bothell, Washington

In the Literature

FROM THE PAGE …

Differences in pharmacologic activity and effect in reptiles as a result of injection location has been anecdotally observed and assumed, and mention has been made in the literature that some pharmaceuticals should be administered in the cranial body to avoid rapid clearance or toxic renal concentration via the renal portal or hepatic portal systems.\(^1,2\) This is the first published report that confirms anesthetic agents can have differing effects based on location of injection.

Alfaxalone is a lipophilic neuroactive steroid that acts as a potent \(\gamma\) -aminobutyric acid agonist. It has been found to have reliable anesthetic results in a number of nontraditional species, including herptiles,\(^3,4\) and is primarily cleared via cytochrome P-450 metabolism in the liver and CNS. This study, in contrast to the previously mentioned studies,\(^1,2\) evaluated the differences in depth and duration of anesthesia observed in snakes that were injected in different regions of the body. Snakes that were injected in the cranial third of the body had an overall deeper plane of anesthesia and for a longer duration as compared with snakes that were injected in the caudal third.

This difference is most likely a result of the first-pass effect of the agent through the hepatic portal system when injected caudally, confirming that the anatomy of these species can affect pharmacologic effects.

FROM PAGE TO PATIENT

… TO YOUR PATIENTS
Key pearls to put into practice:

1. A functional knowledge of anatomic differences is critical to high-quality, effective herptile medicine.
2. Specific tissue clearance of pharmacologic agents should be considered when selecting drugs, dosages, and administration route and location in reptiles.
3. Anatomy and physiology must be considered in all cases of nontraditional species medicine and therapeutics.

References
Considerations for Diagnosis & Treatment of Feline Bacterial Keratitis

In humans, Selarid may be irritating to skin and eyes. Reactions such as hives, itching and skin redness have been reported in humans in rare instances. Individual s with known hypersensitivity to Selarid should use the product with caution or consult a health-care professional. Selarid contains isopropyl alcohol and the preservative butylated hydroxytoluene (BHT). Wash hands after use and wash off any product in contact with the skin immediately with soap and water. If contact with eyes occurs, then flush eyes copiously with water. In case of ingestion by a human, contact a physician immediately. The safety data sheet (SDS) provides more detailed occupational safety information. For a copy of the SDS or to report adverse reactions attributable to exposure to this product, call 1-866-591-5777. Flammable—Keep away from heat, sparks, open flames or other sources of ignition. Do not use in sick, debilitated or underweight animals (see SAFETY).

PRECAUTIONS:
Prior to administration of Selarid, dogs should be tested for existing heartworm infections. At the discretion of the veterinarian, infected dogs should be treated to remove adult heartworms. Selarid is not effective against adult D. immitis and, while the number of circulating microfilariae may decrease following treatment, Selarid is not effective for microfilariae clearance. Hypersensitivity reactions have not been observed in dogs with patent heartworm infections administered three times the recommended dose of selamectin solution. Higher doses were not tested.

ADVERSE REACTIONS:
Pre-approval clinical trials: Following treatment with selamectin solution, transient localized alopecia with or without inflammation at or near the site of application was observed in approximately 1% of 691 treated cats. Other signs observed rarely (<0.5%) were 1743 treated cats and dogs) included vomiting, loose stool or diarrhea with or without blood, anorexia, lethargy, salivation, tachypnea, and muscle tremors.

Post-approval experience: In addition to the aforementioned clinical signs that were reported in pre-approval clinical trials, there have been reports of pruritus, urticaria, erythema, ataxia, fever, and rare reports of death. There have also been rare reports of seizures in dogs (see WARNINGS).

SAFETY:
Selamectin solution has been tested safe in over 100 different pure and mixed breeds of healthy dogs and over 15 different pure and mixed breeds of healthy cats, including pregnant and lactating females, breeding males and females, puppies six weeks of age and older, and avermectin-sensitive collies. A kitten, estimated to be 5–6 weeks old (0.3 kg), died 8 ½ hours after receiving a single treatment of selamectin solution at the recommended dosage. The kitten displayed clinical signs which included muscle spasms, salivation and neurological signs. The kitten was a stray with an unknown history and was maltreated and underweight (see WARNINGS).

DOGS: In safety studies, selamectin solution was administered at 1, 3, 5, and 10 times the recommended dose to six-week-old puppies, and no adverse reactions were observed. The safety of selamectin solution administered orally also was tested in case of accidental oral ingestion. Oral administration of the recommended topical dose of selamectin solution to cats caused salivation and intermittent vomiting. Selamectin solution also was applied at 4 times the recommended dose to patent heartworm infected cats, and no adverse reactions were observed.

In well-controlled clinical studies, selamectin solution was used safely in animals receiving other frequently used veterinary products such as vaccines, anthelmintics, antibiotics, steroids, shampoos and dips.

STORAGE CONDITIONS: Store below 86°F (30°C).

HOW SUPPLIED: Available in seven separate dose strengths for dogs and cats of different weights (see DOSAGE). Selarid for puppies and kittens is available in cartons containing 1 single dose-applicators. Selarid for dogs and cats is available in cartons containing 6 single dose-applicators. Approved by FDA under ANDA # 200-663

Manufactured by: Norbrook Laboratories Limited Newry, BT35 6PU, Co. Down, Northern Ireland

Revised Dec 2019

FROM THE PAGE …

Possible causes of feline keratitis include viral infection (i.e., feline herpesvirus-1), eyelid abnormalities (e.g., eyelid coloboma, agenesis, entropion, distichiasis, ectopic cilia, tumors), ocular trauma, ocular foreign bodies, corneal sequestra, and bacterial infection. Although bacterial keratitis is less common in cats as compared with other small animals, clinicians should consider the role bacteria can play in keratitis and know how to identify and effectively treat corneal bacterial infections.

In the Literature


Jamie Lembo, DVM
DJ Haeussler Jr, DVM, MS, DACVO
The Animal Eye Institute
Cincinnati & Dayton, Ohio
Florence, Kentucky

Topical Parasiticide For Dogs and Cats

BRIEF SUMMARY:
See Package Insert for full Prescribing Information

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

INDICATIONS:
Selarid is recommended for use in dogs six weeks of age or older and cats eight weeks of age and older for the following parasites and indications:

Dogs:
Selarid kills adult fleas and prevents flea eggs from hatching for one month and is indicated for the prevention and control of flea infestations (Ctenocephalides felis), prevention of heartworm disease caused by Dirofilaria immitis, and the treatment and control of ear mite (Otodectes cynotis) infestations. Selarid also is indicated for the treatment and control of sarcoptic mange (Sarcoptes scabiei) and for the control of tick infestations due to Dermacentor variabilis.

Cats:
Selarid kills adult fleas and prevents flea eggs from hatching for one month and is indicated for the prevention and control of flea infestations (Ctenocephalides felis), prevention of heartworm disease caused by Dirofilaria immitis, and the treatment and control of ear mite (Otodectes cynotis) infestations. Selarid also is indicated for the treatment and control of sarcoptic mange (Sarcoptes scabiei) and for the control of tick infestations due to Dermacentor variabilis.

CAUTION:
Selarid is not effective against adult heartworms. Selarid is not effective against adult D. immitis and, while the number of circulating microfilariae may decrease following treatment, Selarid is not effective for microfilariae clearance. Hypersensitivity reactions have not been observed in dogs with patent heartworm infections administered three times the recommended dose of selamectin solution. Higher doses were not tested.

ADVERSE REACTIONS:
Pre-approval clinical trials: Following treatment with selamectin solution, transient localized alopecia with or without inflammation at or near the site of application was observed in approximately 1% of 691 treated cats. Other signs observed rarely (<0.5%) were 1743 treated cats and dogs) included vomiting, loose stool or diarrhea with or without blood, anorexia, lethargy, salivation, tachypnea, and muscle tremors.

Post-approval experience: In addition to the aforementioned clinical signs that were reported in pre-approval clinical trials, there have been reports of pruritus, urticaria, erythema, ataxia, fever, and rare reports of death. There have also been rare reports of seizures in dogs (see WARNINGS).

SAFETY:
Selamectin solution has been tested safe in over 100 different pure and mixed breeds of healthy dogs and over 15 different pure and mixed breeds of healthy cats, including pregnant and lactating females, breeding males and females, puppies six weeks of age and older, and avermectin-sensitive collies. A kitten, estimated to be 5–6 weeks old (0.3 kg), died 8 ½ hours after receiving a single treatment of selamectin solution at the recommended dosage. The kitten displayed clinical signs which included muscle spasms, salivation and neurological signs. The kitten was a stray with an unknown history and was maltreated and underweight (see WARNINGS).

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In well-controlled clinical studies, selamectin solution was used safely in animals receiving other frequently used veterinary products such as vaccines, anthelmintics, antibiotics, steroids, shampoos and dips.

STORAGE CONDITIONS: Store below 86°F (30°C).

HOW SUPPLIED: Available in seven separate dose strengths for dogs and cats of different weights (see DOSAGE). Selarid for puppies and kittens is available in cartons containing 1 single dose-applicators. Selarid for dogs and cats is available in cartons containing 6 single dose-applicators. Approved by FDA under ANDA # 200-663

Manufactured by: Norbrook Laboratories Limited Newry, BT35 6PU, Co. Down, Northern Ireland

Revised Dec 2019

FROM PAGE TO PATIENT


Jamie Lembo, DVM
DJ Haeussler Jr, DVM, MS, DACVO
The Animal Eye Institute
Cincinnati & Dayton, Ohio
Florence, Kentucky
This retrospective study of 81 cats (102 corneal samples) describes clinical characteristics of cats diagnosed with feline keratitis, as well as in vitro susceptibility patterns of corneal bacterial isolates. Most patients were presented with unilateral disease and exhibited blepharospasm and ocular discharge.

Gram-positive bacteria were most often cultured (82 out of 102 samples), with *Staphylococcus* spp isolated from 55% of samples. Most samples (62 out of 81 cats) contained a single bacterial isolate. All isolates were susceptible to ofloxacin; other effective in vitro antibiotics included ciprofloxacin, ticarcillin, gentamicin, and moxifloxacin. Although chloramphenicol and doxycycline were effective in vitro, the authors did not recommend them as first-line therapeutics due to their bacteriostatic activity. Overall success for maintaining vision and globe retention was very good (88%) in this study.

**... TO YOUR PATIENTS**

Key pearls to put into practice:

1. Bacterial keratitis is uncommon in cats. When present, gram-positive bacteria, particularly *Staphylococcus* spp, are the most likely infectious agents.

2. First-line antibiotics to treat suspected bacterial keratitis include ofloxacin, ciprofloxacin, ticarcillin, gentamicin, and moxifloxacin.

3. Judicial empiric use of antimicrobials is essential to prevent antibacterial resistance. Culture and susceptibility testing is recommended when possible.
Congenital Malformations of the Lumbosacral Vertebral Column

Kristyn D. Broaddus, DVM, MS, DACVS
Veterinary Services of Hanover
Mechanicsville, Virginia

In the Literature
Bertram S, Ter Haar G, De Decker S. Congenital malformations of the lumbosacral vertebral column are common in neurologically normal French bulldogs, English bulldogs, and pugs, with breed-specific differences. Vet Radiol Ultrasound. 2019;60(4):400-408.

FROM THE PAGE …

French bulldogs, English bulldogs, and pugs can be grouped together based on brachycephalic anatomy. They are known to have respiratory difficulty due to shortened noses and share a propensity for congenital vertebral malformations. These breeds are also known to have block vertebrae, hemivertebrae, transitional vertebrae, and neural tube defects. A study revealed that the degree of screw-tail in French bulldogs correlates with the severity of hemivertebrae in the thoracic region.

The current study examined 149 CT scans of vertebrae L6 to S3 and coccygeal vertebrae in neurologically normal pugs, French bulldogs, and English bulldogs over a 6-year period. The goal of the study was to determine whether vertebral lumbosacral (LS) malformations were present in neurologically normal dogs and whether the severity of tail deformity was linked to the presence of vertebral malformations in the LS region. Fifty-one percent of dogs had evidence of at least one type of congenital vertebral malformation, 60.5% had LS intervertebral disk herniations, and 67.1% had abnormal tails; normal tail morphology was only identified in 32.9% of dogs. These results support an association between LS hemivertebrae at L7 and S1 and the degree of tail malformation and intervertebral disk herniation in English and French bulldogs. Tails were more consistently normal in pugs, and this breed exhibited more transitional LS vertebral malformations than hemivertebral malformations. All breeds had an increased incidence of intervertebral disk disease as age increased.
This study concluded that the severity of screw-tail in English and French bulldogs is correlated with the presence of hemi-vertebrae; pugs do not have true screw-tails and are more likely to have transitional vertebrae. In addition, apparently clinically normal pugs and English and French bulldogs can have vertebral abnormalities. Because these results were found in clinically normal dogs, the study authors caution against overinterpreting results of CT scans and emphasize the importance of lesion localization during neurologic examination to avoid intervening in a clinically normal patient. In addition, there were some limitations due to the study’s retrospective nature and the fact that most dogs did not undergo neurologic examination; it is possible that patients with intermittent or mild neurologic deficits were considered normal.

**… TO YOUR PATIENTS**

Key pearls to put into practice:

1. A genetic defect of the DVL2 gene that is linked to vertebral malformations of the thoracic and coccygeal vertebrae has been identified in English and French bulldogs. Pugs do not share this defect and therefore should not be considered to have true screw-tails. The tail defect in pugs is more likely vertebra curva, the result of bone bending from soft tissue tension during development.

2. The study findings further support minimizing severe screw-tails due to their correlation with vertebral malformations. Although patients may be clinically and neurologically normal, selective breeding to minimize the screw tail phenotype may improve the gene pool.

3. Although advanced imaging can be helpful for visualizing anatomic neurologic lesions, the physical examination, including a thorough neurologic examination, is the most important factor in determining the relevance of imaging findings. In some cases, findings could be consistent with normal aging and not be clinically problematic.

**References**


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**LOOK FOR THESE ARTICLES IN FUTURE ISSUES**

- Advising Pet Owners on Nutritional Adequacy
- Top 5 Indications for Appetite Stimulation
- Case Review: Lethargy & Anorexia Following Foreign Body Surgery
- Immune-Mediated Skin Diseases Image Gallery
- Feline Asthma
Research Note:

**Fungal Cultures for Feline Dermatophytosis**

This retrospective study of 371 cats treated for dermatophytosis sought to determine how often a first negative fungal culture was indicative of mycological cure as compared with 2 negative fungal cultures. Results demonstrated that a first negative fungal culture for *Microsporum canis* indicated mycological cure in 90.3% of cats, and subsequent cultures remained negative. Of the remaining cats, other than being lesional, 19 were healthy and had 1 negative fungal culture within the first 3 weeks of treatment, followed by ≥1 positive fungal cultures; these cats went on to mycological cure without event. Another 17 cats had concurrent medical illness in addition to dermatophytosis. These patients initially had resolution of lesions and negative fungal cultures but ≥1 positive fungal culture during treatment; mycological cure was not achieved until the concurrent illness was resolved. In otherwise healthy cats in which high treatment compliance is achieved, 1 negative fungal culture may be sufficient to indicate mycological cure.

**Source**


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Subconjunctival Hemorrhage in Dogs

Georgina Newbold, DVM, DACVO
The Ohio State University

In the Literature

FROM THE PAGE …

When a patient is presented for red and/or bruised ocular tissue, there may be concern for trauma or nonaccidental injury/physical abuse. In a large study of pets presented for traumatic injury, subconjunctival hemorrhage (ie, bleeding between the conjunctiva and sclera) was associated with nonaccidental injury.1

However, there are several nontraumatic causes of subconjunctival hemorrhage that must be ruled out to avoid missing a systemic problem. These causes, in addition to cases of known trauma, were investigated in a recent study. Medical records of 147 dogs with subconjunctival or scleral hemorrhage were retrospectively analyzed. In 81% of dogs, subconjunctival hemorrhage was attributed to a traumatic event (eg, vehicular trauma, animal attack); of these cases, <5% were the result of nonaccidental injury. The remaining 19% of patients were determined to have a primary systemic or ocular problem that led to subconjunctival bleeding. Because a significant number of patients in this study had distinct systemic causes for subconjunctival hemorrhage, it is important to consider diagnoses other than trauma or nonaccidental injury.

Because a significant number of patients in this study had distinct systemic causes for subconjunctival hemorrhage, it is important to consider diagnoses other than trauma or nonaccidental injury.
When patients with subconjunctival hemorrhage are assessed, a thorough history, including the potential for unwitnessed trauma, should be obtained. A complete physical examination is necessary to look for evidence of puncture or bite wounds or abrasions. The patient should also be examined closely for any signs of petechiation or ecchymoses. A thorough ocular examination should be performed to assess for other signs of bleeding (eg, hyphema, iridal hemorrhage, retinal hemorrhage). Presence of additional intraocular signs may indicate a systemic problem or primary ocular condition (eg, glaucoma, orbital mass).

Diagnostic testing is important in cases in which trauma is not strongly suspected or observed. Blood pressure >160 mm Hg may be a concern for systemic hypertension, but pain, stress, and anxiety following trauma can also cause transient elevation in blood pressure. CBC, including platelet count, and prothrombin and activated partial thromboplastin times should be performed to rule out coagulopathies such as immune-mediated thrombocytopenia and rodenticide toxicity (Figure). A serum chemistry profile is also recommended to look for bleeding disorders secondary to acute liver injury or toxicity. In some cases, vasculitis secondary to rickettsial disease, envenomation, and/or another inflammatory condition may lead to a bleeding disorder.

Although nonaccidental injury is possible, subconjunctival hemorrhage may signal a bleeding disorder rather than abuse or trauma.

Reference
Canine Atopic Dermatitis: Supporting the Multimodal Approach

Canine atopic dermatitis (AD) is a life-long condition that often manifests relatively early in life (i.e., between 6 months and 3 years of age) and affects ≈1 in 10 dogs.1-3 Predisposed breeds include West Highland white terriers, Lhasa apsos, boxer dogs, German shepherd dogs, cocker spaniels, bulldogs, shar-peis, and golden and Labrador retrievers, some of the most popular dog breeds.2-4

AD can impact patient and owner quality of life.5 Signs of AD include pruritus, erythema, and development of other skin lesions and secondary skin infections.1,2 The most common body regions affected include the axillae, inguinal area, interdigital spaces, muzzle, concave pinnae, antebrachial fossae, and periocular areas.6 Self-trauma and skin infections can exacerbate inflammation.3 Secondary skin and ear infections from Staphylococcus spp and/or Malassezia spp are common and tend to recur, which exacerbates the damaging cycle in the skin that perpetuates the condition.7 This propensity for relapse, as well as AD’s attribution to genetic and environmental factors, makes AD similar to its counterpart eczema in human medicine.8-11

Pathogenesis
AD is thought to be caused by an immunoglobulin E (IgE)-mediated hypersensitivity immune response; these allergy response-associated antibodies are found mostly in the skin, mucous membranes, and lungs. AD has traditionally been thought to be caused by a response to inhaled allergens (e.g., pollen, dust, dander, mold); however, newer evidence in dogs suggests that the cutaneous route of exposure to allergens is the most important.10

The underlying cause of AD is not fully understood;7 but increasing evidence shows that skin barrier dysfunction is prevalent in atopic dogs.6 It is unknown whether the skin barrier defect is a primary or secondary issue.12 Evidence suggests that inflammation disrupts skin barrier properties and likely contributes to a vicious cycle in dogs with AD in which an abnormal skin barrier increases the propensity toward allergen sensitization and exposure and then skin barrier function is worsened further by allergic inflammation response.6,7,13 These issues can also lead...
to secondary bacterial and yeast skin infections, which further exacerbate the cycle. Common components of skin barrier dysfunction include skin dysbiosis, structural changes, and altered intercellular lipid content, all of which allow for transepidermal water loss (TEWL) and penetration by allergens.

Studies have shown that TEWL is greater in atopic dogs than in normal dogs, increases with allergen exposure in atopic dogs, is greater in younger atopic dogs than in adult atopic dogs after exposure, and is lower during remission as compared with atopic dogs prior to treatment. Allergen penetration activates an immune response that exacerbates inflammation and clinical signs primarily through degradation of histamine-releasing mast cells, although other inflammatory mediators and immune cells are also involved.

The Role of Intercellular Lipids
Altered intercellular lipids contribute to increased TEWL and penetration by allergens. In addition to free fatty acids, cutaneous ceramides are a major lipid component of the stratum corneum (ie, outer skin layer). As compared with normal dogs, dogs with AD have decreased levels of both free fatty acids and cutaneous ceramides in skin lesions and skin that looks grossly normal. In a study, after being challenged with allergens, ceramide levels in atopic dogs returned to prechallenge levels within 2 months of lesion remission.

Traditional Approaches
AD is usually managed through various therapy combinations. A number of products, including Janus kinase inhibitors, monoclonal antibodies, and corticosteroids or immunosuppressants, are traditionally used in the management of canine AD. Allergen-specific immunotherapy is the only treatment option that may lead to allergen tolerance over time, although a safe option, allergen-specific immunotherapy can be costly and take 6 to 9 months for initial observations of efficacy.

Supplemental Options
Other options for AD may be cost-prohibitive to the pet owner, cause adverse effects, and/or be ineffective alone. Topicals and anti-histamines can be less expensive but tend to have lower efficacy and duration of effect. Therefore, research into additional supplemental management options for AD could be beneficial.

Hardy Kiwi
Extracys derived from hardy kiwi (Actinidia arguta) fruit have been shown to change Canine Atopic Dermatitis Extent and Severity Index (CADESI)-03 scores in atopic dogs when used with steroids. CADESI is a subjective scoring system used to assess the severity of AD and monitor the condition over time, especially in clinical trials. Hardy kiwi extract has also been used to maintain lower CADESI scores after steroids have been tapered off. This maintenance is likely achieved through the effects of the extract shown in regulation of allergic response and inflammatory mediators. The fruit contains phenolic acids (ie, quinic and citric acid), monoterpenes, and flavonoids that may contribute to the activity of its extracts. The duration of administration has been correlated positively with the effects and benefits. Hardy kiwi extract is best used long-term as part of a multimodal approach to therapy.

Ceramides
Ceramides are commonly considered for topical application, but evidence for oral administration is emerging. Ceramides present in the skin represent 35% to 40% of the intercellular cement that binds the cells of the stratum corneum to provide an effective skin barrier. Positive effects with oral ceramides in humans have been demonstrated on skin hydration and TEWL, IgE reduction, and reduction of other inflammatory mediators.

β Glucans
β glucans are found in nature as a structural component of the cell wall of yeast, bacteria, and fungi. They are known for their immune-modulating effects and may help activate both innate and adaptive responses involved in AD. In a double-blinded, placebo-controlled study in dogs with AD, mean overall improvement of pruritus, erythema, scaling, and lichenification was 63%. These effects are likely associated with the modulation of inflammatory mediators.

Essential Fatty Acids
Because of their safety and low cost, essential fatty acids are a common component of a multimodal approach to managing canine AD. Inflammatory mediator, pruritus, and drug-sparing benefits have been demonstrated. Linoleic acid is commonly used, as it is the precursor to γ linoleic acid; however, due to the absence of appropriate enzymes, this conversion is not possible in the skin and overall may be systemically deficient in atopic patients. Providing performed long-chain omega-3 fatty acids and γ linoleic acid has had effects on TEWL, pruritus, IgE levels, inhibition of histamine release, and modulation of inflammatory mediators involved in AD.

Conclusion
Canine AD is a chronic condition that can be difficult to manage and frustrating for owners and veterinarians alike. Traditional approaches may be only partially effective alone, are sometimes cost-prohibitive, and can potentially cause adverse effects. Supplemental options, including hardy kiwi extract, ceramides, β glucans, and essential fatty acids, such as Dermaquin, provide an opportunity to support the efforts of a multimodal approach, potentially reduce pharmacological use—and therefore possible reduction of adverse effects—and promote maintenance of a healthy skin barrier in a cost-effective manner.
Cystocentesis

Philip Krawec, DVM
Adesola Odunayo, DVM, MS, DACVECC
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Cystocentesis (ie, obtaining urine directly from the urinary bladder by inserting a needle through the body wall) is common and considered the ideal method for obtaining urine for urinalysis and culture and susceptibility testing. Cystocentesis typically helps prevent contamination (eg, from bacteria, RBCs, WBCs, or debris from the lower urinary tract and perineum) that can occur with voided or catheterized urine samples. Diagnosis of bacterial cystitis is somewhat simplified through cystocentesis, as samples through this method should be sterile; quantitative bacterial counts should be analyzed when evaluating voided samples. Although frequently iatrogenic and self-limiting, hematuria may be noted in cystocentesis samples.

The urinary bladder is located in the caudal abdomen and positioned within the pelvic inlet ventral to the colon. The urinary bladder may fall to the dependent portion of the caudal abdomen if the patient is in lateral recumbency. The ureters terminate in the dorsal aspect of the bladder at the trigone. The urinary bladder is primarily composed of striated muscle, and blood is supplied by cranial and caudal vesical arteries. When filled, the urinary bladder can be easily palpated in most patients; however, palpation may not be feasible in some obese patients or in patients with either a low volume of urine or anatomic abnormalities (eg, pelvic bladder).

Indications for cystocentesis include collecting urine samples from patients for which a urine sample is needed. Most cystocentesis samples are used for urinalysis and urine culture and susceptibility testing. Other diagnostic tests may include urine protein:creatinine ratio, urine cortisol concentration, urine catecholamine concentration, urine leptosprirosis PCR, and urine electrolyte concentration.

Cystocentesis may also be used therapeutically in patients that have urinary obstruction secondary to uroliths, urethral plugs, and/or neoplasia. Decompressive cystocentesis can alleviate patient discomfort prior to urinary obstruction removal and can lower intraluminal bladder pressure and facilitate retropulsion of urethral plugs/uroliths, potentially easing catheterization.
Decompressive cystocentesis should be performed with an extension set and a 3-way stopcock to allow for a single needle insertion as opposed to multiple needle insertions. Although decompressive cystocentesis has previously been discouraged, studies have suggested there is minimal risk for bladder rupture/uroperitoneum.8

Cystocentesis is often performed with ultrasonographic guidance, although this is not required (ie, blind cystocentesis). Using ultrasonography can help direct visualization of the needle in the urinary bladder lumen, avoiding iatrogenic damage of surrounding structures (Figure 1). The relative size of the bladder, echogenicity of its contents, and any obvious structural abnormalities can also be observed. A primary advantage of blind cystocentesis is that it does not require special equipment. Cystocentesis can be challenging to perform in patients that have abdominal effusion and should be performed with ultrasonographic guidance in such cases.

Cystocentesis is usually performed in awake patients, but sedation should be considered in fractious or uncooperative patients. See Related Article, page 68, for a full outline of a sedation protocol.

Considerations & Contraindications
Blind cystocentesis is contraindicated in patients with reproductive disorders (eg, pyometra); use of ultrasonographic guidance is recommended for such patients. There are no specific contraindications to blind cystocentesis in male dogs, although blood vessels on either side of the prepuce should be avoided (Figure 2).

There are some conditions, however, in which cystocentesis should be avoided entirely. Cystocentesis should be avoided in patients with pyoderma to prevent possible introduction of bacteria into the abdominal cavity and in patients that are unstable, as putting unstable patients in dorsal or lateral recumbency may lead to decompensation of hemodynamic status. Cystocentesis is also contraindicated in patients that may have bladder neoplasia, as cystocentesis in these patients can increase the risk for seeding neoplastic cells into the abdominal cavity.9

Coagulation status (ie, prothrombin time, activated partial thromboplastin time, thromboelastography, platelet count) should be considered before performing cystocentesis in patients at risk for bleeding. In addition, laceration or perforation of intra-abdominal blood vessels (eg, aorta) can lead to life-threatening hemorrhage.10
exploratory surgery may be required in patients that develop hemoabdomen or uroabdomen following cystocentesis that cannot be stabilized with conservative management.\textsuperscript{10,11}

Other potential complications include bladder wall hematoma, bladder wall rupture leading to uroabdomen, intravesicular blood clots, focal peritonitis, peritoneal free gas, abdominal wall abscessation, nodular fat necrosis, aortic or bladder wall hematoma, and bladder mucosal detachment.\textsuperscript{12} Vasovagal collapse has also been reported in cats following cystocentesis.\textsuperscript{13} In addition, one case report describes a dog with bacterial cystitis that developed septic peritonitis following cystocentesis.\textsuperscript{11}

After cystocentesis, a small amount of gas may be introduced into the urinary bladder iatrogenically but is typically of no clinical consequence (Figure 3). Evidence of this can be seen on ultrasonography after the procedure is completed and appears as horizontally oriented, parallel hyperechoic lines reverberating off the introduced gas.

\textbf{Patient Preparation & Positioning}

Depending on clinician preference and patient temperament, a staff member may hold the patient. Patients can be positioned in either dorsal or lateral recumbency. The authors prefer lateral recumbency in cats. In female dogs in dorsal recumbency, the bladder is usually located below the umbilicus, where isopropyl alcohol pools. A V-trough may help maintain patient comfort in dorsal recumbency. For patients in dorsal recumbency, the urinary bladder is often located on the midline between the fourth and fifth nipples. In male dogs, the prepuce makes aspiration of urine on the midline difficult. Paramedian insertion of the needle is acceptable; however, the caudal superficial epigastric veins that lie on either side of the prepuce should be avoided. Standing cystocentesis, which involves puncturing through the lateral abdominal wall, has been described as safe and effective and may be less stressful for patients.\textsuperscript{14}

Although there are no evidence-based recommendations, the authors recommend preparing the ventral abdomen by clipping the hair and scrubbing the proposed insertion site to minimize the risk for iatrogenic bacterial peritonitis (Figure 4).
WHAT YOU WILL NEED

- Clippers and antiseptic solution (dilute chlorhexidine or iodine-based preparation)
- 1- to 1.5-inch, 22-g needle
- 3- to 12-mL syringe
- Collection tubes (glass red top tube or any empty tube without preservatives)
  - A nonadditive sterile tube is generally recommended for culture. There are other tubes available that may aid in keeping bacteria viable in transit. A reference laboratory can typically help identify appropriate tubes for urine-based tests.
- Ultrasound machine (for ultrasound-guided cystocentesis only)
- Sedating agent, if needed
- 70% isopropyl alcohol
- Additional supplies if removing a large volume of urine
  - Extension set
    - Alternatively, a butterfly catheter can be used in smaller patients in lieu of an extension set and needle
  - 3-way stopcock
  - Larger syringe (12-60 mL)
  - V-trough (optional)

STEP-BY STEP
ULTRASOUND-GUIDED CYSTOCENTESIS

General Author Insights

Avoid moving or repositioning the needle in the abdominal cavity. If urine is not obtained after the first aspiration, pull the needle straight out without repositioning to avoid laceration of any major structures. The needle should also be quickly removed if the patient is uncooperative. Use a new needle for each cystocentesis attempt.

If obvious blood is obtained during cystocentesis, stop aspiration and discontinue further attempts. Rule out significant hemorrhage by evaluating the patient’s heart rate, blood pressure, respiratory rate, and mucous membrane color. This should be done immediately and at least every 15 minutes for the first hour. Peripheral packed cell volume/total solids should be evaluated in patients suspected of having significant hemorrhage. Evaluate the abdominal cavity immediately and again 15 minutes later, using ultrasonography to look for free abdominal fluid. Consider sampling the abdominal fluid if a mild to moderate amount of fluid is present to rule out uroabdomen or hemoabdomen.

If the urinary bladder is too small to obtain a sample, wait 30 to 120 minutes, then reassess the size of the urinary bladder. Administering fluids (IV or SC) may help increase urine volume, but certain results (eg, urine specific gravity) may be skewed.
STEP 1

Place the patient in either dorsal or lateral recumbency. If the patient is a male dog, gently retract the penis off the midline.

Gently palpate the caudal abdomen to isolate and secure the urinary bladder.

STEP 2

Using an ultrasound probe, visualize the urinary bladder. Insert the needle attached to a syringe roughly 5 to 10 mm cranial to the ultrasound probe. Introduce the needle at a 45° angle to the transducer probe and pass it into the abdomen in a cranial-to-caudal orientation.

Author Insights

Before inserting the needle, pull back on the syringe plunger and push it back into place (ie, pop the seal) to prevent marked movement of the needle tip resulting from increased resistance that occurs during the first pull back.

Avoid damaging the ultrasound transducer probe with the needle (Figure) during cystocentesis, as scratching its surface will decrease the lifespan of the probe and can affect image quality.
**STEP 3**

Visualize the needle (appears as a hyper-echoic line with distal shadowing [seen in the top left of the *Figure*]), then advance it into the urinary bladder lumen, terminating near the junction of the bladder and urethra (seen on the right side of the *Figure*).

**STEP 4**

Apply negative pressure to the syringe to obtain the sample, then release the negative pressure and slowly withdraw the needle.

**Author Insight**

A repeat scan of the urinary bladder area, especially along the needle tract and just cranial to the apex of the bladder, can be performed to evaluate for evidence of a urine leak.
STEP-BY-STEP
BLIND CYSTOCENTESIS

STEP 1

With the patient in either lateral or dorsal recumbency and a staff member holding the patient, gently palpate the caudal abdomen and isolate the urinary bladder.

STEP 2

Using gentle digital pressure, secure the urinary bladder with one hand. If the patient is in dorsal recumbency (Figure), insert the needle with the syringe attached in a cranial-to-caudal orientation and a 45° angle to the body wall. If the patient is in lateral recumbency, insert the needle in a cranial-to-caudal orientation while approaching the urinary bladder from its lateral aspect.

Author Insight

Before inserting the needle, pull back on the syringe plunger and push it back into place (ie, pop the seal) to prevent marked movement of the needle tip resulting from increased resistance that occurs during the first pull back.
**STEP 3**

Apply negative pressure to the syringe to obtain the sample, then release the negative pressure and slowly withdraw the needle.

![A](image1)

**A** Blind cystocentesis in a cat restrained in lateral recumbency. The urinary bladder is stabilized with one hand while the needle is inserted into the urinary bladder through the flank.

![B](image2)

**B** Blind cystocentesis in a cat restrained in dorsal recumbency. The urinary bladder is stabilized with one hand while the needle is inserted into the urinary bladder along the ventral midline. Blind cystocentesis demonstrating paramedian needle insertion in a male dog. The caudal superficial epigastric veins (arrows) can be noted and should be avoided.

**References**


The authors would like to thank Phil Snow and Dr. Kryssa Johnson for assistance in obtaining images, as well as Vibe Hespel and Penny Hedges for their support.

Images were simulated for illustrative purposes. Cystocentesis was not performed in the patients shown in this article.

**RELATED ARTICLE**

For a full outline of a sedation protocol that can be used for cystocentesis, see Top 5 Short Procedure Sedation Scenarios at cliniciansbrief.com/article/top-5-short-procedure-sedation-scenarios
TRANSPORTING TO TELEMEDICINE?

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NexGard® (afoxolaner) is available in four sizes of beef-flavored, soft chewables for oral administration to dogs and puppies according to their weight. Each chewable is formulated to provide a minimum afoxolaner dosage of 1.14 mg/lb (2.5 mg/kg). Afoxolaner has the chemical composition 1-Naphthalenecarboxamide, 4-[5-[3-chloro-5-(trifluoromethyl)-2-phenyl]-5-dihydro-2-(trifluoromethyl)-3-isoxazolyl]-N-(2-oxo-2,2,2-trifluorovinyl)alaninethylester.

**Indications:**
NexGard kills adult fleas and is indicated for the treatment and prevention of flea infestations (Ctenocephalides felis), and the treatment and control of Black-legged tick (Ixodes scapularis), American Dog tick (Dermacentor variabilis), Lone Star tick (Amblyomma americanum), and Brown dog tick (Rhipicephalus sanguineus) infestations in dogs and puppies 8 weeks of age and older, weighing 4 pounds of body weight or greater, for one month. NexGard is indicated for the prevention of Borrelia burgdorferi infections as a direct result of killing licea scapularis vector ticks.

**Dosage and Administration:**
NexGard is given orally once a month, at the minimum dosage of 1.14 mg/lb (2.5 mg/kg).

**Dosing Schedule:**

<table>
<thead>
<tr>
<th>Body Weight</th>
<th>Afoxolaner Per Chewable (mg)</th>
<th>Chewables Administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0 to 10.0 lbs.</td>
<td>11.3</td>
<td>One</td>
</tr>
<tr>
<td>10.1 to 24.0 lbs.</td>
<td>28.3</td>
<td>One</td>
</tr>
<tr>
<td>24.1 to 60.0 lbs.</td>
<td>68</td>
<td>One</td>
</tr>
<tr>
<td>60.1 to 121.0 lbs.</td>
<td>136</td>
<td>One</td>
</tr>
<tr>
<td>Over 121.0 lbs.</td>
<td>Administer the appropriate combination of chewables</td>
<td></td>
</tr>
</tbody>
</table>

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

**Flea Treatment and Prevention:**
Treatment with NexGard may begin at any time of the year. In areas where fleas are common year-round, monthly treatment with NexGard should continue the entire year without interruption. To minimize the likelihood of flea reinfection, 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 drugs out of the reach of children. In case of accidental ingestion, contact a physician immediately.

**Precautions:**
Afoxolaner is a member of the isoxazole class. This class has been associated with neurologic adverse reactions including tremors, ataxia, and seizures. Seizures have been reported in dogs receiving isoxazole class drugs, even in dogs without a history of seizures. Use with caution in dogs with a history of seizures or neurologic disorders (see Adverse Reactions and Post-Approval Experience).

**Tick Treatment and Control:**
The safe use of NexGard in breeding, pregnant or lactating dogs has not been evaluated.

**Adverse Reactions:**
In a well-controlled US field study, which included a total of 333 households and 155 treated dogs (145 administered afoxolaner; 200 administered active control), no serious adverse reactions were observed with NexGard.

Over the 90-day study period, all observations of potential adverse reactions were recorded. The most frequent reactions reported at an incidence of >1% within any of the three months of observations are presented in the following table. The most frequently reported adverse reaction was vomiting. The occurrence of vomiting was generally self-limiting and of short duration and tended to decrease with subsequent doses in both groups. Five treated dogs experienced anorexia during the study, and two of those dogs experienced anorexia with the first dose but not subsequent doses.

**Table 1: Dogs With Adverse Reactions.**

<table>
<thead>
<tr>
<th>Adverse Reaction</th>
<th>Treatment Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Afoxolaner</td>
</tr>
<tr>
<td></td>
<td>N (%)</td>
</tr>
<tr>
<td>Vomiting (with and without blood)</td>
<td>17</td>
</tr>
<tr>
<td>Dry/Facky Skin</td>
<td>13</td>
</tr>
<tr>
<td>Diarrhea (with and without blood)</td>
<td>13</td>
</tr>
<tr>
<td>Lethargy</td>
<td>7</td>
</tr>
<tr>
<td>Anorexia</td>
<td>5</td>
</tr>
</tbody>
</table>

1Number of dogs in the afoxolaner treatment group with the identified abnormality.
2Number of dogs in the control group with the identified abnormality.

In the US field study, one dog with a history of seizures experienced a seizure on the same day after receiving the first dose and on the same day after receiving the second dose of NexGard. This dog experienced a third seizure one week after receiving the third dose. The dog remained enrolled and completed the study. Another dog with a history of seizures had a seizure 19 days after the third dose of NexGard. The dog remained enrolled and completed the study. A third dog with a history of seizures received NexGard and experienced no seizures throughout the study.

**Post-Approval Experience (July 2010):**
The following adverse events are based on post-approval adverse drug experience reporting. Not all adverse events are reported to FDA/CVM. It is not always possible to reliably estimate the adverse event frequency or establish a causal relationship to product exposure using these data. The following adverse events reported for dogs are listed in decreasing order of reporting frequency for NexGard:

- Vomiting, pruritus, lethargy, diarrhea (with and without blood), anorexia, seizure, hyperactivity/ restlessness, panting, erythema, ataxia, dermatitis (including rash, papules), allergic reactions (including hives, swelling), and tremors.

**Contact Information:**
For a copy of the Safety Data Sheet (SDS) or to report suspected adverse drug events, contact Merial at 1-888-637-4251 or www.nexgardfordogs.com.

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

**Mode of Action:**
Afoxolaner is a member of the isoxazole family, shown to bind to a binding site to inhibit insect and acarine ligand-gated chloride channels, in particular those gated by the neurotransmitter gamma-aminobutyric acid (GABA), thereby blocking pre- and post-synaptic transfer of chloride ions across cell membranes. Prolonged afoxolaner-induced hyperexcitation results in uncontrolled activity of the central nervous system and death of insects and acarines. The selective toxicity of afoxolaner between insects and acarines may be inferred by the differential sensitivity of the insects and acarines’ GABA receptors versus mammalian GABA receptors.

**Effectiveness:**
In a well-controlled laboratory study, NexGard began to kill fleas four hours after initial administration and demonstrated >98% effectiveness at eight hours. In a separate well-controlled laboratory study, NexGard demonstrated 100% effectiveness against adult fleas 24 hours post-infestation for 35 days, and was >93% effective at 12 hours post-infestation through Day 21, and on Day 25. On Day 28, NexGard was 81.1% effective 12 hours post-infestation. Dogs in both the treated and control groups that were infested with fleas on Day-1 generated flea eggs at 12- and 24-hours post-treatment (0-11 eggs and 1-17 eggs in the NexGard treated dogs, and 4-86 eggs and 0-118 eggs in the control dogs, at 12- and 24-hours, respectively). At subsequent evaluations post-infestation, fleas from dogs in the treated group were essentially unable to produce any eggs (0-1 eggs) while fleas from dogs in the control group continued to produce eggs (1-141 eggs).

In a 90-day US field study conducted in households with existing flea infestations of varying severity, the effectiveness of NexGard against fleas on the Day 30, 60 and 90 visits compared with baseline was 98.0%, 99.7%, and 99.8%, respectively. Collectively, the data from the three studies (two laboratory and one field) demonstrate that NexGard kills fleas before they can lay eggs, thus preventing subsequent flea infestations after the start of existing flea infestations.

In well-controlled laboratory studies, NexGard demonstrated >97% effectiveness against Dermacentor variabilis, >94% effectiveness against licea scapularis, and >93% effectiveness against Rhipicephalus sanguineus, 48 hours post-infestation for 30 days. At 72 hours post-infestation, NexGard demonstrated >97% effectiveness against Amblyomma americanum for 30 days. In two separate, well-controlled laboratory studies, NexGard was effective at preventing Borrelia burgdorferi infections after dogs were infested with licea scapularis vector ticks 28 days post-treatment.

**Animal Safety:**
In a margin of safety study, NexGard was administered orally to 8 to 9-week-old Beagle puppies at 1, 3, and 5 times the maximum exposure dose (6.3 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 coagulation tests), gross pathology, histopathology or organ weights. Vomiting occurred throughout the study, with a similar incidence in the treated and control groups, including one dog in the 5x group that vomited four hours after treatment.

In a well-controlled field study, NexGard was used concomitantly with other medications, such as vaccines, anthelmintics, antibiotics (including topicals), steroids, NSAIDS, anesthetics, and antimithotics. No adverse reactions were observed from the concomitant use of NexGard with other medications.

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

**How Supplied:**
NexGard is available in four sizes of beef-flavored soft chewables: 11.3, 28.3, 68 or 136 mg afoxolaner. Each chewable size is available in color-coded packages of 1, 3 or 5 beef-flavored chewables.

NADA 141-406, Approved by FDA
Marketed by: Frontline Vet Labs®, a Division of Merial, Inc.
Duluth, GA 30096-4640 USA
Made in Brazil.

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1. **PROCEDURES PRO PAGE 14**
   After surgical closure of an elbow hygroma, external coaptation should be used for an additional _______________ days.
   A. 1 to 2
   B. 3 to 5
   C. 6 to 9
   D. 10 to 14

2. **CONSULT THE EXPERT PAGE 27**
   Jaw fractures account for _______ of all fractures in cats.
   A. 15%
   B. 25%
   C. 35%
   D. 45%

3. **CASE IN POINT PAGE 33**
   Which of the following is known to increase zinc absorption from the GI tract?
   A. Iron
   B. Casein
   C. Corticosteroids
   D. Proton pump inhibitors

4. **PROCEDURES PRO PAGE 61**
   When performing cystocentesis on a patient in dorsal recumbency, the urinary bladder is often located between the _____________ nipples.
   A. 2nd and 3rd
   B. 3rd and 4th
   C. 4th and 5th
   D. 5th and 6th

**Answer Key:**
A HARDY SKIN BARRIER: the best defense against allergens

Immune System Support

Skin Barrier Support

Inhibit Inflammatory Mediators

Supports Skin Hydration

NEW!

DERMAQUIN®
SKIN SUPPORT SUPPLEMENT

with hardy kiwi

Available in SOFT CHEWS for small/medium and large dogs
To learn more, visit DERMAQUIN.COM
A million thanks.

Actually, over 220 million—that’s how many times NexGard® (afoxolaner) has been prescribed.¹

» The only flea & tick control product indicated for the prevention of *Borrelia burgdorferi* infections as a direct result of killing black-legged ticks

» Gentle protection in a bite-sized monthly dose

» Proven safety for puppies as young as 8 weeks, weighing 4 pounds or more

» The savory beef-flavored chew that makes compliance a treat

**NexGard®**

(afoxolaner) Chewables

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**IMPORTANT SAFETY INFORMATION:** NexGard® is for use in dogs only. The most frequently reported adverse reactions include vomiting, pruritus, lethargy, diarrhea 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 or neurologic disorders. For more information, see the full prescribing information or visit NexGardClinic.com.

¹ Data on file at Boehringer Ingelheim.

See page 70 for product information summary.