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IN THIS ISSUE

Volume 19 Number 1

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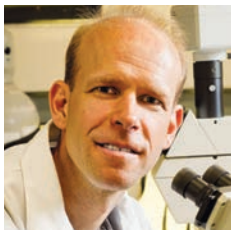

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Antibiotics and UTIs: appropriate use through faster access to urine culture results

Urinary tract problems are one of the most common and uncomfortable conditions veterinarians diagnose in cats and dogs. They're also cumbersome and stressful for pet owners. They are a leading reason why veterinarians prescribe antibiotics. A recent innovation offers a unique opportunity for veterinarians to deliver more precise care for urinary tract problems faster while upholding One Health principles.

In an ideal world, when veterinarians suspect an infection, they collect a urine sample and submit it for a complete urinalysis (visual, chemical and microscopic exam), which includes urine culture and sensitivity testing. Sample collection issues, lengthy turn-around times for results and pet-owner financial constraints often impact this diagnostic plan. Understandably, pet owners want quick relief for their pets and themselves. The veterinary community's growing concern about antibiotic resistance is often at odds with these well-intentioned owners.

Antimicrobial Resistance—a global threat to human and animal health: According to the World Health Organization, antibiotic resistance is one of the biggest threats to global health, food security and development today. Emerging from the natural evolution of bacteria, compliance issues and antibiotic misuse in human and veterinary medicine, antibiotic effectiveness is decreasing and antibiotic resistance is increasing. As a result, it's becoming difficult to treat an ever-increasing number of infections, including pneumonia, salmonellosis and pyoderma/dermatitis.

Antibiotic stewardship is critically important to human and animal health. According to the Centers for Disease Control and Prevention, up to half of all antibiotics prescribed in human medicine are done so incorrectly or unnecessarily. Animal health is similarly affected. In one veterinary medicine study, up to 40% of antibiotics were prescribed with no evidence of infection. Updated guidelines from the International Society for Companion Animal Infectious Diseases recommend improved antimicrobial stewardship due to the risks involved in improper use. These risks mimic those impacting human medicine: antimicrobial resistance at-large and, for individual animals, repeat or prolonged treatment due to past failures to resolve infection. Each situation can have major negative impacts on veterinary medicine on the whole as well as on the health and longevity of individual pets.

While today's diagnostic testing supports rapid confirmation of bacteria on a microscopic sediment exam, upholding the principles of antibiotic stewardship while also meeting pet owner demands for a speedy recovery require a new approach: one that supports rapid urine culture results that are highly sensitive and specific for detecting live bacteriuria.

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Antimicrobial resistance is a global concern. Veterinarians have a key role in prudent antibiotic choices to reduce development of multi-drug resistant infections. Antech Diagnostics' investment in advanced technology has accelerated access to urine culture results, supporting veterinarians' enduring commitment to One Health principles while allowing them to deliver rapid, precise treatment for a common, painful condition. For more information about the new FIRSTract Urine Culture test, please visit www.antechdiagnostics.com/FIRSTract.

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WE ASKED . . .

What is the most common clinical emergency seen in your clinic?

"Fatty liver; we get many anorexic cats that just decide to stop eating."—*Kelsey B*

"Urethral obstruction in male cats. Good thing that is my favorite emergency!"—*Amy B*

"Goldendoodles. They are not a clinical emergency—they are the catalyst."—*Kelli M*

Would you rather spay an overweight dog or remove a carnassial tooth with a slab fracture?

"Easy choice—the tooth"—*Bradley S*

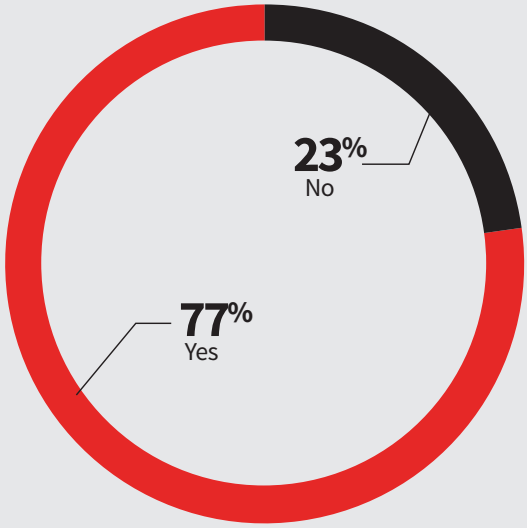
"A spay for me, please; I hate dental extractions!"—*Dawnetta W*

"Maxillary carnassial tooth, absolutely; however, if it is mandibular, I would rather do the spay."—*Cindy R*

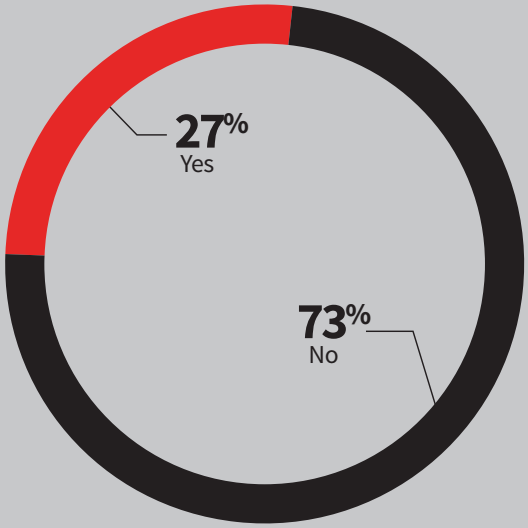
"Tooth every time. There is no way the patient can bleed out from a tooth!"—*Jennifer M*

"I like this fantasy world in which we get to pick. I pick tooth."—*Chung Y*

Do you close the subcutaneous layer when spaying cats?



Do you suture the gingiva after removing persistent deciduous canine teeth?



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Coaptation Devices for Elbow Hygromas

Jessica Wiley Montoya, LVMT
Karen M. Tobias, DVM, MS, DACVS

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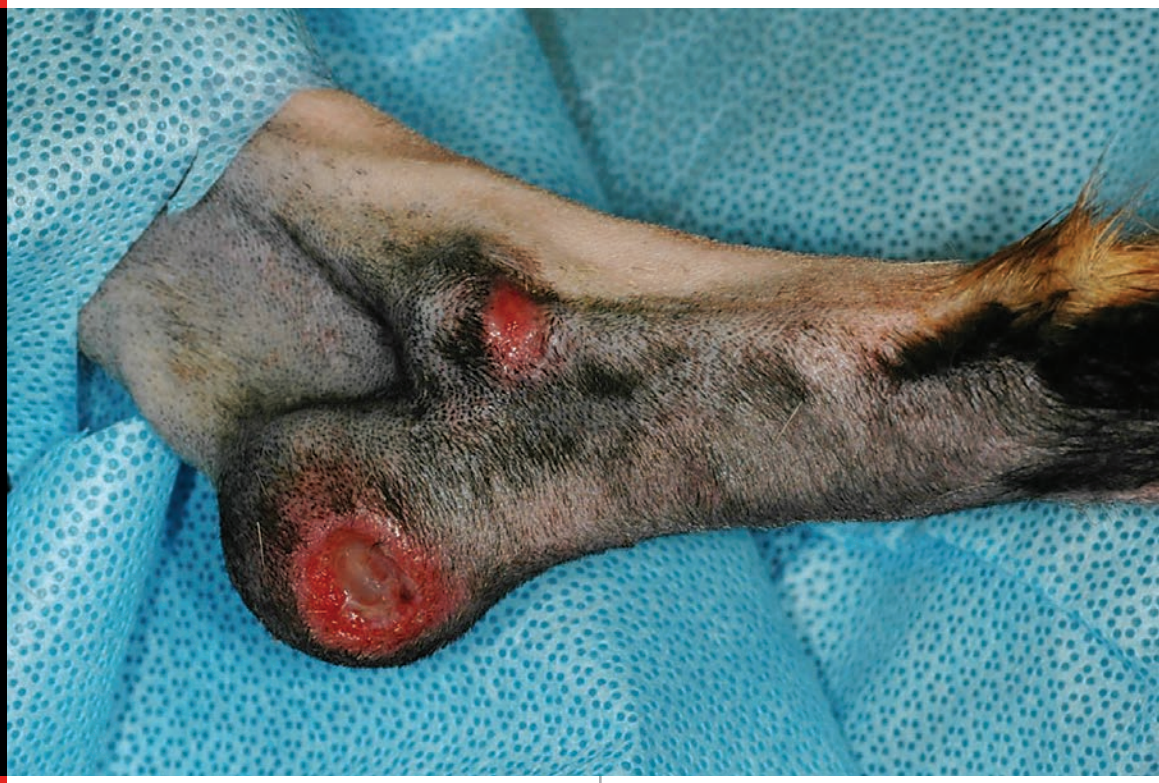

NOTICE OF CORRECTION

In the article, "Consult the Expert: Anticonvulsants," published in the October 2020 issue of *Clinician's Brief*, the starting dosage for zonisamide in dogs and cats was listed as "10-20 mg/kg PO every 12 hours." The correct dosage is "10-20 mg/kg PO every 24 hours." *Clinician's Brief* regrets the error.

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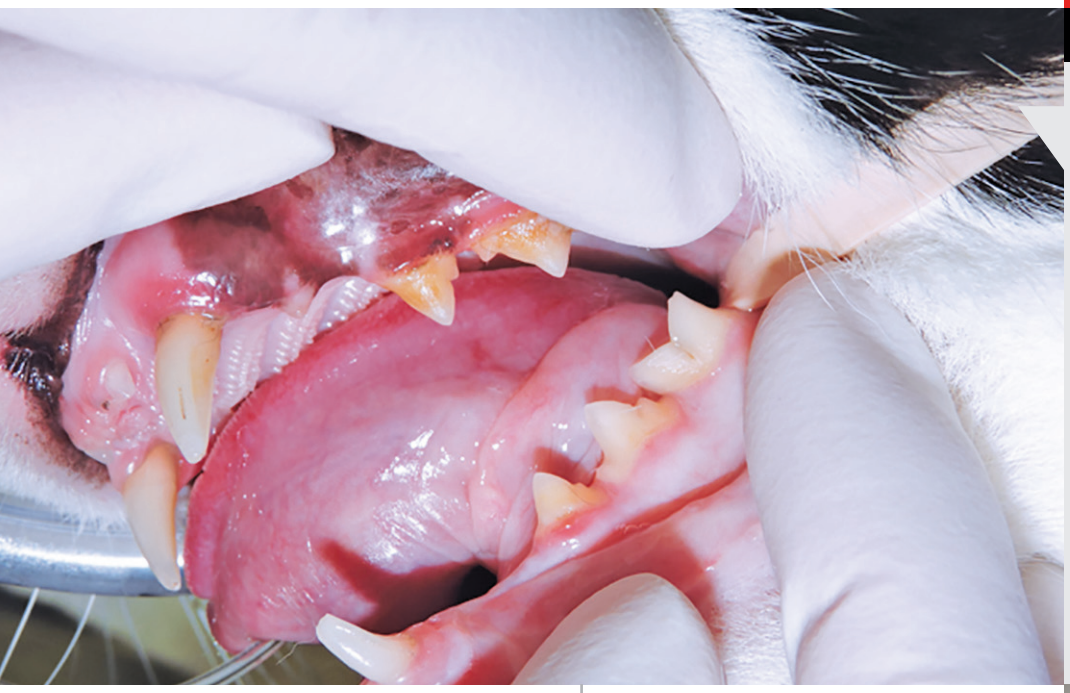

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brief.vet/stages-of-puppies

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TOP 5 PAGE 21

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MANAGEMENT TREE PAGE 18

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MANAGEMENT TREE PAGE 18

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CONSULT THE EXPERT PAGE 10

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IMAGE GALLERY PAGE 57

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CONSULT THE EXPERT

FELINE AGGRESSION

Amy L. Pike, DVM, DACVB
Animal Behavior Wellness Center
Fairfax, Virginia

More than 30 million families have pet cats, and most own more than one.[1] Feline aggression is a common behavior concern that can occur between housemates or be directed at humans.[2-5] Aggression and house soiling are the signs seen most often by both general clinicians and veterinary behaviorists[2-5] and are typically listed as the reason for relinquishment.[6]

Background

Human-Directed Aggression

Feline aggression toward humans can be directed at owners, unfamiliar household visitors, and/or those with whom the cat comes in contact outside the home (eg, veterinary staff, groomers) and may be due to fear, a medical condition (result of a disorder [eg, pain]), petting, play (result of inadequate enrichment), redirection, or territoriality.

Feline-Directed Aggression

Cats in the same household that have a mostly harmonious relationship can still engage in conflict (***Figure***) that may be based on fear, a medical condition (result of a disorder [eg, pain]), redirection, resource guarding, status-related aggression, or territoriality.[7]

Signs of intercat aggression can range from obvious (eg, witnessed fights, hissing or chasing, wounds) to subtle (eg, physically blocking access to resources [eg, food, water, litter boxes, resting spots, human attention], avoidance [eg, leaving the room when a particular cat enters, hiding under furniture, perching on high shelves or counters]).[8] Subtle signs are often missed by pet owners and clinicians.

Identifying which cat is the aggressor and which is the victim can be difficult for owners; differentiation is based on body language and vocalizations. The aggressor will stare directly at the victim, the ears will often be pointed forward, and the tail may be twitching quickly side to side and held at or above the topline of the body. The victim may try to avoid eye contact, crouch, attempt to slink, hold the ears pinned back, and tuck the tail into the body. Hissing is a fear-based vocalization that most often comes from the victim.

Aggression among household cats can be a root cause of other behavior or associated conditions, including psychogenic alopecia, inappropriate elimination, urine marking, excessive or inappropriate

▲ **FIGURE** Schrodinger and Fibonacci, 2-year-old spayed Devon rex cats, are highly bonded (***A***) but occasionally fight over access to resources and territory (eg, familiar humans, toys, favored resting spots; ***B***). Fibonacci (***B***; cat on left) is shown blocking Schrodinger's access to the bed and/or toy. Schrodinger is showing avoidance behavior by attempting to make herself smaller and leaning away from Fibonacci.

scratching, weight loss or gain, physical signs of stress (eg, disparate body condition), chronic vomiting with no medical cause, and decreased elimination frequency.[8]

Indoor (ie, resident) cats can also show aggression toward unfamiliar cats (eg, strays, neighborhood cats with outdoor access). Resident cats that see an outdoor cat through a door or window may become aggressively aroused and, although physical altercations are only likely if the resident cat is allowed outside, it may take out this aggression on a human or animal housemate, especially one in close physical proximity.[9] Aggression directed toward another cat in the household can cause the victim to become fearful of the aggressor, and subsequent conflicts can last past the inciting event.

History & Clinical Signs

A thorough history of aggressive episodes should be taken; the ***SOCRATES Mnemonic for Pain Assessment*** was originally developed for assessing pain but can be modified to assess a history of aggression.[10]

A primary medical etiology that may contribute to or cause aggression should also be ruled out, as physical disorders that increase discomfort can

SOCRATES MNEMONIC FOR PAIN ASSESSMENT

The following has been modified to assess for a history of aggression.

SITE

- Where does aggression occur (eg, on the bed, on the couch, in the kitchen, near windows or doors the cat uses to look outside)?
- Who or what is aggression directed toward?

ONSET

- When did aggression begin?
- Was the onset sudden or gradual?
- Were early warning signs (eg, fear) observed in certain situations?
- Did a traumatic event precede the onset of aggression?

CHARACTER

- How does aggression manifest (eg, hissing, swatting, yowling, biting)?
- What type of injuries (if any) have been sustained?
- How does the cat appear during the aggression episode? Body position and posture of the ears, eyes, mouth, whiskers, and tail can help determine whether aggression is offensive or defensive in nature.
- Does the cat separate itself or is owner intervention necessary?
  - If owners must intervene, what type of injuries have been sustained (if any)?

RADIATION

- Does aggression extend to other circumstances?
- Does aggression continue after the trigger or stimulus has been removed?
- Does the cat redirect its behavior to a human or another cat when aggressively aroused?

ASSOCIATIONS

- Is aggression associated with any events (eg, a food bowl is present, an outdoor cat approaches the yard, visitors are present)?

TIME COURSE/PATTERN

- Does aggression follow a pattern (eg, only at night, after a prolonged absence of the owner, when visitors are present)?

EXACERBATING OR RELIEVING FACTORS

- What measures have been taken to mitigate aggression?
- Have other training methods been previously used?
- Have any medications, supplements, nutraceuticals, pheromones, or over-the-counter products been used?
- Which interventions have helped or exacerbated aggression?

SEVERITY

- According to the owner, how severe is the cat's aggression on a scale of 1 to 10? (This scale can help gauge the severity of aggression and determine the likelihood the owner will euthanize or rehome the cat.)

lead to or increase the likelihood of behavior disorders.[11] A physical examination (including orthopedic and neurologic evaluation), CBC, serum chemistry profile, measurement of total thyroxine and free thyroxine levels by equilibrium dialysis, and urinalysis should be performed. Further testing, including imaging, may be needed depending on the diagnostic results.

Pain is a key differential to rule out for aggression[11] but can be difficult to assess in the clinic. Owners should take pictures and video of their cat's activity at home (eg, walking, running, climbing up and down stairs, jumping on and off surfaces) to allow the clinician to look for mobility concerns. Photos, videos, and physical examination can be compared to the Feline Grimace Scale, which can help identify pain.[12] A study looking at 5 key facial expressions as markers for acute pain in cats identified ear position, orbital tightening, muzzle tension, whisker changes, and head position[12]; cats can be scored on these 5 points to determine if appropriate analgesia is being achieved. After medical disorders have been ruled out or appropriately treated, the behavior disorder can be addressed with a comprehensive treatment plan.

Diagnosis

Diagnosis is made by assessing body language of the aggressor cat as defensive (ie, fearful) or offensive (ie, confident), determining the actual target of the aggression (ie, the victim or redirected from something else), and identifying the underlying trigger (eg, being petted, being lifted, seeing a cat outside the home).

Pain is a key differential to rule out for aggression[11] but can be difficult to assess in the clinic.

Treatment & Management

Management

Management is the first step in a comprehensive treatment plan for aggression, regardless of the target or motivation, and begins with avoidance of triggering situations.

For aggression directed toward owners, verbal and physical punishment and physical interaction with the cat (ie, picking the cat up) should be avoided, as these can trigger fear-based aggression. Because cats groom each other around the whiskers and under the chin, petting should be brief and focused on these places, as it is less likely that aggression will be triggered because the cat is comfortable being touched in these areas. Interaction with the cat when it is highly aroused from another stimulus (eg, seeing another cat outside, returning home from the veterinary clinic) should be avoided; the cat may need to be lured into a closed room until it sufficiently calms down. Play with interactive and feeding/hunting toys should be increased. Each play session should only last ≈5 to 10 minutes, as cats often lose interest in toys that do not satisfy the entire predatory sequence. Switching toys midway through play sessions can help increase interest in continued play. Engaging in play and hunting opportunities with feeding/hunting toys that dispense food or treats can help the cat's innate need to stalk, capture, kill, and eat, making the cat less likely to take out aggression on a human or pet in the household.

Aggression toward visitors entering the home can be avoided by confining the cat in a room or floor of the house in which there is no access to the visitor.

Aggression toward other cats in the household can be avoided by setting up separate areas for each cat, feeding them in separate rooms, and potentially physically separating them with baby gates (2 stacked vertically on top of the other), partitions, and/or closed doors.

When aggression stems from seeing outdoor cats, owners can make the outdoor environment less hospitable by not placing food or water outside, not using bird feeders, and potentially using a motion-activated sprinkler system that will spray the cat when detected; these actions can discourage cats from returning to the yard. Owners can also reduce visibility by covering windows and/or doors, using opaque or frosted privacy film on windows, and/or blocking access to rooms with windows.

Medication

Use of products (eg, nutraceuticals, pheromones, commercial diets) and medications to decrease fear, anxiety, stress, and overall arousal is the second step in a comprehensive treatment plan for aggression. It is important to reduce stress and anxiety because aggression is a behavioral strategy a cat may employ when scared. There are no FDA-approved medications for treatment of behavior problems in cats. Commonly used products and anxiolytics include pheromones, which have been shown to decrease intercat conflict in multicat households over 28 days[13]; these products should be placed where the cat spends most of its resting time.

Studies on nutraceuticals and prescription diets used to reduce fear, anxiety, and stress in cats have been conducted, but their clinical significance for fear-induced aggression may be limited due to lack of placebo controls and limited number of enrolled patients in each study. L-theanine, an amino acid found in green tea, has been shown to decrease signs of fear and anxiety in cats.[14,15] α-casozepine,[16] a naturally occurring protein in cow's milk, and prescription diets[17] containing α-casozepine and tryptophan, a precursor for serotonin, have also been shown to help decrease fear, anxiety, and stress in cats.

Medications, such as selective serotonin reuptake inhibitors (SSRIs; eg, fluoxetine, paroxetine), tricyclic antidepressants (TCA; eg, clomipramine, amitriptyline), serotonin antagonist and reuptake inhibitors (eg, trazodone[18]), and $\alpha_2\delta$ ligands (eg, gabapentin[19,20]) can also be used. SSRIs increase the amount of serotonin available in the synaptic cleft by blocking its reuptake into the presynaptic neuron. TCAs also block reuptake of serotonin but additionally block norepinephrine reuptake. TCAs have anticholinergic effects and, thus, have a higher number of adverse effects than SSRIs. Because TCAs have shown similar efficacy as SSRIs in the treatment of certain anxiety disorders in cats,[21] TCAs are no longer as commonly used. Unfortunately, there are no studies on the use of psychotropic medications to specifically treat aggression in cats; therefore, all use is anecdotal and extrapolated from studies on use for other anxiety disorders,[22] including inappropriate elimination[23] and urine spraying.[24,25]

Patients should be individually evaluated to determine the suitability of these products in reducing both daily and event-associated anxiety. If the aggression is either unpredictable or frequent in nature, a daily medication (eg, SSRI, TCA) should be chosen. If the aggression is predictable and infrequent, an event medication (eg, trazodone, gabapentin) alone may be suitable. Some patients with multiple diagnoses may need a daily medication plus an event medication for higher stress events (eg, veterinary clinic visits). Consultation with a board-certified veterinary behaviorist or resident in clinical behavior medicine may be needed.

Behavior Modification

Behavior modification is the third step in a comprehensive treatment plan for aggression. Multimodal environmental modifications in the form of increasing territory, structured play sessions, and feeder and hunting toys are the easiest changes that can be made and have been shown to help prevent behavior problems, as well as treat the underlying fear, anxiety, and stress.[26,27] In addition, training cats to target an object or go to a location on cue can help safely redirect the cat.

Prognosis & Prevention

Prognosis depends on the owner's ability to keep all members of the household safe with management,

which can be exponentially more difficult when there are children or elderly or cognitively impaired household members; extent of physical injuries should also be considered, as managing risk during treatment is more dangerous when there are injuries. The owner must also be able to administer the recommended products or medication, which is often stressful for the owner and the cat, especially when the cat will not consume medication hidden in food.

One study has shown a poor prognosis for resolution of intercat aggression when the first encounter or introduction was associated with scratching or biting or was considered unfriendly or aggressive.[28]

Clear communication with the owner about prognosis, desired outcomes, and continued need for coaching throughout the course of treatment is key. Behavior change is gradual, and it can sometimes take months or longer to achieve a desirable outcome. Many owners struggle with the patience and diligence needed to address the problem.

Clinical Follow-Up/Monitoring

Clinicians without a special interest and/or specialized education in feline behavior and training should at minimum understand the behavior concepts outlined in this article and be able to refer owners to a qualified behaviorist or trainer to discuss training adjustments and behavior modification. Clinicians should research the credentials, educational background, and continuing education when selecting a referral. This is especially true when referring a feline patient, as there are fewer paraprofessionals with the education and experience to work with cats as compared with dogs. There are many resources and websites that can help clinicians find a qualified consultant in their area (see ***Suggested Reading***).

Conclusion

Feline aggression is a common behavior problem. Management strategies, anxiolytic products, diet, medication, and behavior modification can help clinicians, owners, and patients optimize the chances for successful management.

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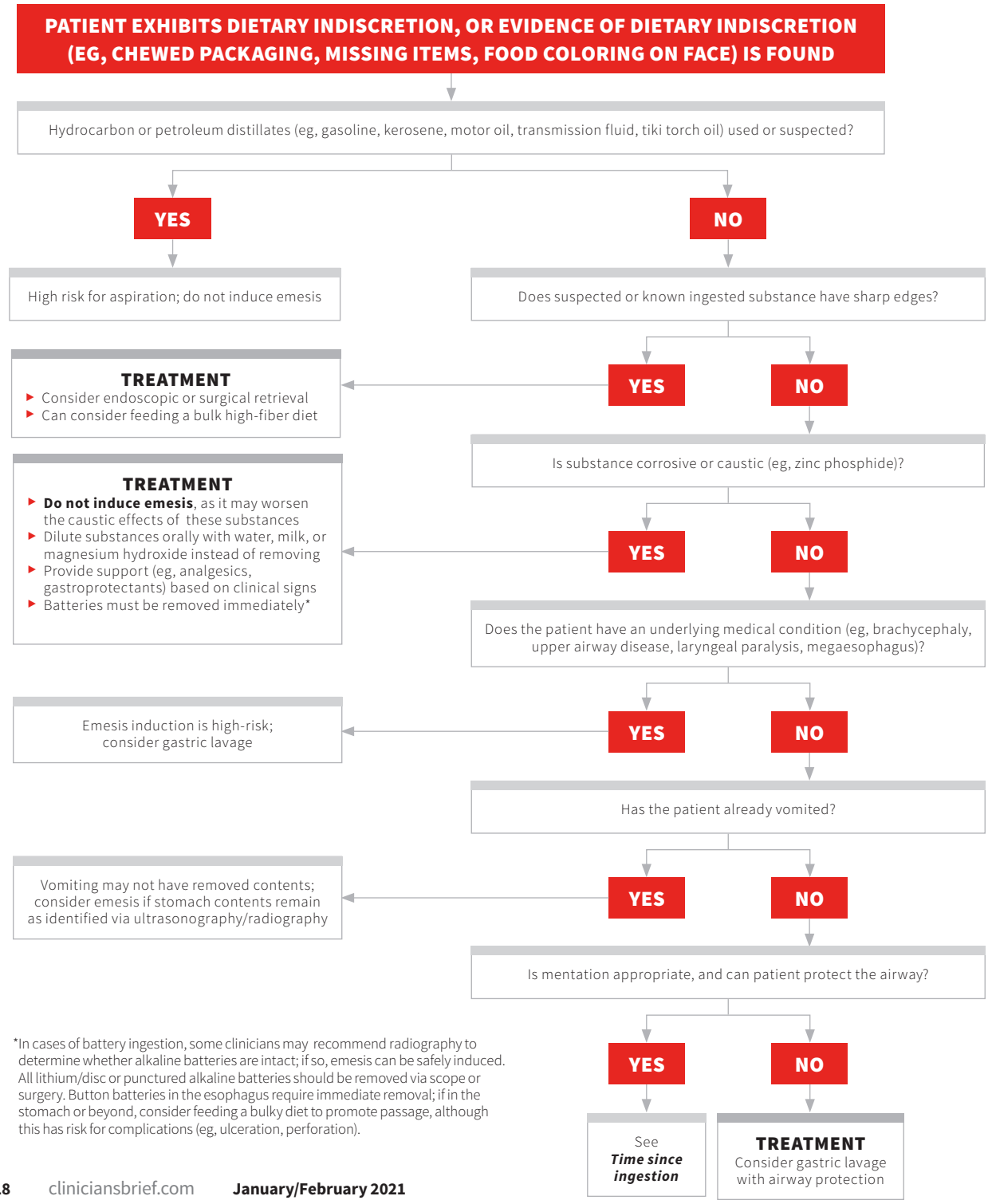
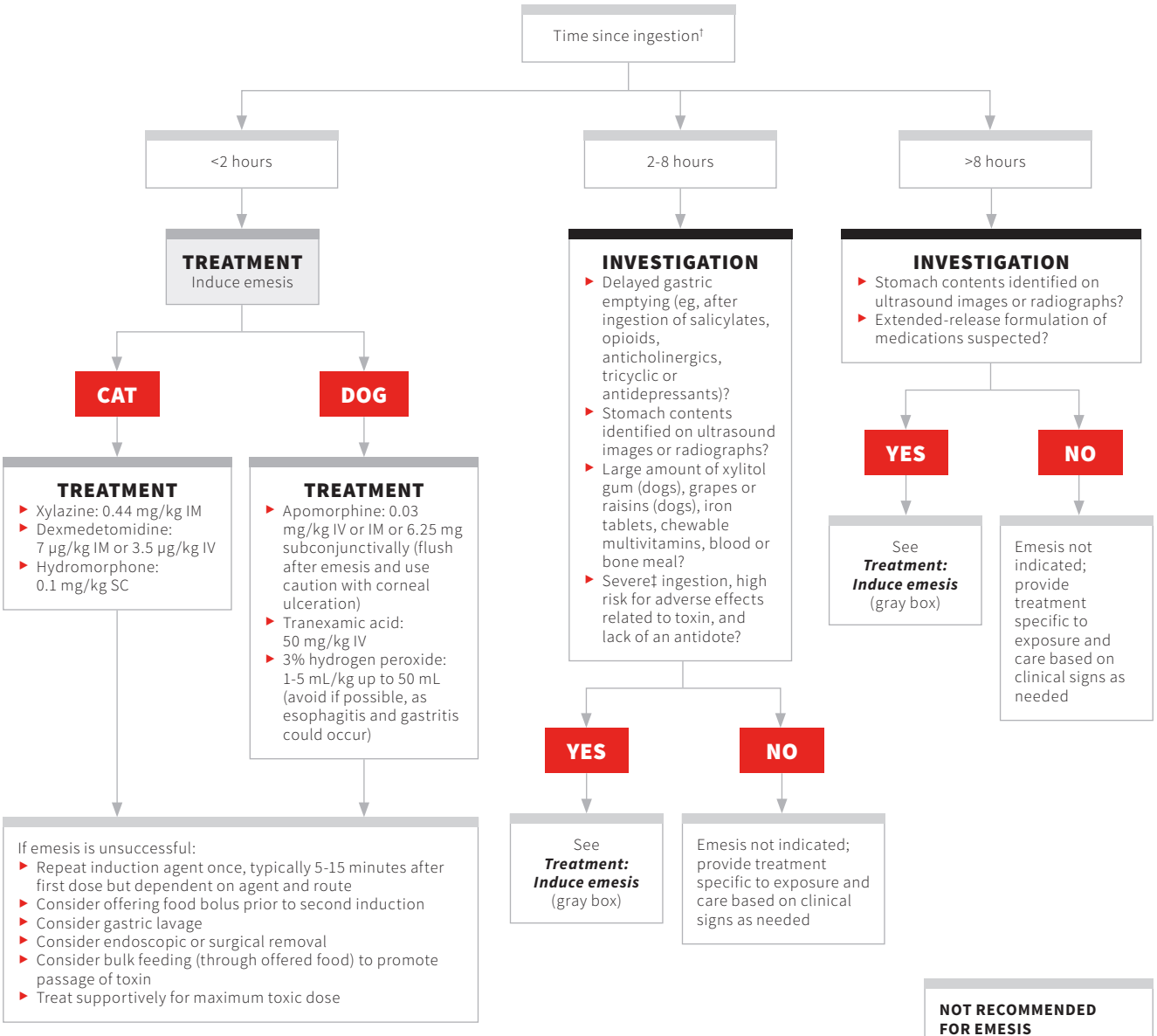
Behavior change is gradual, and it can sometimes take months or longer to achieve a desirable outcome. Many owners struggle with the patience and diligence needed to address the problem.

EMESIS INDUCTION

Kendon Kuo, DVM, MS, DACVECC
Katherine Gerken, DVM, MS, DACVECC
Auburn University



*In cases of battery ingestion, some clinicians may recommend radiography to determine whether alkaline batteries are intact; if so, emesis can be safely induced. All lithium/disc or punctured alkaline batteries should be removed via scope or surgery. Button batteries in the esophagus require immediate removal; if in the stomach or beyond, consider feeding a bulky diet to promote passage, although this has risk for complications (eg, ulceration, perforation).



NOT RECOMMENDED FOR EMESIS
- Liquid soap
- Ipecac syrup
- Salt
- Digital induction
- Mustard powder
- Hydrogen peroxide (cats)

†Due to the lack of a specific timeline recommendation in veterinary medicine, the authors provide these time frames based on time passed since suspected ingestion.
‡Ingestion is considered severe if the amount or type of toxicant ingested leads to higher risk for more serious toxicity.

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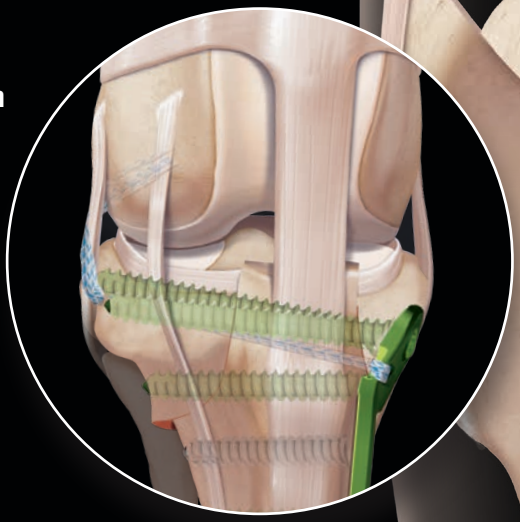

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Top 5 Breed-Associated Biochemical Abnormalities

Julie Allen, BVMS, MS, MRCVS, DACVIM (SAIM), DACVP (Clinical)
Durham, North Carolina

The serum chemistry profile is a primary component of the minimum database. However, test results should always be interpreted in relation to other patient findings including signalment, history, and physical examination findings.

Of particular importance is the patient's breed, which should always be considered when interpreting results. Because breed-specific reference intervals are not established for every breed, it is important to be aware of parameters that may lie outside reference intervals but may be frequently encountered without obvious pathology in a particular breed. Conversely, it is also imperative to know when an abnormal laboratory result is of concern for a certain breed due to an associated disease predisposition.

Following are the author's top 5 breed-specific biochemical abnormalities.

1 Increased ALP in Scottish Terriers

Some studies have documented persistent, progressive increases in ALP levels in Scottish terriers[1-3] resulting from increased synthesis

TOP 5 BREED-ASSOCIATED BIOCHEMICAL ABNORMALITIES

1. Increased ALP in Scottish terriers
2. Increased BUN in Yorkshire terriers
3. Increased creatinine in greyhounds
4. Increased ALT in Labrador retrievers
5. Increased lipase in boxers

and release from biliary epithelium, hepatocytes, or bone.[4] Induction can be stimulated by cholestasis, certain drugs (eg, corticosteroids), and hormones, as well as increased osteoblastic activity. The corticosteroid-induced isoform is most often increased in this breed.[1,3]

Increased ALP levels typically occur in the absence of notable clinical signs, although some clinicians have suggested that some neutered male dogs develop prostatomegaly and some Scottish terriers may display polyuria/polydipsia. However, few of these dogs test positive for hyperadrenocorticism on routine screening (eg, low-dose dexamethasone suppression), whereas others have increased levels of sex steroid hormones (predominantly progesterone and androstenedione).[1,3] In a study of dogs that tested positive for hyperadrenocorticism and were treated with trilostane, treatment was ineffective in all the dogs and detrimental in some cases, possibly due to the increases in sex steroid hormones.[2] Of note, clinically normal dogs should not be tested for hyperadrenocorticism.

A genetic defect similar to the 21-hydroxylase deficiency that causes adrenal hyperplasia in humans is suspected to be the cause of increased ALP levels in Scottish terriers.[1,3] The disorder causes no clinical abnormalities in some dogs, whereas others gradually develop a degenerative vacuolar hepatopathy that occasionally progresses to hepatic insufficiency, sometimes with secondary portal hypertension.[2] Increased hepatic copper levels may also occur, and some dogs develop hepatocellular carcinoma.[2] As a result, increased ALP in Scottish terriers should not be dismissed as inconsequential and warrants continued monitoring and additional diagnostics (eg, abdominal ultrasonography, bile acids) as needed.

Increased ALP in Scottish terriers should not be dismissed as inconsequential and warrants continued monitoring and additional diagnostics as needed.

2 Increased BUN in Yorkshire Terriers

Yorkshire terriers anecdotally have a higher incidence of increased BUN as compared with other breeds. However, this abnormality is often associated with normal creatinine levels and adequately concentrated urine, suggesting a prerenal cause. Differential diagnoses for prerenal causes of increased BUN in dogs include dehydration, GI bleeding, consumption of a high-protein diet, and increased protein catabolism (eg, due to strenuous exercise or corticosteroids), but in a large percentage of Yorkshire terriers, these causes are excluded.[5]

Yorkshire terriers are predisposed to GI disease, including protein-losing enteropathies (eg, lymphangiectasia).[6] Thus, it has been postulated that the increased BUN may result from subclinical GI bleeding, although these patients do not appear to develop signs of iron-deficiency anemia and anecdotally have no response to GI-protectant therapy. In addition, a recent study in Yorkshire terriers with protein-losing enteropathy identified low BUN among the clinical pathologic findings.[7] To further confound the issue, this breed has an increased incidence of congenital liver disease and corresponding decreased BUN synthesis.[6]

A renal origin cannot be completely excluded, however, as some Yorkshire terriers have concurrent proteinuria and, in one study, this breed accounted for 5.8% of biopsy-confirmed cases of immune-mediated glomerulonephritis,[8] perhaps supporting glomerulotubular imbalance (anecdotal). Consequently, a cause for the increase remains unclear and more research (eg, evaluating SDMA) is needed. In the interim, high-protein diets, GI bleeding, and renal dysfunction should be eliminated as potential causes of increased BUN. Anecdotally, the biochemical abnormality

does not appear to have much impact clinically in Yorkshire terriers.

3 Increased Creatinine in Greyhounds

Greyhounds are considered an idiosyncratic breed due to several clinical pathology variables that often fall outside standard reference intervals.[9] One of the best-described is increased creatinine levels (mean, 1.6 mg/dL vs 1.0 mg/dL).[9] Creatine is synthesized in the liver from glycine and arginine, after which it is transported to muscle (skeletal and cardiac) and phosphorylated to phosphocreatine in a reaction catalyzed by creatine kinase. Phosphocreatine then acts as the major energy store for muscle by donating phosphate during episodes of decreased adenosine triphosphate (ATP). The residual creatine is then degraded to creatinine, which is excreted essentially unchanged from the kidneys.[5]

Various causes have been proposed for the increased creatinine levels in greyhounds, including decreased glomerular filtration rates, although this was not substantiated.[9] Eating a high-meat diet (eg, one typically fed to racing dogs) has also been suggested as a factor; however, in one study, elevations persisted after dogs were retired and fed a more conventional diet.[10] The increase has also been anecdotally attributed to higher body stores of phosphocreatine as a result of increased muscle mass, which could also account for the higher ALT levels seen in this breed.[9] Consequently, mild increases in creatinine levels (up to 2.1 mg/dL) in clinically normal greyhounds may not require further diagnostic investigation.[9] Mean SDMA level is also higher in greyhounds than in other dogs and has a different reference interval.[11] However, this biomarker is believed to be unaffected by lean muscle mass, so further research into the exact cause of increased creatinine in this breed is warranted.

4 Increased ALT in Labrador Retrievers

Labrador retrievers are predisposed to chronic hepatitis due to excessive copper accumulation[12-14]; idiopathic chronic hepatitis has also been noted. Labrador retrievers with this disorder may be subclinical or have signs that range from mild and nonspecific to indicators of severe liver disease, such as jaundice or ascites. The copper-associated form of the disease appears to have both genetic (ie, ATP7A and ATP7B gene mutations) and dietary (ie, increased levels in commercial dog food) causes.[15,16] Liver biopsy with histopathology is required for definitive diagnosis (and ideally for monitoring). Mononuclear or mixed inflammatory infiltrates with hepatocyte necrosis and/or apoptosis and varying degrees of fibrosis are found on biopsy. Histochemical staining and quantification of hepatic copper levels are also essential.[13]

ALT is a moderately specific indicator of hepatocellular injury in dogs, and an increase in ALT levels is the most common clinicopathologic abnormality noted in Labrador retrievers with chronic hepatitis.[4,17] Although ALT measurement is an acceptable predictor of histopathologic evidence of chronic hepatitis, its sensitivity is poor in the earlier stages of disease.[17] As a result, it has been suggested that a different reference interval with a lower upper limit be considered for this at-risk breed. Circulating microRNAs and testing for ATP7A and ATP7B gene mutations for diagnosis and, in the case of microRNAs, monitoring the disease may also be valuable.[15,18] Doberman pinschers, American and English cocker spaniels,

An increase in ALT levels is the most common clinicopathologic abnormality noted clinically in Labrador retrievers with chronic hepatitis.[4,17]

ATP = adenosine triphosphate

West Highland white terriers, English springer spaniels, and Bedlington terriers are also predisposed to chronic hepatitis. Increased ALT in any of these breeds should not be overlooked. Persistent ALT increases should be evaluated further with bile acids and abdominal ultrasonography, although hepatic biopsy with histopathology and copper quantification is ultimately required for definitive diagnosis.

5 Increased Lipase in Boxers

Hyperlipasemia has been noted in boxers. Lipase has several sources but is usually of pancreatic origin.[4] Some assays (eg, the 1,2-o-dilauryl-rac-glycero-3-glutaric acid-[6'-methylresorufin] ester [DGGR] lipase assay) are considered to be more specific for the pancreatic isoenzyme than others.[19] In general, lipase can be increased with pancreatitis, GI disease, exogenous steroids, decreased glomerular filtration rate (lipase is renally excreted), and, rarely, hepatic or pancreatic neoplasia.[4] Boxers with hyperlipasemia are often clinically normal and have no GI signs or other manifestations (including laboratory abnormalities) consistent with pancreatitis (anecdotal). This has led to speculation that boxers may have higher values as a "normal" finding and may warrant a breed-specific reference interval.[20] However, in a postmortem study, pancreatitis was reported with a higher incidence in boxers than in other breeds,[21] although only 2 of the 200 cadavers examined were boxers. The breed disposition for this disorder was suggested again in a study in which 4 of 61 dogs with chronic pancreatitis were boxers.[22] If boxers are predisposed to pancreatitis, it seems to be subclinical in most cases. An increased prevalence of chronic pancreatitis may eventually result in exocrine pancreatic insufficiency; however, another study found that boxers are in fact at lower risk for pancreatic insufficiency than are other breeds.[23]

Increased lipase levels may be less of a concern in boxers than in other breeds, particularly in the absence of clinical signs.

Boxers are at extremely low risk for diabetes mellitus but at higher risk for insulinoma.[24] The genetic reasons for these findings remain unknown, but an abstract several years ago noted that islet cells in boxers were larger than those in other breeds, suggesting higher β-cell mass due to increased islet regeneration and/or reduced apoptosis.[25] The larger islet cells could explain this breed's resistance to diabetes mellitus and predisposition to insulinoma. Perhaps the exocrine pancreas in boxers also has greater mass compared with other breeds, which may account for the hyperlipasemia. More research is needed into the pancreata of this breed, but it is possible that increased lipase levels may be less of a concern in boxers than in other breeds, particularly in the absence of clinical signs.

Conclusion

It is important to recognize that these abnormalities may represent underlying pathologic or, in some cases, subclinical disease processes, versus an expected or "normal" finding in a specific breed. These biochemical abnormalities also provide another rationale for serial monitoring of laboratory test results to assess persistence and/or progression.

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FROM PAGE TO PATIENT

Designed to bridge the gap between research pages and daily practice protocol, the following pearls offer tips and techniques to grow the general practitioner's clinical excellence.

RESEARCH NOTES

BRAVECTO® 1-MONTH

(fluralaner) Chews for Dogs

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

Description:
Bravecto 1-Month (fluralaner) is a flavored chew formulated to provide a minimum dose of 4.5 mg/lb (10 mg/kg) body weight of fluralaner.

The chemical name of fluralaner is (±)-4-[5-(3,5-dichlorophenyl)-5-(trifluoromethyl) -4,5-dihydroisoxazol-3-yl]-2-methyl-*N*-[2-oxo-2-(2,2,2-trifluoroethylamino)ethyl]benzamide.

Indications:
Bravecto 1-Month kills adult fleas and is indicated for the treatment and prevention of flea infestations (*Ctenocephalides felis*) and the treatment and control of tick infestations [*Ixodes scapularis* (black-legged tick), *Dermacentor variabilis* (American dog tick) and *Rhipicephalus sanguineus* (brown dog tick)] for one month in dogs and puppies 8 weeks of age and older, and weighing 4.4 pounds or greater.

Bravecto 1-Month is also indicated for the treatment and control of *Amblyomma americanum* (lone star tick) infestations for one month in dogs and puppies 6 months of age and older, and weighing 4.4 pounds or greater.

Dosage and Administration:
Bravecto 1-Month should be administered orally as a single dose monthly according to the **Dosage Schedule** below to provide a minimum dose of 4.5 mg/lb (10 mg/kg) fluralaner.

381411 R8

Bravecto 1-Month should be administered with food.

Dosage Schedule

Body Weight Ranges (lb)	Fluralaner content (mg)	Chews Administered
4.4 – 9.9	45	One
>9.9 – 22.0	100	One
>22.0 – 44.0	200	One
>44.0 – 88.0	400	One
>88.0 – 123.0*	560	One

*Dogs over 123.0 lb should be administered the appropriate combination of chews

Treatment with Bravecto 1-Month may begin at any time of the year and can continue year-round without interruption.

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

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

Keep Bravecto 1-Month in a secure location out of reach of dogs, cats, and other animals to prevent accidental ingestion or overdose.

Precautions:
Fluralaner is a member of the isoxazoline class. This class has been associated with neurologic adverse reactions including tremors, ataxia, and seizures. Seizures have been reported in dogs receiving isoxazoline class drugs, even in dogs without a history of seizures. Use with caution in dogs with a history of seizures or neurologic disorders.

Bravecto 1-Month is not effective against *A. americanum* in puppies less than 6 months of age (see **Effectiveness**).

The safety of Bravecto 1-Month has not been evaluated in breeding, pregnant and lactating dogs (see **Animal Safety**).

Adverse Reactions:
In a well-controlled U.S. field study, which included 271 dogs (201 dogs were administered Bravecto 1-Month every 30 days and 70 dogs were administered an oral active control [an isoxazoline] every 30 days), there were no serious adverse reactions associated with treatment. Over the 90-day study period, all observations of potential adverse reactions were recorded.

Dogs with Adverse Reactions in the Field Study

Adverse Reaction (AR)	Fluralaner Group: Percentage of Dogs with the AR during the 90-Day Study (n= 201 dogs)	Active Control Group: Percentage of Dogs with the AR during the 90-Day Study (n= 70 dogs)
Pruritus	7.0%	10.0%
Diarrhea	3.0%	4.3%
Vomiting	3.0%	4.3%
Decreased Appetite	3.0%	0.0%
Liver enzymes (serum ALT or ALP) greater than twice the upper reference range*	1.0%	1.4%
Lethargy	1.0%	1.4%
Weight loss (>15%)	0.5%	0.0%

*Alanine aminotransferase (ALT); alkaline phosphatase (ALP)

One dog in the Bravecto 1-Month group with a history of seizures managed with anticonvulsant medication had seizure activity 28 days after its first dose; the dog received its second dose later the same day. No additional seizures occurred during the study. One dog in the control group with no history of seizures had seizure activity 12 days after its second dose. The dog was started on anticonvulsant medication and no additional seizures occurred during the study.

During the palatability assessment, four dogs coughed within 1 hour of dosing with Bravecto 1-Month. Palatability was not assessed in the control group.

In well-controlled laboratory effectiveness studies, one dog and three puppies administered Bravecto 1-Month had diarrhea (with or without blood).

Post Approval Experience (2019):
The following adverse events are based on post-approval adverse drug experience reporting for fluralaner. 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: Vomiting, lethargy, diarrhea (with and without blood), anorexia, pruritus, polydipsia, seizure, allergic reactions (including hives, swelling, erythema), dermatitis (including crusts, pustules, rash), tremors and ataxia.

To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Merck Animal Health at 1-800-224-5318. Additional information can be found at www.bravecto.com. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at http://www.FDA.gov/reportanimalae.

Clinical Pharmacology:
Peak fluralaner concentrations are achieved between 1 and 3 days following single or multiple oral administrations of Bravecto 1-Month to young puppies and adult dogs. The elimination half-life ranges from 5.0 to 8.5 days for puppies and 12.6 to 15.7 days for adult dogs. Due to reduced drug bioavailability in the fasted state, Bravecto 1-Month should be administered with food.

Mode of Action:
Fluralaner is for systemic use and belongs to the class of isoxazoline-substituted benzamide derivatives. Fluralaner is an inhibitor of the arthropod nervous system. The mode of action of fluralaner is the antagonism of the ligand-gated chloride channels (gamma-aminobutyric acid (GABA)-receptor and glutamate-receptor).

Effectiveness:
Treatment and Prevention of Flea Infestations:
In well-controlled laboratory studies in dogs 6 months of age and older, Bravecto 1-Month started killing fleas within 4 hours after treatment and was > 99% effective by 12 hours after treatment or post-infestation for 35 days.

In a well-controlled laboratory study in dogs 8 weeks of age and older, Bravecto 1-Month demonstrated 100% effectiveness against fleas for 30 days.

In a well-controlled 90-day U.S. field study conducted in households with existing flea infestations, the effectiveness of Bravecto 1-Month against fleas on Day 30, 60, and 90 visits compared with baseline was 99.6%, 99.9%, and 99.9%, respectively. Dogs with signs of flea allergy dermatitis showed improvement in erythema, alopecia, papules, scales, crusts, and excoriation as a direct result of eliminating flea infestations.

Treatment and Control of Tick Infestations:
In well-controlled laboratory studies in dogs 8 weeks of age and older, Bravecto 1-Month demonstrated ≥97.7% effectiveness against *Rhipicephalus sanguineus* ticks at 48 hours after treatment or infestation for 30 days.

In well-controlled laboratory studies, fluralaner, the active ingredient in Bravecto 1-Month, demonstrated effectiveness against *Ixodes scapularis* and *Dermacentor variabilis*.

In well-controlled laboratory studies in dogs 6 months of age and older, Bravecto 1-Month demonstrated >96% effectiveness against *Amblyomma americanum* at 48- and 72-hours after treatment or infestation for 31 days.

Bravecto 1-Month failed to demonstrate >90% effectiveness against *Amblyomma americanum* in 8-week-old puppies.

Palatability:
In a well-controlled U.S. field study, which included 579 doses administered to 201 dogs, 81.5% of dogs voluntarily consumed Bravecto 1-Month within 5 minutes, an additional 9.0% voluntarily consumed Bravecto 1-Month within 5 minutes when offered with food, and 9.5% required forced administration.

Animal Safety:
Margin of Safety Study:
In a margin of safety study, Bravecto 1-Month was administered orally to 8-week old puppies at 1, 3, and 5X the maximum labeled dose of 22.5 mg/kg with 8 dogs per group at three, 30-day intervals (Days 1, 31 and 61). The dogs in the control group were untreated.

There were no clinically-relevant, treatment-related effects on body weights, food consumption, organ weights, hematology, C-reactive protein, coagulation profile, urinalysis, gross pathology and histopathology. Diarrhea and mucoid or discolored feces were the most common observations, occurring at a similar incidence in the treated and control groups. Vomiting was noted in one dog in the 5X group and one dog in the control group on Day 2. Splayed hind limbs were noted in one dog in the 1X treatment group post-dose on Day 61. Tremors were noted in one dog in each of the 3 fluralaner dose groups on Day 1 at 4 hours post-dose. Trembling was noted in one dog in the 1X group on Day 2. Blood urea nitrogen (BUN) was elevated in one dog in the 3X group on Day 8. BUN and serum creatinine were elevated in one dog in the 5X group on Day 85.

Reproductive Safety Study:
Reproductive safety was evaluated for fluralaner, the active ingredient in BRAVECTO 1-Month. Fluralaner was administered orally to intact, reproductively-sound male and female Beagles at a dose of up to 168 mg/kg on three to four occasions at 8-week intervals. The dogs in the control group were untreated. There were no clinically-relevant, treatment-related effects on the body weights, food consumption, reproductive performance, semen analysis, litter data, gross necropsy (adult dogs) or histopathology findings (adult dogs and puppies). One adult dog in the treated group suffered a seizure during the course of the study (46 days after the third treatment). Abnormal salivation was observed on 17 occasions: in six treated dogs (11 occasions) after dosing and four control dogs (6 occasions).

The following abnormalities were noted in 7 pups from 2 of the 10 dams in only the treated group during gross necropsy examination: limb deformity (4 pups), enlarged heart (2 pups), enlarged spleen (3 pups), and cleft palate (2 pups). During veterinary examination at Week 7, two pups from the control group had inguinal testicles, and two and four pups from the treated group had inguinal and cryptorchid testicles, respectively. No undescended testicles were observed at the time of necropsy (days 50 to 71).

In a well-controlled field study Bravecto 1-Month was used concurrently with other medications, such as vaccines, anthelmintics, antibiotics (including topicals), steroids, analgesics, and anesthetics. No adverse reactions were observed from the concurrent use of Bravecto 1-Month with other medications.

Storage Conditions:
Do not store above 86°F (30°C).

How Supplied:
Bravecto 1-Month is available in five strengths (45, 100, 200, 400, and 560 mg fluralaner per chew). Each chew is packaged individually into aluminum foil blister packs sealed with a peelable paper backed foil lid stock. Product may be packaged in 1, 3, or 4 chews per package.

Approved by FDA under NADA # 141-532

Rev: 03/20

DESIGNED FOR PUPPIES

Introducing BRAVECTO® 1-MONTH Chews—essential flea and tick protection for puppies 8 weeks of age and older, and weighing 4.4 lbs or greater.

BRAVECTO® 1-MONTH (fluralaner) Chews

With BRAVECTO 1-MONTH Chews, puppies can get just the right amount of protection they need for their growing bodies.

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IMPORTANT SAFETY INFORMATION:

BRAVECTO 1-MONTH Chews are for dogs 8 weeks of age and older. Side effects may include itching, diarrhea, vomiting, decreased appetite, elevated ALT, lethargy, and weight loss. Fluralaner is a member of the isoxazoline class. This class has been associated with neurologic adverse reactions including tremors, ataxia, and seizures. Seizures have been reported in dogs receiving isoxazoline class drugs, even in dogs without a history of seizures. Use with caution in dogs with a history of seizures or neurologic disorders. **BRAVECTO 1-MONTH** Chews are not effective against A. americanum in puppies less than 6 months of age. For full prescribing information, see page 28.

MERCK Animal Health

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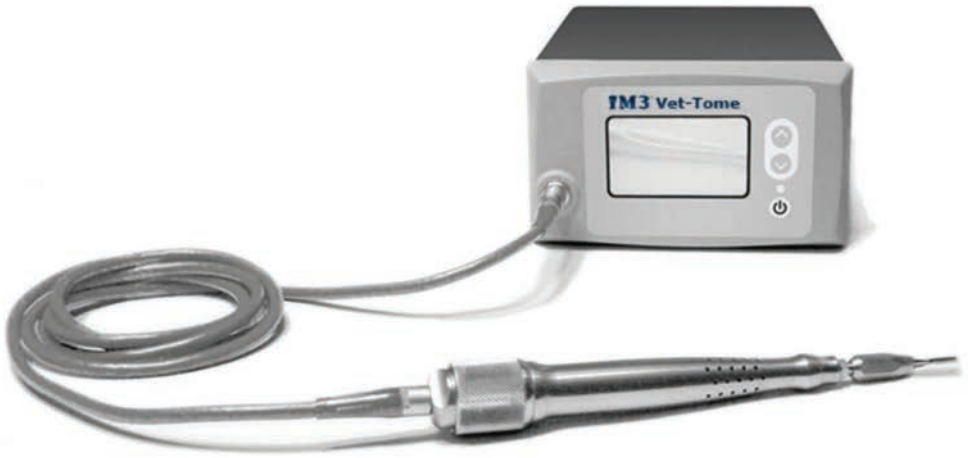

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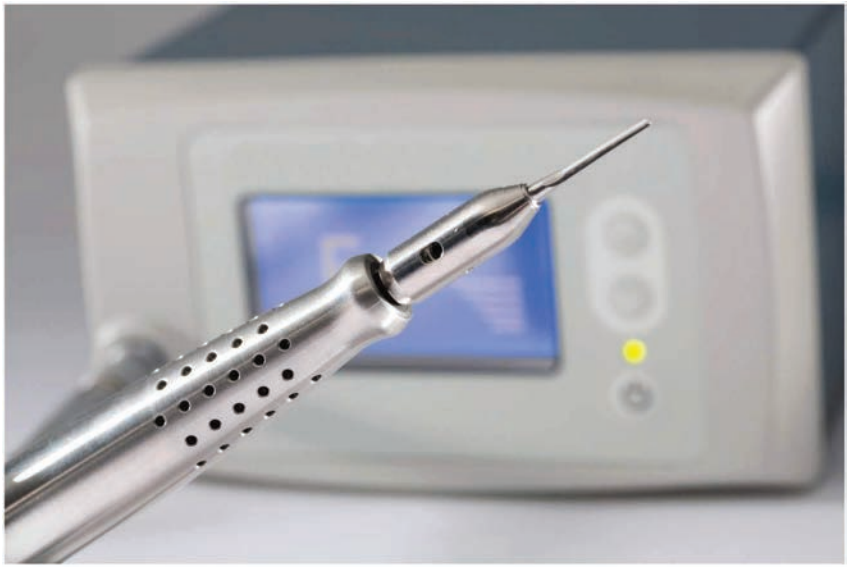

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Effect of Cranial Cruciate Ligament Treatment on Canine Life Expectancy

Christian Latimer, DVM, CCRP, DACVS-SA
Veterinary Referral Hospital of Hickory
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In the literature

Boge GS, Engdahl K, Bergström A, et al. Disease-related and overall survival in dogs with cranial cruciate ligament disease, a historical cohort study. *Prev Vet Med*. 2020;181:105057.

FROM THE PAGE ...

Cranial cruciate ligament (CCL) disease is one of the most common orthopedic conditions in dogs and the leading cause of canine pelvic limb lameness.[1]

Surgical management of CCL disease has been shown to be the most effective treatment for returning the affected leg to function and limiting progression of stifle osteoarthritis. There are several procedures to treat this disorder, with osteotomy and extracapsular techniques being commonly used. Conservative management, which can include any combination of rest, NSAIDs, physical therapy, nutraceuticals, and intra-articular stifle injections, is an alternative option.

This historical cohort study evaluated the effect of treatment method (ie, conservative vs surgical management) and multiple risk factors (eg, body weight) on the survival of dogs with CCL disease (n = 333). Most veterinary studies on orthopedic conditions in dogs focus outcome measures on degree of lameness, return to function, and complication rate; this study, however, specifically evaluated the effect of treatment on life expectancy.

Models in this study revealed improved survival in surgically treated dogs as compared with dogs managed conservatively. In addition, factors shown to negatively affect survival included increasing age, increasing body weight, and having other orthopedic conditions.

Some important factors were not accounted for. Meniscal tears occur in a large portion of dogs with CCL disease and can be a source of pain and lameness. In this study, many patients treated surgically most likely had a meniscal injury treated at the time of surgery; however, joint exploration was rarely performed in dogs managed conservatively, so meniscal injury could be considered a confounding factor. In addition, increasing body weight was found to negatively affect survival, although smaller dogs generally tend to have a longer lifespan than larger dogs.

Findings regarding how CCL disease can affect survival rate in dogs can help clinicians make decisions regarding treatment recommendations for these patients.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. CCL disease may affect life expectancy in dogs.
2. Patient factors (eg, age, body weight, presence of orthopedic and nonorthopedic comorbidities) should be considered when selecting a treatment method for CCL disease in dogs.
3. Surgical treatment often results in the most favorable long-term outcome for dogs with CCL disease.

Reference

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NUTRITIONAL NOTES

Managing the Microbiome: A New Treatment Approach for Feline Gastrointestinal Disease

Sponsored by Hill's Pet Nutrition

As with humans, the feline GI tract is colonized by a large number of microorganisms, collectively known as the microbiome. These organisms play an important role in both systemic health and disease by either directly or indirectly affecting a wide range of physiologic host functions, including host immune system modulation, defense against enteropathogens, and providing various metabolites and substrates that can be used by the host for nutritional benefit.[1]

The microbiome exists as a balanced ecosystem of desirable and undesirable organisms, which is crucial to host homeostasis. When this balance is disrupted (ie, dysbiosis), there can be many deleterious effects for not only the GI tract but the entire body as well. Research has shown that there are significant differences between the fecal microbiome of healthy cats as compared with cats with diarrhea[2] and/or inflammatory bowel disease,[3] suggesting that dietary modification may be useful as a therapeutic modality.

Food serves as a substrate for the microbiome in both dogs and cats and is an important contributor to microbiome composition and metabolism.[4] Thus, a complete food focusing on the feline microbiome could potentially have significant benefits in the treatment of patients with chronic enteropathies.

Case Presentation

Max, a 10-year-old neutered male domestic shorthair cat, was presented to his primary veterinarian for recurrent constipation. His owner reported intermittent constipation of several month's duration, with intermittent diarrhea between episodes. He also had a history of cystitis and struvite crystalluria but was otherwise healthy. CBC, serum chemistry profile, and urinalysis did not reveal any underlying systemic cause for constipation. Abdominal radiography revealed granular stool in the colon but was otherwise unremarkable.

His owner reported that Max had been prescribed many different medications, probiotics, and nutritional supplements in the past but that Max is challenging to medicate and his clinical signs would often recur following cessation of antibiotic therapy. The owner also noted that Max refused his food when probiotics were added, despite being mixed into the canned food. Due to suspected dysbiosis and the need for a long-term solution to his chronic GI issues, Max's veterinarian recommended Hill's Prescription Diet Gastrointestinal Biome, with no additional medications or supplements.

Utility of Food Focusing on Alterations in the Microbiome

Hill's Gastrointestinal Biome is a complete and balanced food that contains a proprietary blend of prebiotics as a core nutritional technology, preventing the need to provide supplementation with any additional pre- or probiotics. Microbes in the gut ferment these prebiotics, produce gut-nourishing compounds, and release and activate

plant-bound antioxidants and anti-inflammatory compounds. This stimulates the release of postbiotics at higher levels than traditional fiber foods, promoting healthy stool and benefiting overall systemic health.

Relying on pre- or probiotic dietary additives can sometimes be a concern from an owner compliance standpoint; in addition, many patients may refuse to eat foods with powder or liquid additives. There is also a level of inherent uncertainty as to whether the pet has actually ingested all of the additive when it is mixed or added to the current food, particularly if a pet does not eat the entire meal or if more than one pet in the household might be able to access the food bowl.

Moreover, prebiotics differ from probiotics in that probiotics are live microorganisms that may enhance intestinal health; however, because probiotics are single organisms, they do not address the complexity of the ecosystem of microbial organisms unique to each individual patient. Prebiotics, on the other hand, are foods available to all the resident micro-organisms and are therefore able to impact a pet's individual microbiome ecosystem balance. Hill's Gastrointestinal Biome contains ActivBiome+™ technology, which uses a a proprietary blend of prebiotics that works synergistically with the pet's individual microbiome and has been shown to resolve clinical signs in as few as 24 hours.[5]

The use of a therapeutic food may also help mitigate the overuse of antibiotics and help with antibiotic stewardship. Although some pets may respond to antibiotic therapy, clinical signs often return once the antibiotic has been discontinued, which may result in prolonged and multiple antibiotic courses.

The availability of a wet option can help aid in hydration for pets with chronic constipation or those with systemic illness due to chronic intestinal disease.

Hill's Gastrointestinal Biome is available in both dry and wet options for cats and dogs. The availability of a wet option can help aid in hydration for pets with chronic constipation or those with systemic illness due to chronic intestinal disease. In addition, most pets find wet options tasty, which may help promote long-term compliance.

Case Outcome

The wet formulation of the food was elected for Max to help improve his hydration and increase water intake to further address his constipation and promote urinary health. Max's owner was advised that Hill's Gastrointestinal Biome, in addition to managing Max's primary condition, has the additional benefit of S+OXSHIELD technology to promote a urinary environment that reduces the risk for developing struvite and calcium oxalate crystals. Max ate Hill's Gastrointestinal Biome food readily, and within 24 hours, his stool became more regular with regard to frequency and consistency.

Max is currently well managed on dietary therapy alone, without the need for any additional medications or nutritional supplements.

Conclusion

A complete and balanced therapeutic food that focuses on nourishing the feline gut microbiome can help support digestive health and overall well-being. This product is fast-acting, although some cats may require multimodal therapy. Now more than ever, pet owners can play an integral role in the health of their pets through food selection and modification. Hill's revolutionary ActivBiome+™ technology is a first of its kind, with evidence-based nutrition prioritizing microbiome health and targeting GI disease at the source.

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2. Suchodolski JS, Foster ML, Sohail MU, et al. The fecal microbiome in cats with diarrhea. *PLoS One.* 2015;10(5):e0127378.
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Use of Crossmatching Prior to First Transfusion in Cats

Eva Spada, DVM, PhD
Daniela Proverbio, DVM, PhD
Veterinary Transfusion Research Laboratory
University of Milan
Milan, Italy

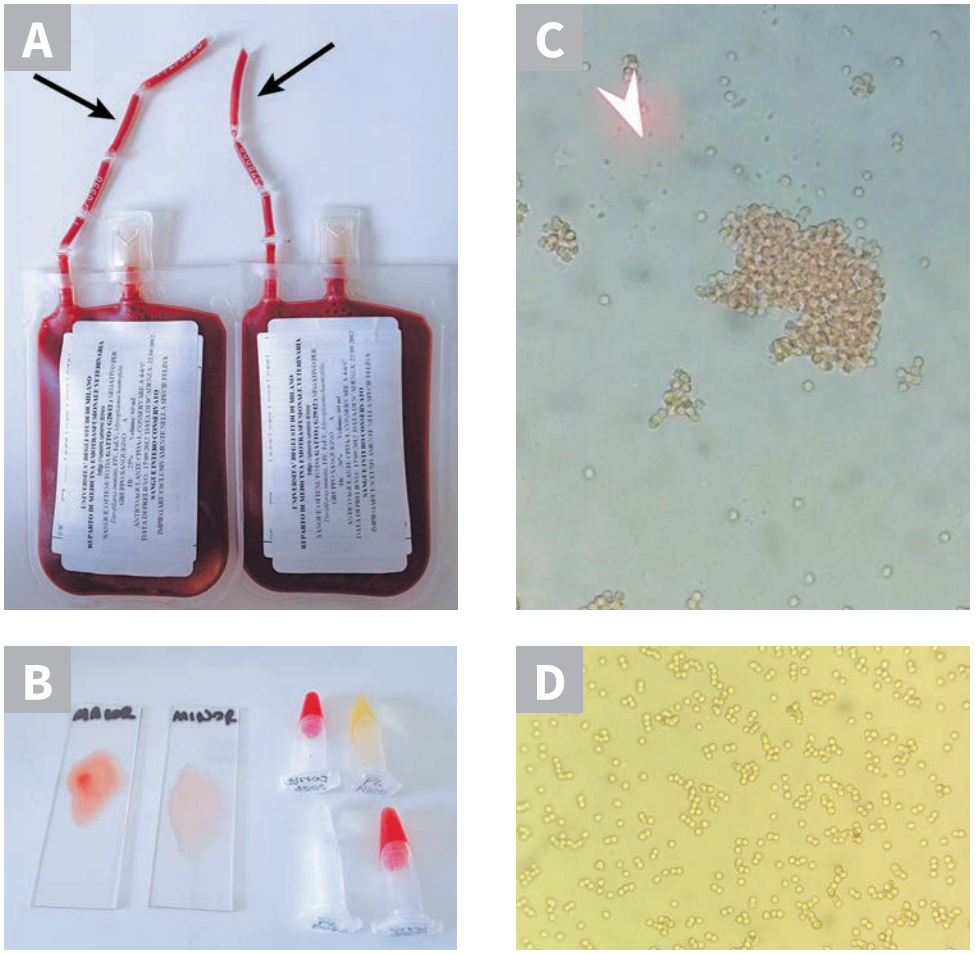
In the literature

Humm KR, Chan DL. Prospective evaluation of the utility of cross-matching prior to first transfusion in cats: 101 cases. *J Small Anim Pract*. 2020;61(5):285-291.

FROM THE PAGE ...

The major AB blood system in cats results in blood types A, B, and AB.[1] Cats may also be positive or negative for the Mik antigen.[2] In most cats, alloantibodies are present against absent blood type RBC antigens and are implicated in hemolytic transfusion reactions during first blood transfusions.[3] Blood typing and crossmatching can help minimize hemolytic transfusion reactions. Crossmatching determines compatibility between the donor and recipient. *Major* crossmatching identifies antibodies in recipient plasma against donor RBC antigens, whereas *minor* crossmatching identifies antibodies in donor plasma against recipient RBC antigens.[4,5] There have been a number of retrospective and prospective studies on the effectiveness of crossmatching before first blood transfusions in cats to prevent transfusion reactions and ensure the most effective transfusion is performed. However, despite these studies, the clinical effectiveness of crossmatching before the first transfusion in cats remains controversial.[6]

This study sought to determine whether crossmatching is necessary before the first blood transfusion in a cat. It assessed the frequency of crossmatching incompatibility in 101 naive feline blood transfusion recipients using a standard laboratory slide agglutination test (***Figure***) and a commercial gel kit crossmatching method. The study then assessed the impact of crossmatching incompatibility on the likelihood of hemolytic transfusion reactions. A relatively high level of major crossmatching incompatibility was detected with the slide agglutination method and a much lower level with the gel test (27% and 4%, respectively). The gel test appeared most specific for predicting hemolytic transfusion reactions. Furthermore, the effect of crossmatching incompatibility on packed cell volume posttransfusion was evaluated; administration of crossmatching incompatible blood to transfuse naive cats was not associated with lower retention of RBCs 12 hours posttransfusion as compared with administration of crossmatching compatible blood. The frequency of acute transfusion reactions and errors in blood transfusions was ≈20% in this feline population.



▲ **FIGURE** Segments of whole blood units (***A***; ***arrows***) used to prepare washed RBCs and plasma samples to be used with recipient RBCs and plasma in major and minor crossmatching (***B***). After incubation, samples are microscopically evaluated (40× high power objective). RBC agglutination (***C***) indicates incompatible cross-matching, whereas the presence of either rouleaux (***D***) or nonagglutinated RBCs is indicative of compatible crossmatching.

… TO YOUR PATIENTS

Key pearls to put into practice:

1 Cats may have hemolytic transfusion reactions on first transfusion; however, in this study, these reactions were not associated with increased mortality.

2 A commercial gel kit test may better predict the likelihood of hemolytic transfusion reactions in naive feline blood transfusion recipients as compared with the laboratory standard slide crossmatching method.

3 If multiple donors or blood units are available, performing crossmatching before first transfusion and use of a compatible donor/unit is optimal; if this is not feasible, however, transfusion without crossmatching can be safe and effective.

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6. Safrany B, Adamantos S. Is a cross-match necessary before a cat's first blood transfusion? *Vet Evid*. 2020;5(2).

Disinfecting for Methicillin-Resistant *Staphylococcus pseudintermedius* in the Clinic

William Oldenhoff, DVM, DACVD
Madison Veterinary Specialists
Monona, Wisconsin

In the literature

Soohoo J, Daniels JB, Brault SA, Rosychuk RAW, Schissler JR. Efficacy of three disinfectant formulations and a hydrogen peroxide/silver fogging system on surfaces experimentally inoculated with meticillin-resistant *Staphylococcus pseudintermedius*. *Vet Dermatol*. 2020;31(5):350-e91.

FROM THE PAGE …

Thorough environmental disinfection is critical in veterinary clinics to limit nosocomial infections. Methicillin-resistant *Staphylococcus pseudintermedius* (MRSP) is of particular importance for veterinary patients, as it is one of the most commonly isolated resistant pathogens in dogs and cats,[1] and hospitalization and frequent visits to the clinic have been identified as risk factors for infection.[2,3] There are currently no commercial disinfectant sprays or foggers effective against MRSP.

This study investigated the activity of 4 products on MRSP: a hydrogen peroxide and silver fogging system, a quaternary ammonium product, an accelerated hydrogen peroxide product, and a hydrogen peroxide and silver product. Surfaces were inoculated with MRSP then cleaned per manufacturer recommendations with the tested products.

To test the fogging system, 8 inoculated samples were placed in various locations in a clinic examination room. The fog was deployed and the room sealed for the recommended duration. Researchers found that the quaternary ammonium and accelerated hydrogen peroxide products provided mean reduction in MRSP cfu counts of 99.97% and 99.98%, respectively. A mean reduction of 97.81% was noted with the hydrogen peroxide and silver product and 52.14% with the fogging system.

… TO YOUR PATIENTS

Key pearls to put into practice:

1 The sprays used in this study demonstrated superior activity as compared with the fogging system. However, using a disinfectant after every patient (versus which product is used) is the most important component of cleaning. The quaternary ammonium and accelerated hydrogen peroxide products demonstrated superior efficacy in MRSP disinfection. The hydrogen peroxide and silver product also provided significant reduction and may be acceptable in a clinical setting. Ultimately, cleaning is the most critical part of preventing nosocomial infections.

2 The hydrogen peroxide and silver fogging system cannot be recommended as a sole means of disinfection but may have a role as an adjunct to disinfection, particularly in areas in the clinic where the risk for infection is higher (eg, surgery suite).

3 The environment is just one source of nosocomial infections. Other sources include hands and shared grooming equipment, and thorough and frequent cleaning is critical to preventing the spread of microbes.

References

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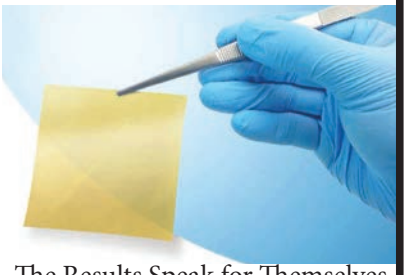

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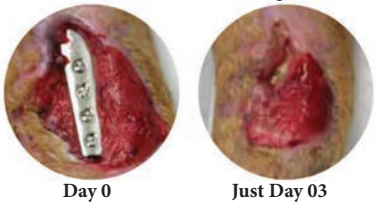

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J1535A	4” x 4” (102mm x 102mm)

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Cod Fish Skin Graft

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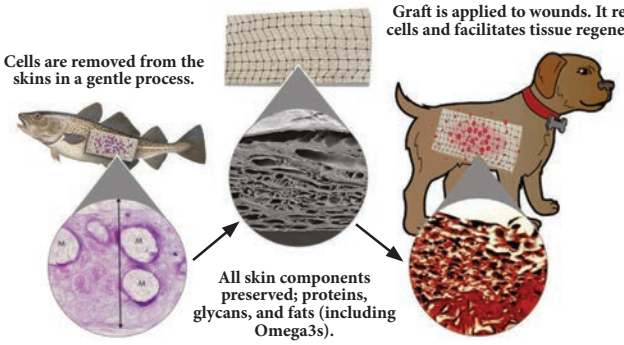

- Long shelf life (5 years)
- Store at room temp
- In sterile chevron pouch
- Can be applied without sedation
- Non immunogenic
- A cellular matrix

Product Code	Size
J1540	3cm x 7cm (1.2” x 2.8”)
J1540A	7cm x 7cm (2.8” x 2.8”)
J1540B	7cm x 10cm (2.8” x 4”)

Sold individually

Assessment of Imidacloprid/ Moxidectin Treatment in Heartworm-Infected Dogs

Nancy Vincent-Johnson, DVM, MS, DACVIM (SAIM), DACVPM
Fort Belvoir Veterinary Center
Fort Belvoir, Virginia

In the literature

Savadelis MD, Coleman AE, Rapoport GS, et al. Clinical assessment of heartworm-infected beagles treated with a combination of imidacloprid/ moxidectin and doxycycline, or untreated. *J Vet Intern Med*. 2020;34(5):1734-1745.

FROM THE PAGE . . .

Dirofilaria immitis, an etiologic agent of heartworm disease, contains an endosymbiotic bacterium of the genus *Wolbachia*, which produces a host inflammatory response when released on the death of the adult parasite. Treatment with doxycycline prior to heartworm adulticidal therapy eliminates *Wolbachia* spp from worms, diminishing associated inflammation and resulting pulmonary pathology. Coadministration of doxycycline with long-term macrocyclic lactone administration has been shown to be effective in slowly killing adult heartworms and eliminating microfilariae. Efficacy rates vary widely with the specific macrocyclic lactone, likely due to relative dosage rates.[1]

In this study,* researchers surgically transplanted adult heartworms into 16 beagles; dogs were randomly assigned to treatment (n = 8) and nontreatment (n = 8) control groups. Four weeks after transplantation, the treatment group received topical 10% imidacloprid + 2.5% moxidectin at the standard dose, along with doxycycline (10 mg/kg PO every 12 hours). Doxycycline was given for 30 days, and imidacloprid/moxidectin was continued every 4 weeks for a total of 10 treatments. The control group received no treatment or placebo. Clinical data consisting of CBC, serum chemistry profile, radiography, and echocardiography were collected for all dogs ≈1 week before and 3 weeks after surgical transplantation of adult worms, as well as every 4 weeks for the duration of the treatment period.

*This study was funded by Bayer HealthCare Animal Health.

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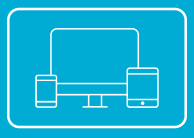

Online Experiences

Zoom Meeting
21-22 January 2021

Zoom Meeting
18-19 February 2021

Wet-Lab Experiences

VITICUS Center
27-28 March 2021

Zoom Meeting
18-19 February 2021

Dry-Lab Experiences

Atlanta, GA
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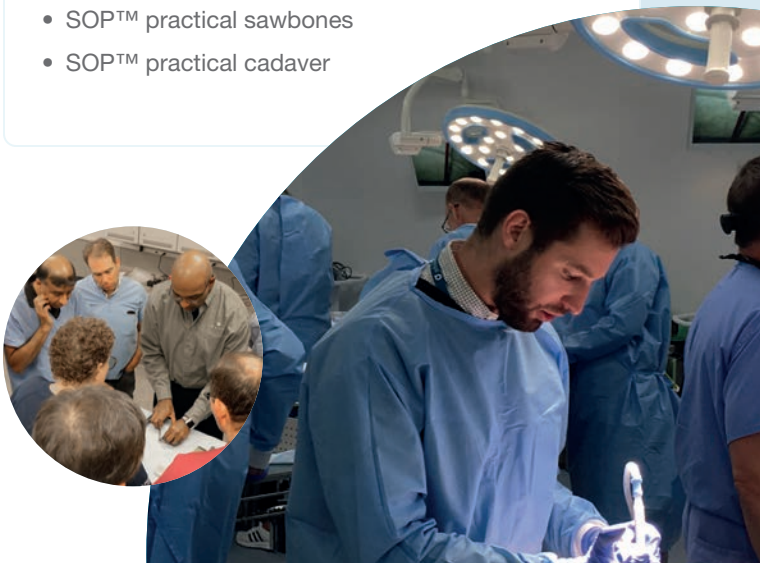

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Serum ALT and ALP were significantly higher in treated dogs on day 28 as compared with untreated dogs; few other differences were found between the groups. Aside from significantly fewer treated dogs having echocardiographic evidence of adult heartworms at all time points, any differences were considered of minimal or indeterminate clinical relevance. On necropsy, dogs in the treatment group had significantly higher pulmonary arterial thrombus scores than the control group; however, pulmonary thromboembolism is an inevitable consequence of successful adulticide therapy. Authors concluded that this treatment protocol was well-tolerated with no clinically relevant adverse effects.

Pulmonary thromboembolism is an inevitable consequence of successful adulticide therapy.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. The adulticidal efficacy of doxycycline and monthly imidacloprid/moxidectin therapy is 95.9%, which is comparable to the recommended standard adulticide therapy that consists of pretreatment with doxycycline and a select macrocyclic lactone followed by a 3-dose regimen of melarsomine.[1] Doxycycline and monthly imidacloprid/moxidectin therapy also successfully eliminated microfilariae within 3 weeks.

2. Results of this study suggest the risk for clinically relevant complications in dogs treated with doxycycline and monthly imidacloprid/moxidectin is comparable to that in nontreated dogs. Both groups had moderate exercise restrictions throughout the study; exercise restriction remains a vital component of adulticidal therapy regardless of protocol.

3. As compared with standard therapy, the slower time to effect of imidacloprid/moxidectin adulticide therapy causes a longer period of continued cardiopulmonary damage; thus, slow-kill adulticide methods are not recommended by the American Heartworm Society.[2] However, this protocol may be an acceptable alternative when melarsomine is not an option.

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Suggested Reading

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Research Note:
Ganciclovir Use in Cats with Feline Herpesvirus-1

Feline herpesvirus-1 (FHV-1) is a primary cause of painful corneal and conjunctival ulcerations in cats. Various topical ophthalmologic treatments have been assessed, and in vitro data suggest ganciclovir has superior efficacy as compared with other ophthalmologic medications. This study first confirmed the in vitro efficacy of ganciclovir for FHV-1, then evaluated the safety and tolerability of topically applied 0.15% ganciclovir eye gel (GEG) in healthy cats. No significant differences were noted between eyes treated with GEG versus a lubricating eye gel; however, both gels caused minor ocular irritation. No systemic changes were noted. Additional studies are needed to investigate the efficacy of GEG in cats with ocular clinical signs as a result of FHV-1 infection.

Source

Lewin AC, Liu CC, Alling C, Camacho-Luna P, Miessler B, Carter RT. In vitro efficacy of ganciclovir against feline herpesvirus type 1 and assessment of ocular tolerability in healthy cats. *J Feline Med Surg*. 2020. doi:10.1177/1098612X20944363.

Research Note:
Demyelinating Polyneuropathy in Miniature Schnauzers

In humans, Charcot-Marie-Tooth disease consists of several hereditary motor and sensory peripheral neuropathies. An analogous condition was recently identified in 12 miniature schnauzers (age of onset, 3-18 months). Clinical signs at presentation were megaesophagus (11 dogs) and aphonic bark (11 dogs), with and without obvious neuromuscular weakness. Electrodiagnostic testing identified marked decreases in motor and sensory nerve conduction velocities, including in dogs without neuromuscular weakness. Treatment was aimed at clinical signs and included head elevation during and after feeding, as well as administration of antacids, gastroprotectants, prokinetics, and antiemetics. Clinical signs progressed to significant pelvic limb weakness, muscle atrophy, decreased flexor reflexes, and delayed postural reactions in one dog. Death directly attributed to the disease occurred in only 1 other dog due to aspiration pneumonia.

Source

Farré Mariné A, Granger N, Bertolani C, Mascort Boixeda J, Shelton GD, Luján Feliu-Pascual A. Long-term outcome of miniature schnauzers with genetically confirmed demyelinating polyneuropathy: 12 cases. *J Vet Intern Med*. 2020;34(5):2005-2011.

Comparison of Urinary Catheterization Techniques

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In the literature

Tipler AE, Moses EA, Greer R, Delisser P, McCracken BD, Moses PA. Urinary catheterisation of female dogs: a comparison between three techniques for catheter placement. *Aust Vet J*. 2020;98(8):364-370.

FROM THE PAGE ...

Placement of urinary catheters is associated with many complications, including UTIs and traumatization of tissue.[1-10] To reduce complications, urinary catheters should be efficiently placed aseptically and atraumatically.[1,6-8,11,12] Although there are multiple placement techniques, there are no studies comparing them.[1,2]

The objective of this study was to describe a novel catheterization technique in female dogs and compare its ease of learning and duration of placement with traditional techniques. Nine fourth-year veterinary students with no prior catheterization experience were enrolled in the study. A 30-minute tutorial was provided by experienced veterinary technicians that included descriptions and videos of 3 catheterization techniques: visualization with speculum, blind palpation, and visualization with a novel catheterization device. An appropriately sized Foley catheter with stylet was used for all catheterizations.

Nine canine cadavers of varying sizes were used. Each student catheterized a small (<22 lb [10 kg]), medium (33-55.1 lb [15-25 kg]), and large (>66.1 lb [30 kg]) dog using all 3 catherization techniques. Time to perform each technique was measured, and a maximum time of 40 minutes was allotted. A poststudy questionnaire assessed students' ease of learning, ease of performance, and preference for technique.

All catheterization attempts were completed during the allotted time, with only 23 of 27 attempts completed for the blind palpation group. Regardless of dog size, visualization with speculum and visualization with a novel catheterization device were faster than blind palpation. Median time to catheterization was shortest for visualization with speculum (300 seconds) and longest for blind palpation (725 seconds). Although the novel catheterization device technique took longer to perform (420 seconds) as compared with speculum, it remained significantly faster than blind palpation. Visualization with a novel catheterization device was considered the easiest technique by 6 of the 9 students, and none considered it the hardest technique.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. An ideal urinary catheterization technique should be easy to learn and perform while maintaining sterility. Using a technique that allows visualization of the urethral papilla may result in increased success of placement of female urinary catheters.
2. Although both visualization with speculum and with a novel catheterization device provide visualization of the urethral papilla, the novel catheterization device technique may be less cumbersome and easier to perform. In addition, this technique offers a sterile pathway to the urethral papilla, thus potentially increasing sterility.
3. Maintaining sterility during urinary catheterization remains paramount, regardless of technique used.

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Long-Bone Fractures in Rabbits

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Kansas State University

In the literature

Garcia-Pertierra S, Ryan J, Richardson J, et al. Presentation, treatment and outcome of long-bone fractures in pet rabbits (*Oryctolagus cuniculus*). *J Small Anim Pract*. 2020;61(1):46-50.

FROM THE PAGE ...

Long-bone fractures are relatively common in pet rabbits and often occur as a result of mishandling, accidental blunt trauma, and/or predation. As often occurs with caged small mammals, fractures can also occur without an obvious or observed cause.

Despite rabbits being common pets, there is a lack of evidence-based guidance for the treatment and outcome of fractures in this species, as recommendations for fracture management are largely based on individual case reports or clinical experience and ex vivo research studies. A large-scale retrospective report described the cause, characteristics, treatment, and outcome of fractures in small-breed rabbits[1]; an associated study found that treatment with external skeletal fixation resulted in healing of most fractures.[2]

This retrospective review reports the characteristics of long-bone fractures in rabbits presented to an institution. In this report, long-bone fractures often occurred in young patients, were usually closed diaphyseal fractures, and lacked a clear etiology. Most (n = 22; 73%) fractures underwent primary orthopedic repair, but only 73% of these treated fractures achieved functional recovery. All cases that underwent plate fixation (n = 5) resulted in functional recovery.

Postoperative complications were reported in 9 (41%) cases treated surgically and included delayed healing, nonunion with poor function, ileus following surgical fixation, implant failure, severe stifle osteoarthritis, pressure ulcers, seroma formation, screw loosening, and external skeletal fixation transfixion pin discharge. Subjective parameters not evaluated in this study (eg, surgeon experience in treating rabbits) should also be taken into consideration.

The main limitations of this report include the small number of rabbits in the study, the wide range of affected bones and treatments, and the number of different surgeons involved, which, as the authors describe, precludes robust conclusions and limits the scope of comparisons among different fracture repair methods.

Continues ▶

CANINE LEPTOSPIROSIS: THE BEST TREATMENT REMAINS PREVENTION

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Leptospirosis is a zoonotic bacterial infection that can be found throughout most of the United States. Dogs can be exposed to leptospires from soil, water, and fomites contaminated with infected urine and become infected when bacteria enters the mucous membranes.[1] After an incubation period, spirochetes ultimately reside in renal tubules, resulting in urinary shedding. Apparently healthy dogs may shed leptospires in their urine for weeks to months if unidentified and untreated, causing further contamination and increasing the risk for spreading infection.

Due to factors such as climate change, population growth, and habitat encroachment, reports of canine leptospirosis are on the rise and expected to continue to increase.[2,3] Therefore, appropriate biosecurity, biosurveillance, and prevention measures are more imperative now than ever when diagnosing and treating patients with leptospirosis.

Urinary Shedding

Urinary shedding in infected patients begins 7 to 10 days after infection and ceases 2 to 3 days after initiation of appropriate antibiotic therapy.[4] Shedding can also occur in clinically healthy dogs (ie, subclinical carriers). Leptospires can persist in renal tubules for weeks to months, resulting in the potential for a chronic carrier state.[5] In a study, 8.2% of study dogs were found to be shedding pathologic leptospires, regardless of their health status.[6] Thus, subclinical shedding is likely a larger contributing factor to the spread of leptospirosis and therefore a larger risk to public health than may be expected.[6,7]

Biosecurity & Biosurveillance

Because leptospirosis suspects may not be easily identified, routine use of appropriate biosecurity protocols is advised if there is any reason to be suspicious of leptospirosis. Recommendations should be focused on urinary shedding and include urinary catheterization, restricting walks, minimizing patient movement in hospital, appropriate patient labels advising staff of handling instructions and potential for zoonotic/contagious infection, and frequent hand washing and use of personal protective equipment.[4]

Prevention

Leptospirosis vaccination may be considered a noncore, risk-based vaccine in some areas. However, development of subclinical leptospirosis is common, which may create the impression of a lower incidence than is actually the case, especially if testing is infrequent. Vaccination against leptospirosis can help in preventing infection; however, no vaccine is 100% effective against subclinical infection, and not all vaccines are labeled to help prevent urinary shedding. Nobivac® Lepto 4 has been shown to be effective against urinary shedding and to decrease mortality associated with leptospirosis.[8,9] Prevention of urinary shedding is the best measure to decrease the risk for infection in both animals and humans, ultimately decreasing the risk for transmission of an infection that has the potential to result in fatal illness.

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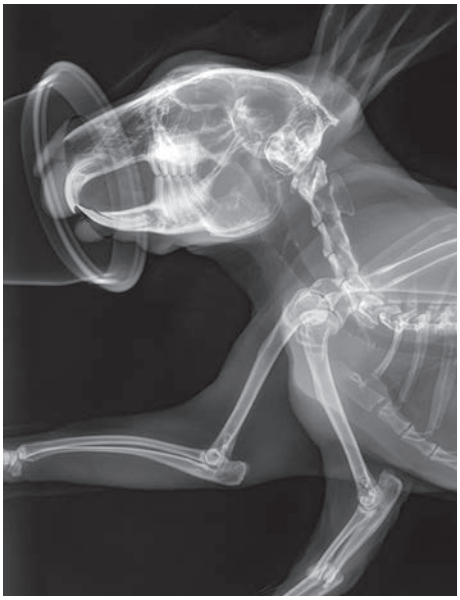

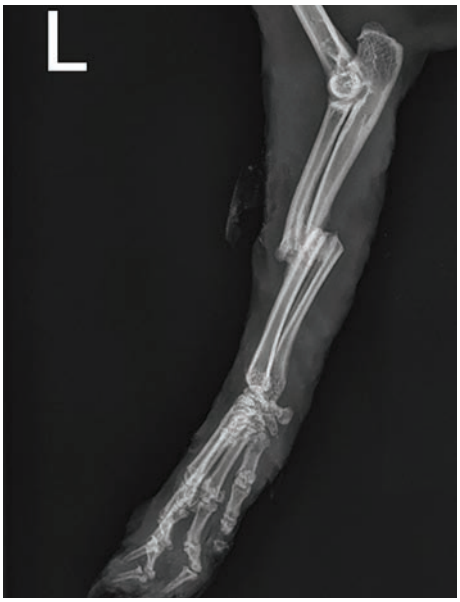

▲ **FIGURE** Right lateral radiograph of a 2-year-old male intact rabbit that caught his left front foot in a cage wire; parallel, mid-diaphyseal fractures of the radius and ulna can be seen (***A***). Due to financial constraints, the pet owners elected for external coaptation, which resulted in frequent splint failure (wet, too tight, pressure sores) that required 3 months of intensive care and resulted in suboptimal bone healing and near loss of the limb due to deep skin infections (***B***). Ideally, these fractures should have been treated surgically using a bone plate or an extra-skeletal fixation device.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Primary fracture management can be more challenging in rabbits than in other species due to rabbits' more brittle cortical bone; however, prognoses are generally good in patients despite the variable repair techniques used for different patients.
2. Bone plating should be considered when indicated.
3. Perioperative management is imperative for a favorable outcome and should always include rigorous pain management, assisted feeding and hydration, and recovery in a stress-free environment.

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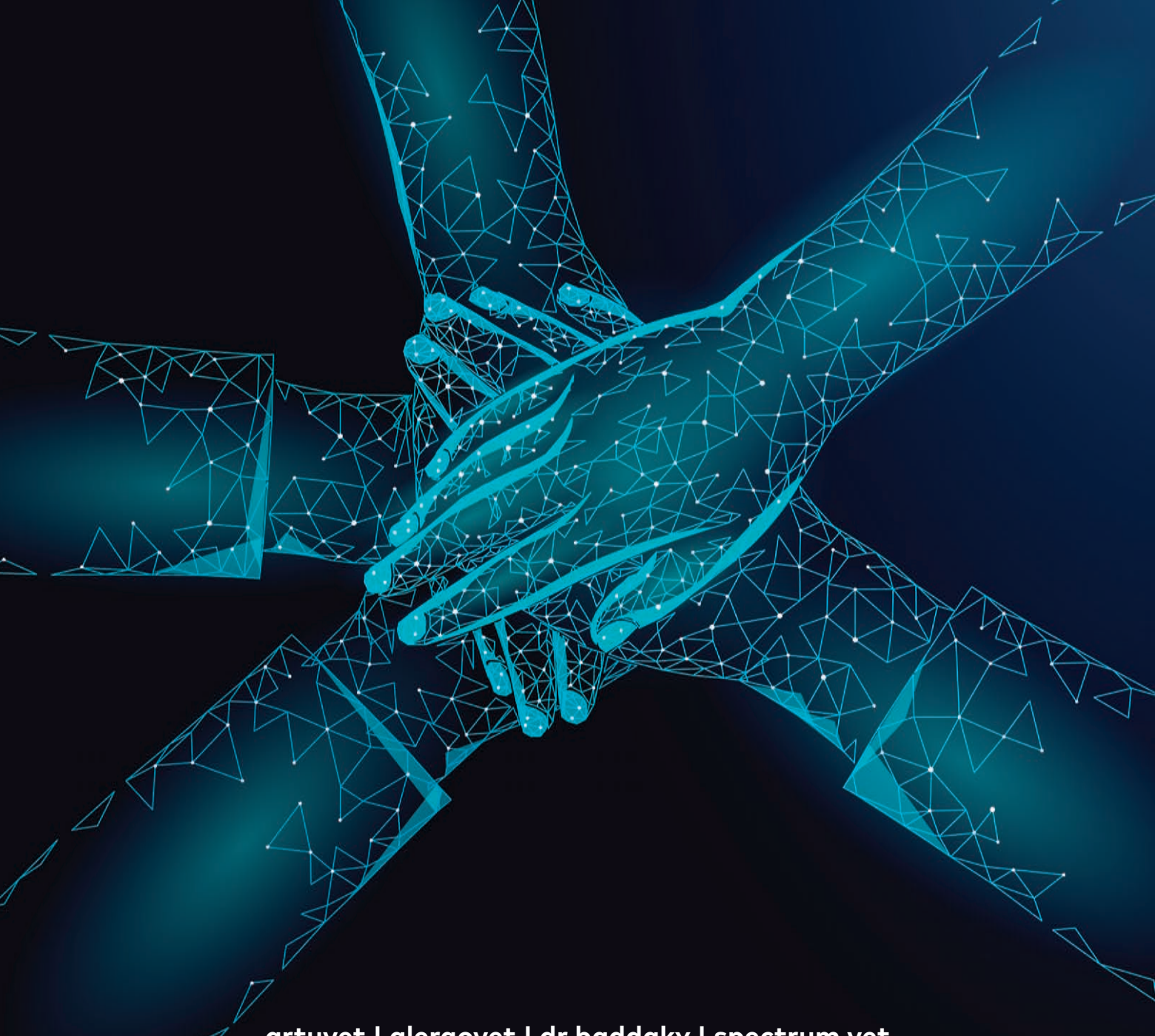

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Diagnostic Use of Spec fPL for Pancreatitis in Cats

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In the literature

Lee C, Kathrani A, Maddison J. Retrospective study of the diagnostic utility of Spec fPL in the assessment of 274 sick cats. *J Vet Intern Med*. 2020;34(4):1406-1412.

FROM THE PAGE ...

In this study, medical records of pet cats presented over a 4-year period, and in which Spec fPL was measured, were reviewed. The study represents the largest clinical evaluation of serum Spec fPL concentrations to date for diagnosis of pancreatitis in cats, and its retrospective nature allowed for inclusion of a significantly larger sample of cats (n = 274) than in previous studies.[1-4] Sick cats were included, regardless of whether pancreatitis was a differential diagnosis, which may have allowed for a slightly wider population than previously reported; however, it is likely that most clinicians have a suspicion for pancreatitis when serum Spec fPL concentrations are measured.

Each cat was assigned to 1 of 4 categories—definite, probable, possible, or unlikely pancreatitis—based on clinical signs, ultrasound changes, and cytology and/or histopathology. Definite pancreatitis was only assigned to cats with cytologic and/or histopathologic evidence of pancreatitis. Probable, possible, and unlikely pancreatitis were based on clinical findings, minimum database, and abdominal ultrasound findings. It is unclear whether categorization was determined by a single author or by a panel vote of all 3 authors. Authors in a previous study using similar categorization reported significant disagreement in classification of cases.[5]

Only 9 cats met the criteria for definite pancreatitis. Notably, 3 of these 9 cats had a Spec fPL concentration within the reference interval, and 1 cat had a Spec fPL in the equivocal range (3.5-5.3 µg/L). Because this was a retrospective study, an obvious cause of these results could not be determined.

Similar to other studies, a low false-positive rate (10%) for serum Spec fPL concentration was confirmed. This rate might be lower than reported, as some cats with pancreatitis may not have had evidence of disease on ultrasonography. It was also confirmed that not all cats with pancreatitis have increased serum Spec fPL concentration; this is likely due to severity or chronicity of disease. However, it is possible the number of true positives was underestimated based on false-negative diagnoses on abdominal ultrasound, as has been previously reported.[1,6]

Other biochemical markers were also evaluated, and no significant difference in serum albumin, total calcium, or serum ALT or ALP activities between the combined definite and probable pancreatitis groups and in the possible and unlikely pancreatitis groups was found. Although a significant difference among groups was found for the serum bilirubin concentration, this difference was not considered clinically relevant.

… TO YOUR PATIENTS

Key pearls to put into practice:

1 Careful integration of all available clinical information, including patient history, physical examination, minimum database, ultrasound findings, and serum Spec fPL concentrations, are crucial for diagnosis of pancreatitis and ruling out of other differential diagnoses or comorbidities in cats.

2 In this study, there was a low false-positive rate when using serum Spec fPL concentration for diagnosis of feline pancreatitis, and serum Spec fPL concentration >5.3 µg/L was uncommon in cats without pancreatitis.

3 Not every cat with pancreatitis has an increased serum Spec fPL concentration; thus, pancreatitis should not be excluded solely based on the normal serum Spec fPL concentration in a sick cat.

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Effects of the COVID-19 Lockdown on the Human–Animal Bond

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In the literature

Bowen J, García E, Darder P, Argüelles J, Fatjó J. The effects of the Spanish COVID-19 lockdown on people, their pets, and the human-animal bond. *J Vet Behav.* 2020;40:75-91.

FROM THE PAGE …

Most countries responded to the COVID-19 pandemic with a lockdown that confined humans to their home, changing the daily life of pets. These changes were likely to create anxiety in pets and their owners.[1]

This study looked at the effects of mandated confinement on pets using statistical methods. When the survey was conducted, mean duration of confinement was 3.2 weeks; 44.6% of pet owners indicated their quality of life was slightly worse, and 11.4% noted quality of life had improved. Of the respondents, 74.3% felt the presence of a pet helped them during confinement. However, some pets showed behavior changes associated with the prolonged presence of humans in the home. Of particular concern, pets of owners with quality-of-life concerns were also likely to have worse quality of life.

There have been anecdotal reports of cats becoming increasingly aggressive toward owners during the pandemic. However, responses in this study do not align with these reports; 1.6% of cats reportedly displayed more aggression, 3.6% became less aggressive, and 16.5% had no change. The frequency of most problem behaviors in cats stayed the same or decreased slightly and included house soiling and urine marking.

Dogs were slightly more likely than cats to have worsening behavior problems (as recorded for 8 of 10 behaviors included in the study); increased vocalization was the most noticeable. Behavior in 11.8% of dogs worsened when dogs were left alone, which—along with increased attention-seeking behavior in both dogs and cats—may indicate a possible increase in cases of separation anxiety when human activities outside the home return to prepandemic levels.[2]

Prolongation of the pandemic, resurgence of COVID-19 cases, and differences in how countries manage their response will affect data gathered by other researchers. This article may provide some early baseline information and a comparably rigorous statistical format to help future researchers.

… TO YOUR PATIENTS

Key pearls to consider in practice:

1. The most significant behavior changes noted in dogs during the COVID-19 lockdown included increased or annoying vocalization, problems when left alone, and aggression toward other dogs when on walks. Both dogs and cats exhibited increased attention-seeking behaviors and fear of loud or sudden noise. House soiling improved in 5.6% and worsened in 2.8% of cats. Cats were also noted to be more relaxed.
2. Dogs did best when they had outdoor access and were taken on frequent walks. Cats living in multicat households also reportedly did better.
3. Dogs reportedly had worse quality of life when owners showed increased emotional closeness and reported increased frequency of getting angry at the dog, as well as when all members of the household were home. Cats reportedly also had worse quality of life when owners showed increased emotional closeness or when owners reported they were anxious.

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Prognostic Factors for Feline Injection Site Sarcoma Recurrence

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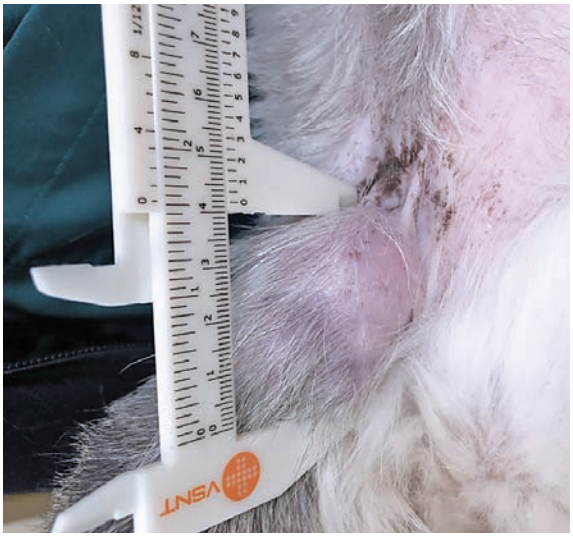
In the literature

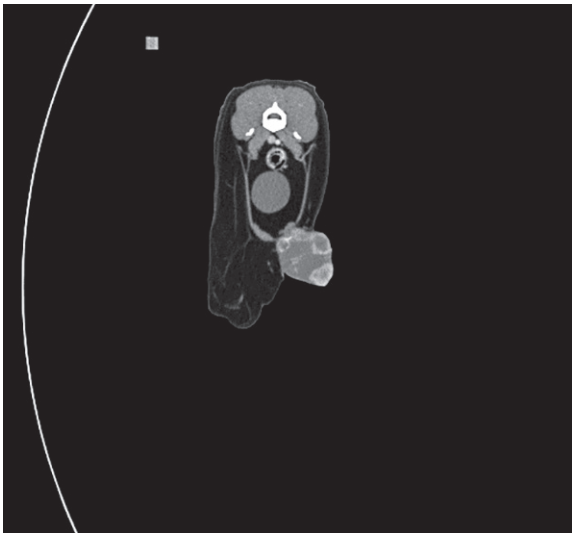
Chiti LE, Martano M, Ferrari R, et al. Evaluation of leukocyte counts and neutrophil-to-lymphocyte ratio as predictors of local recurrence of feline injection site sarcoma after curative intent surgery. *Vet Comp Oncol*. 2020;18(1):105-116.

FROM THE PAGE ...

Feline injection site sarcomas are caused by any stimulus that incites chronic local inflammation of the subcutis or muscles.[1-4] Treatment of these tumors can be challenging because of their locally invasive properties and subsequent high risk for regrowth after surgery. Multiple variables have been assessed to determine the prognostic significance with regard to local recurrence, and completeness of surgical excision has been shown to be a vital factor in multiple studies.[5-8] Unfortunately, even in cases in which histologically tumor-free margins were achieved, local recurrence



▲ **FIGURE 1** Injection site sarcoma on the flank fold of a cat. External measurement: longest diameter, 40 mm



▲ **FIGURE 2** CT scan of the same cat with injection site sarcoma, confirming the flank fold tumor is invading the body wall

has been documented.[6,7] Thus, tumor recurrence is possible despite complete histologic margins. In humans, pretreatment neutrophil:lymphocyte ratio (NLR) has been shown to be a prognostic indicator in patients with several solid tumors, including soft tissue sarcomas,[9] and leukocyte counts and ratios (eg, NLR) have been proposed as prognostic tools in dogs with various tumor types, including soft tissue sarcomas.[10]

In this retrospective study, several CBC parameters (ie, pretreatment NLR, WBC count, neutrophil count, lymphocyte count) were evaluated for use as prognostic markers for recurrence of feline injection site sarcoma.

Eighty-two cats with newly diagnosed, surgically excised injection site sarcomas were included; surgery criteria included wide margin excision, with 3- to 5-cm lateral margins and 2 deep fascial planes, or limb or tail amputation. The impact of NLR and lymphocyte count on overall survival time was assessed as a secondary endpoint.

Cats with ulcerated tumors had significantly higher WBC and neutrophil counts. WBC count, neutrophil count, and NLR were significantly higher in histologically infiltrative injection site sarcomas. NLR was significantly higher in patients with fibrosarcomas and was correlated with tumor size. In univariate and multivariate analysis, NLR, WBC count, and neutrophil count were significant prognostic factors for local recurrence. However, when WBC count, neutrophil count, and NLR were considered together in the Cox regression model, only WBC count remained a prognostic factor for local recurrence. WBC count, neutrophil count, and NLR were not confirmed to be prognostic for overall survival time in the multivariate model.

This study demonstrates that pretreatment NLR, WBC count, and neutrophil count may be of value in identifying cats at higher risk for local recurrence after curative-intent surgery for injection site sarcoma. These parameters are readily available, cost-effective, and objective prognostic tools that can be easily retrieved from routine preoperative hematologic investigations. However, considering the retrospective nature of this study and the low number of included cats, further prospective studies are warranted to confirm these findings.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Feline injection site sarcomas are locally invasive tumors with high risk for local recurrence.
2. Presurgery NLR, WBC count, and neutrophil count may help identify cats at higher risk for local recurrence after surgical excision.
3. WBC count, neutrophil count, and NLR do not appear to be associated with overall survival time in cats with injection site sarcomas that have been treated with curative-intent surgery.

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Coaptation Devices for Elbow Hygromas

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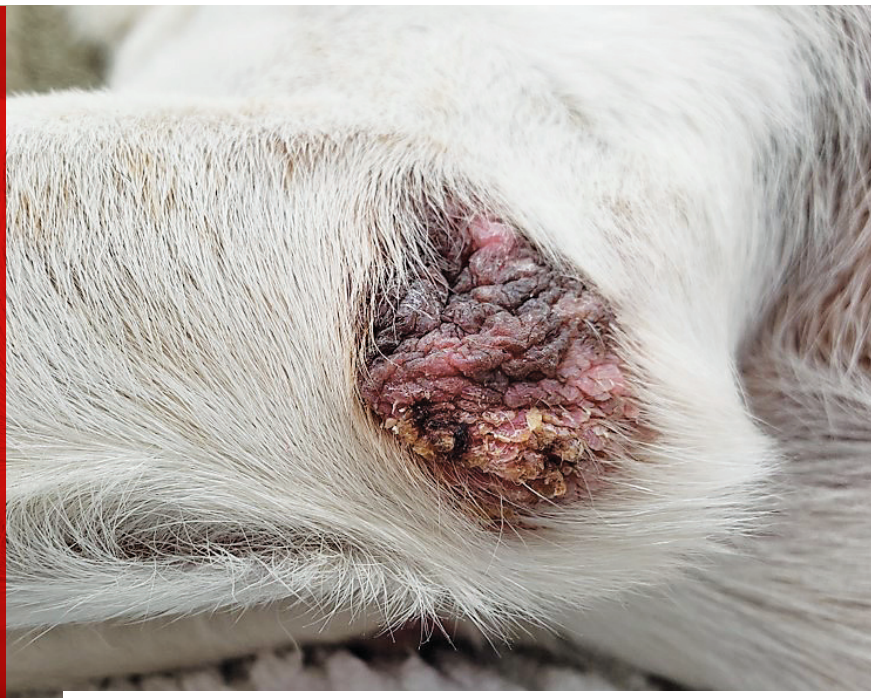
University of Tennessee



▲ **FIGURE 1** Chronic, nonulcerated hygroma on the left elbow of a healthy large-breed dog

Hygromas are soft, benign, fluid-filled masses that form over bony prominences in young adult large- and giant-breed dogs in response to repetitive pressure or blunt trauma.[1-3] Hygromas are typically located over the elbows, although they have been reported in other regions (eg, tuber calcaneous, tuber ischium, carpus; ***Figures 1*** and ***2***).[1] As the bony prominence hits the floor or other hard surfaces, subcutaneous tissue over the bone is damaged. Repetitive trauma results in formation of a pocket of serous fluid that is surrounded by a fibrous capsule and, in some cases, contains granulation tissue.[1-3]

Most hygromas are nonpainful, but they can enlarge, ulcerate, and become infected (***Figures 2*** and ***3***).[1-4] Prevention of hygroma formation and treatment for small, nonpainful hygromas involves elimination of blunt trauma to bony prominences by providing appropriate bedding or applying regional padding or coaptation devices (eg, casts, splints, bandages).[1,4,5] Large, ulcerated, or infected hygromas may require culture, drainage, open wound management, or surgical resection and reconstruction.[1-3,6] Even after aggressive treatment, pressure-relieving measures must be continued to allow the site to heal and to prevent future recurrences.[3]

When selecting or manufacturing a coaptation device, fit is the most important consideration. An ill-fitted coaptation device can result in discomfort, swelling, dermatitis, local tissue necrosis, ulcerations, and muscle atrophy from immobility. In addition, if appropriate positioning is not maintained, the device may not protect the area adequately from further trauma. The device should be lightweight and inexpensive, distribute pressure away from bony prominences, allow unimpeded motion and mobility, and permit appropriate blood flow to the region.[4,7] Doughnut-style padding can be helpful for prevention of hygroma formation or enlargement (***Figure 4***). However, in dogs with ulcerations (***Figure 5***) or surgical reconstructions, doughnut-style padding redistributes

pressure circumferentially to all surrounding tissues, inhibiting blood flow and healing.[4] Application of padding distal to the hygroma (***Figure 6***) can prevent contact of the region with hard surfaces while allowing joint movement and maintaining blood flow along the proximal half of the area. A homemade system from readily available products is especially useful when owner travel is restricted.

Counseling, monitoring, and additional recommendations on care should be based on appearance of the affected area.

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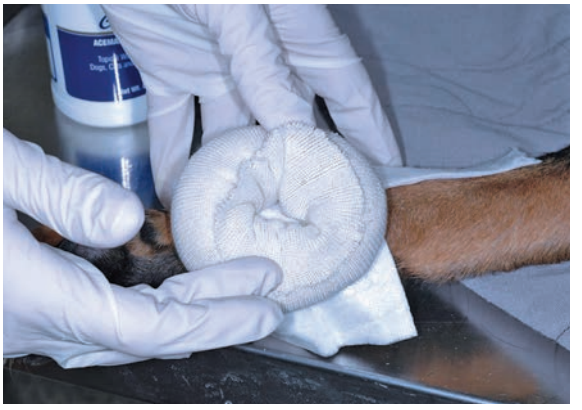
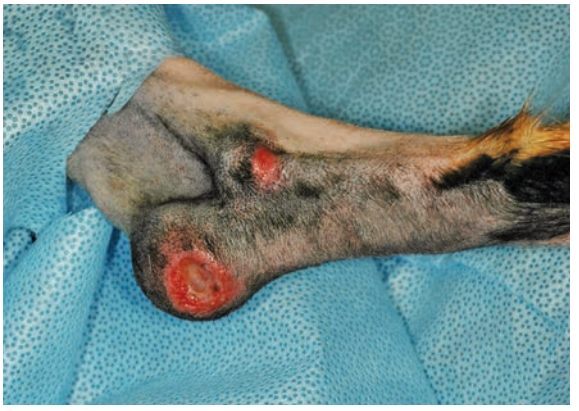
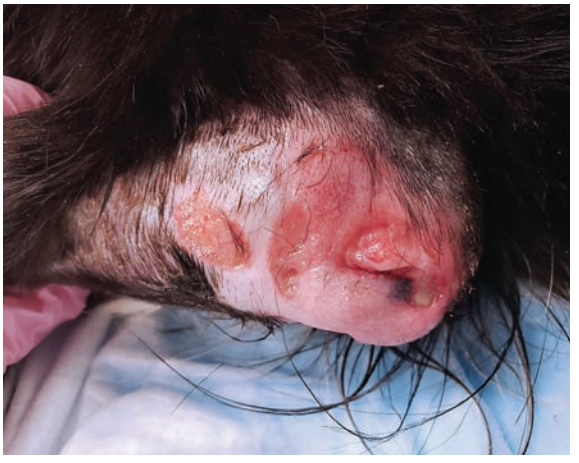


▲ **FIGURE 4** Doughnut-style padding is used to reduce pressure over the boney prominence on the right forelimb near the carpal pad.



▲ **FIGURE 2** Ulcerated hygroma on the tarsus of a dog with a plantigrade stance secondary to neuropathy

▲ **FIGURE 5** Ulcerated tarsal pressure sore



▲ **FIGURE 3** Chronic ulcerated elbow hygroma

▲ **FIGURE 6** Foam padding is added to the plantar surface of the feet of the dog in ***Figure 5*** to prevent direct pressure on the calcaneal processes.

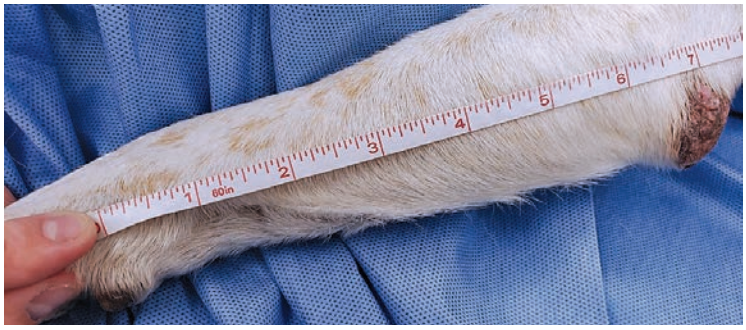
STEP-BY-STEP
PLACING AN EXTERNAL COAPTATION DEVICE TO REDUCE PRESSURE ON ELBOW HYGROMAS

WHAT YOU WILL NEED

- Pool noodle (hollow) or pipe insulation
- Stockinette or a washable stocking, sleeve, or legging material
- Measuring tape and marker
- Scissors or box cutter
- Velcro straps, Velcro tape, or adhesive elastic tape
- Thin foam or extra piece of pool noodle for large limb

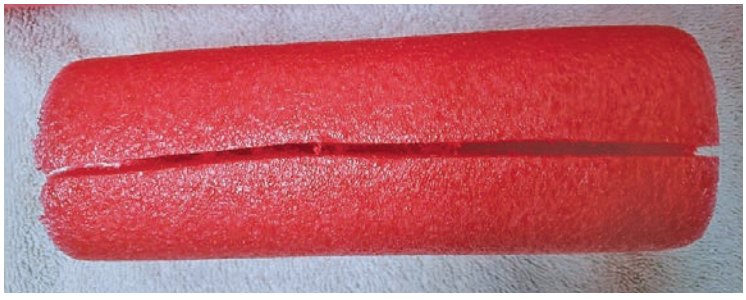
STEP 1

Starting from a point 1 inch below (ie, distal to) the olecranon, or the lowest point of the hygroma, measure the distance to the carpal pad.



STEP 2

Mark a pool noodle with the measurement from ***Step 1***. Cut it to the appropriate length, then use scissors or a box cutter to split it down the center of one side lengthwise.

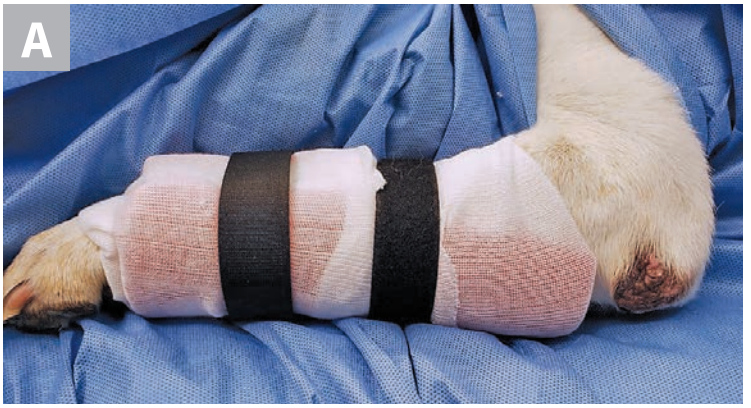


STEP 3

Cut a piece of stockinette at least 4 inches longer than the pool noodle, then slide the stockinette on the patient's leg so that it extends above the elbow and below the carpus. Provide the pet owner with extra stockinette so soiled pieces can be laundered.

STEP 4

Open the pool noodle and slide it over the caudal aspect of the leg. Pull down the excess cuff of stockinette over the proximal and distal edges of the pool noodle, then secure the noodle and stockinette in place with Velcro straps, Velcro tape, or adhesive elastic tape.



AUTHOR INSIGHTS

The pool noodle elevates the limb off the floor to prevent abrupt or traumatic compression along the pressure point. Because the noodle is placed only along one side of the region experiencing pressure, it does not apply 360-degree compression of the tissues as a doughnut bandage would and therefore does not obstruct blood flow all the way around the affected area.

If the Velcro straps or tape cause pressure on the cranial or dorsal aspect of the limb, especially if the limb is large, add a piece of foam to fill the gap between the split sides of the noodle to prevent pressure sores or irritation.

STEP 5

Assess the fit of the device by watching the dog walk and checking for any pressure points.

AUTHOR INSIGHT

For dogs without open wounds, placement of a stockinette under the device may be unnecessary (as shown in the photo).

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Maxillary Extractions in Cats

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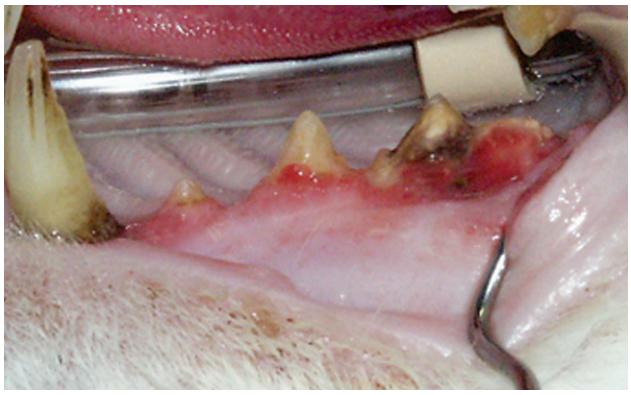
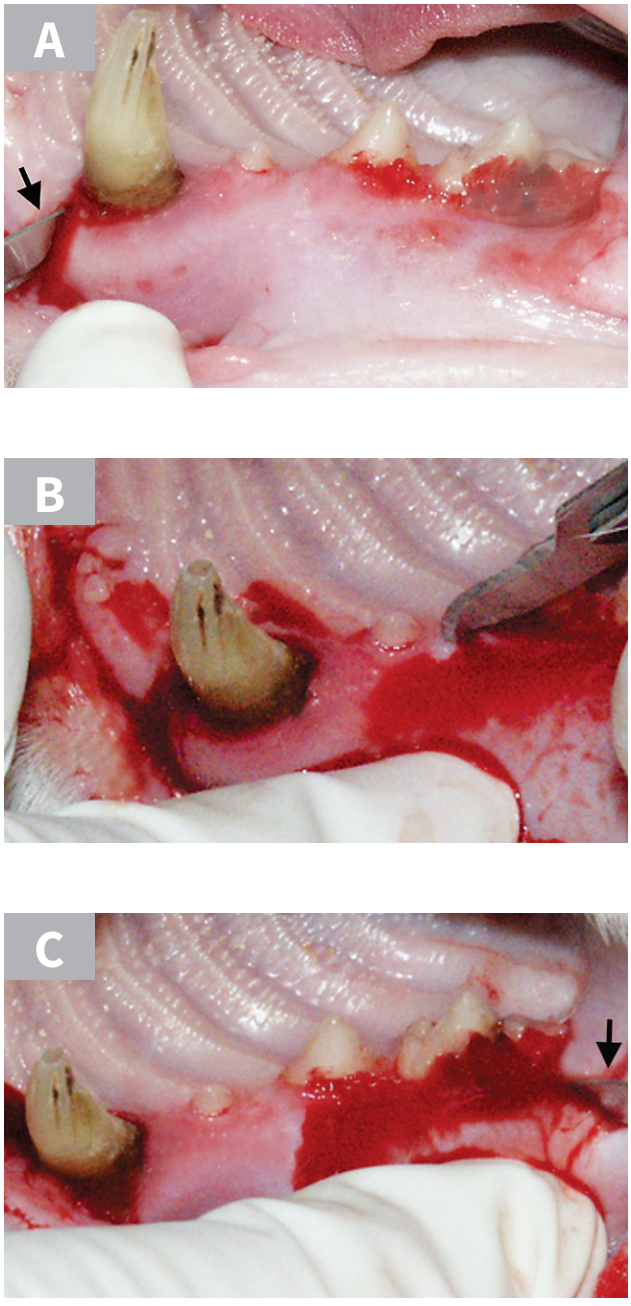
Full-mouth tooth extraction is indicated in cats that have stomatitis, generalized tooth resorption, and/or severe periodontal disease. Each tooth, including the entirety of the root, must be completely removed. Surgical extraction requires familiarity with the following techniques:

- Mucoperiosteal flap development
- Buccal bone removal (ie, alveolectomy)
- Crown sectioning of multirooted teeth
- Crown–root segment elevation and removal
- Removal and contouring of rough bone margins (ie, osteoplasty) at extraction sites
- Debridement of diseased periodontal tissue
- Lavage of extraction sites with dilute chlorhexidine
- Mobilization of mucoperiosteal flaps
- Wound apposition using absorbable suture in a simple interrupted pattern

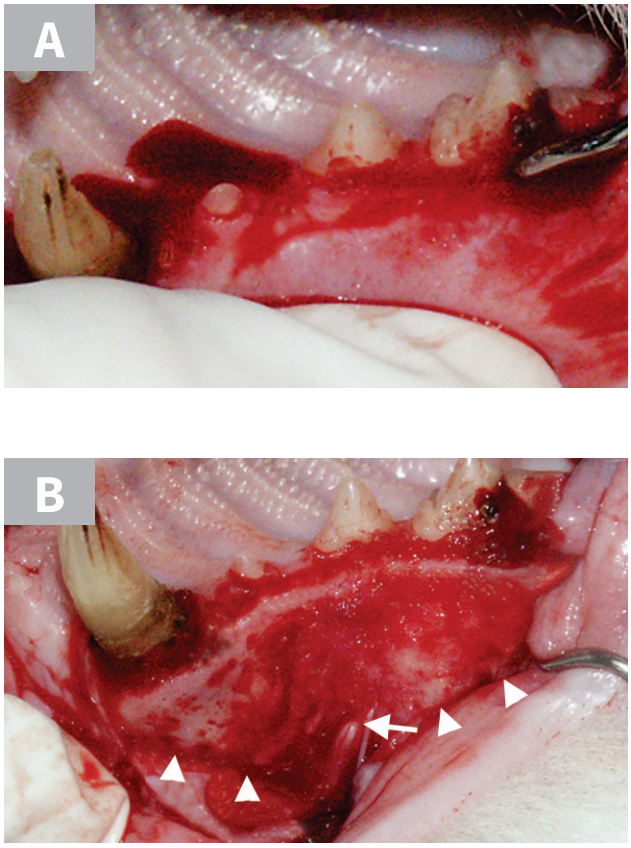
The following images show full-mouth tooth extraction in the maxillary quadrant of cats.



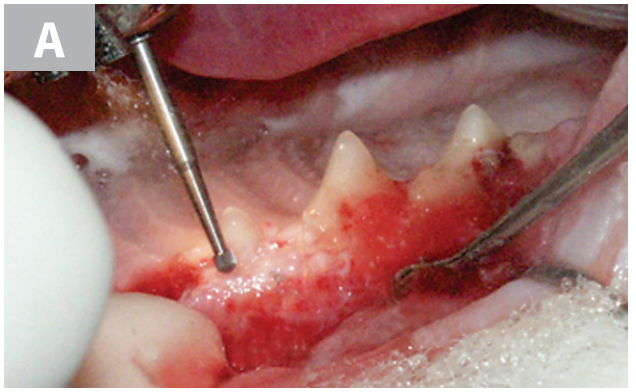
▲ **FIGURE 1** Right maxillary arcade with the patient in dorsal recumbency. Extraction of all teeth was recommended to treat periodontal disease and tooth resorption.

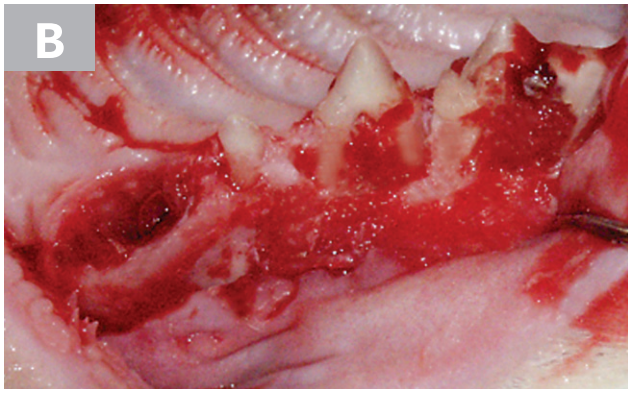


▲ **FIGURE 2** A mucoperiosteal flap is created to extract teeth on the maxillary arcade. A rostral vertical release incision (***A***; ***arrow***) is made at the mesial aspect of the maxillary canine tooth. An intrasulcar incision is made along the buccal aspect of the teeth between the maxillary canine and first molar tooth (***B***). A caudal vertical release incision (***C***; ***arrow***) is made at the distal aspect of the maxillary first molar tooth.

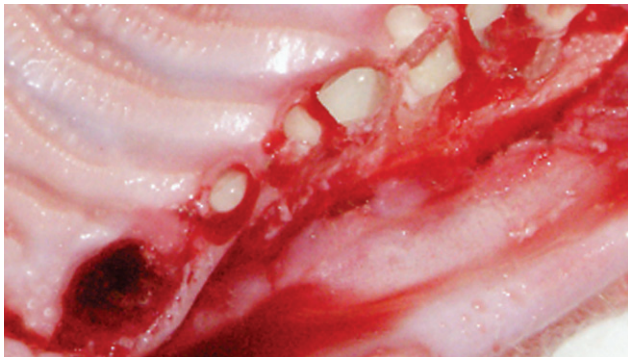


▲ **FIGURE 3** Elevation of the mucoperiosteal flap along the maxillary dental arcade using a small periosteal elevator (***A***). Elevation of the flap (***B***) exposes the cortical bone of the lateral maxilla and may reveal the infraorbital neurovascular pedicle (***arrow***) exiting the infraorbital foramen. Incising the periosteum (***arrowheads***), which tethers the submucosa to bone, is critical to providing flap mobility to ensure tension-free wound closure.

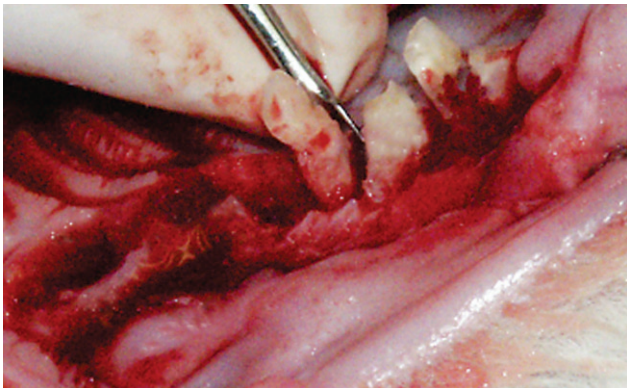




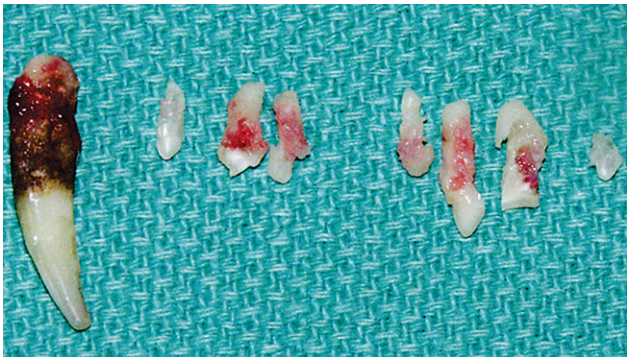
▲ **FIGURE 4** Buccal bone removal (ie, alveolectomy) is used to expose the tooth roots of the maxillary second premolar (***A***) and the remaining teeth of the maxillary dental arcade (***B***) using a high-speed handpiece and a pear-shaped or small round bur. Typically, buccal bone would be removed to facilitate extraction of the maxillary canine tooth. In this case, the canine tooth had grade 3 mobility and was extracted using extraction forceps.



▲ **FIGURE 5** Crown sectioning of the multirooted teeth of the maxillary arcade. The crown is sectioned at the furcation and through the crown. In general, the maxillary first molar tooth is not sectioned based on its common fused-root morphology.



▲ **FIGURE 6** A small periodontal elevator is used to mobilize the crown–root segment. The elevator is placed parallel to the long axis of the root and twisted to disrupt the remaining attached periodontal ligament and mobilize the root. The displaced root is held in its new position by the elevator for 10 to 15 seconds to fatigue the periodontal ligament. This maneuver is repeated multiple times around the crown–root segment to mobilize the segment and enable extraction using extraction forceps.



▲ **FIGURE 7** Extracted crown–root segments of the teeth of the maxillary arcade. Tooth segments should be checked for intact apices, and complete extraction of the entire tooth should be confirmed on postoperative intraoral radiographs.

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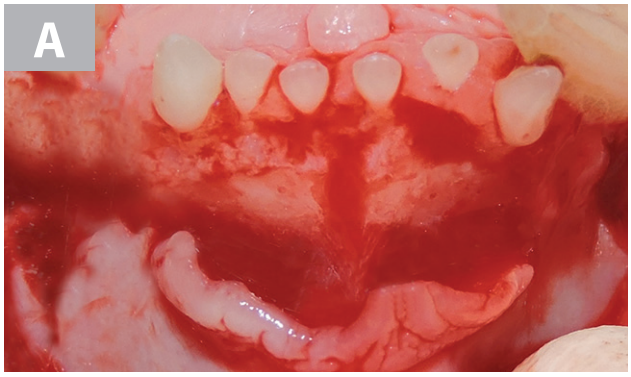
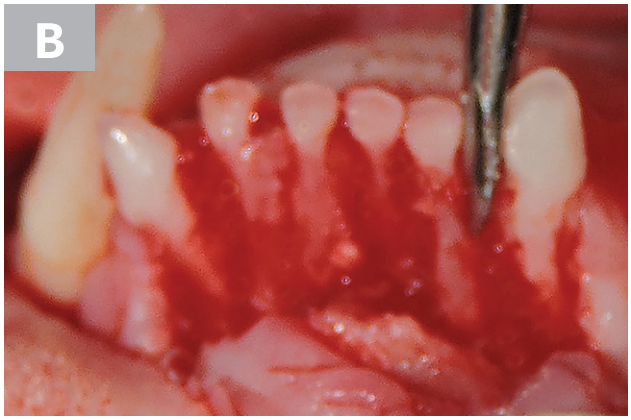
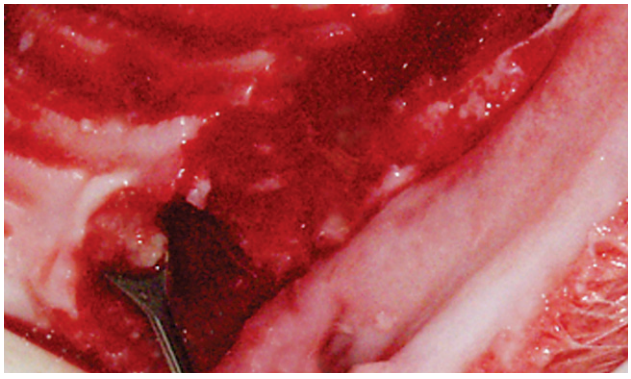
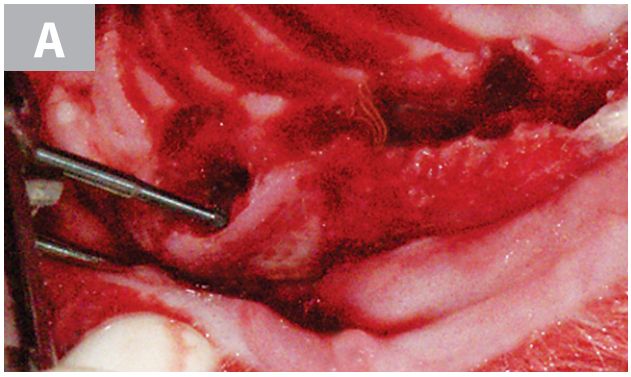


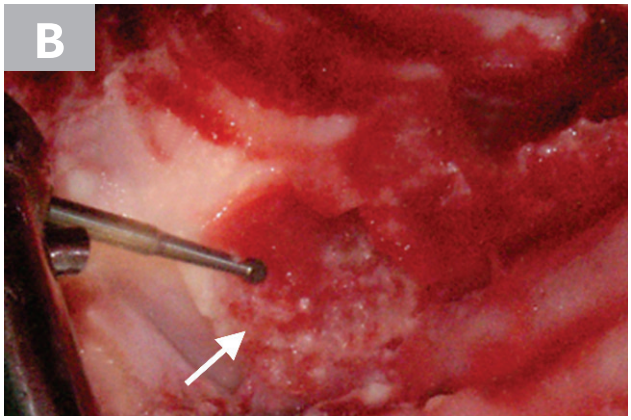


▲ **FIGURE 8** The maxillary incisor teeth are prepared for extraction using the same techniques as described in previous figures. The maxillary rostral quadrant flap release incisions serve as the vertical release incisions for the small mucoperiosteal flap developed for incisor tooth extraction (***A***). The maxillary incisor teeth are extracted using periodontal elevators and extraction forceps (***B***).

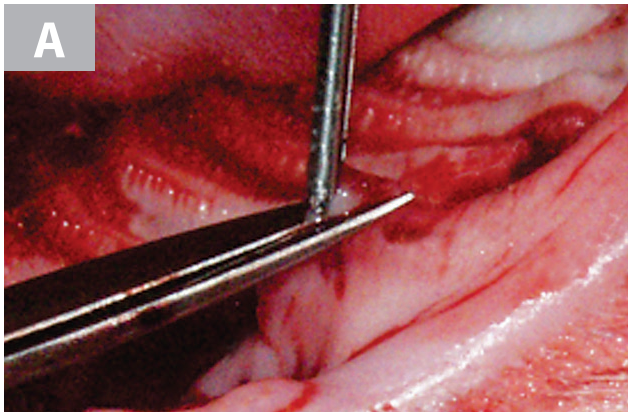


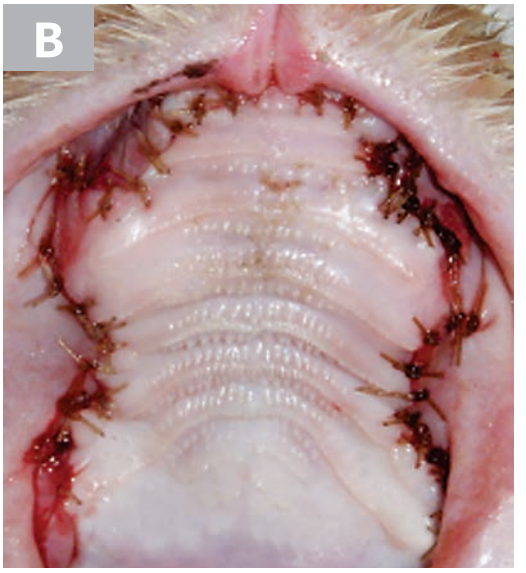
▲ **FIGURE 9** A bone curette is used to debride alveoli of granulation or diseased tissue and other debris associated with the extraction procedure. Dilute chlorhexidine solution is then used to lavage the alveoli.





▲ **FIGURE 10** Osteoplasty is performed with a large round bur to remove and contour rough bone margins secondary to extraction (***A***). It is important to remove proliferative bone (***B***; ***arrow***) associated with osteitis secondary to periodontal disease that is often noted on the buccal aspect of the canine tooth. This maneuver restores anatomic congruity and decreases tension on the apposed mucoperiosteal flap, as there is less surface area for the flap to traverse once it is in its sutured position.





▲ **FIGURE 11** Iris or tenotomy scissors are used to trim gingiva traumatized during extraction (***A***). Maxillary wound closure in a patient undergoing full-mouth extraction is completed via apposition of the mucoperiosteal flaps using absorbable suture in a simple interrupted pattern (***B***).

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The **Nuclear Regulatory Commission (NRC.gov)** recently issued licensing guidelines for **Synovetin OA**, which is administered via intra-articular injection and is intended to reduce synovitis and pain of canine elbow joints as a result of osteoarthritis. Clinical trial data demonstrated Synovetin OA relieves pain and inflammation and improves mobility for up to a year.—*Press Release 12/20*

First Intratumoral Injection to Treat Nonmetastatic Mast Cell Tumors in Dogs

QBiotics (qbiotics.com) has announced approval for **Stelfonta** (tigilanol tiglate injection; **stelfonta.com**), a single-injection veterinary anticancer product for dogs with nonmetastatic, cutaneous mast cell tumors (MCTs). The FDA has also approved the drug for use in nonmetastatic, subcutaneous MCTs in particular areas of the leg. Stelfonta is approved for all grades of canine nonmetastatic MCTs and is a nonsurgical option—injected directly into the MCT (ie, intratumoral injection)—that destroys tumors and stimulates complete tumor-site healing. —*Press Release 11/20*

First-Time Dog Owners Need Veterinary Support

Merck Animal Health (merck-animal-health.com) sponsored an online survey of 1,381 dog owners in the United States. Of the respondents, 73% that adopted their first dog during the pandemic have considered rehoming their pet when the pandemic ends. This is likely because of a lack of pet care knowledge. Twenty-five percent of respondents claimed they are unsure how to properly care for their pet, 58% wished caring for their pet's health was not so time-consuming, and 33% were surprised at the cost of caring for their pet.

Survey results also indicated, however, that 70% of all dog owners are interested in learning new methods to keep their dog (puppy or adult) healthy. This survey aims to help address the concerns of new owners. For more information, visit **bit.ly/merck-survey**—*Press Release 11/20*

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Brief Summary
NADA 141-213, Approved by FDA

Metacam®

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

18490
06/2018

Brief Summary
NADA 141-219, Approved by FDA

Boehringer Ingelheim

Metacam®

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

601307-07
Revised 08/2014

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06/2018

Previcox® (firocoxib)

CHEWABLE TABLETS

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

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

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

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

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

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

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

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

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

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

Adverse Reactions:

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

Adverse Reactions Seen in U. S. Field Studies

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

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

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

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

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

**Sham-dosed (pilled)*

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

Adverse Reactions Seen in the Orthopedic Surgery Postoperative Pain Field Study

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

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

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

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

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

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

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

Hematological: *Anemia, neutrophilia, thrombocytopenia, neutropenia*

Cardiovascular/Respiratory: *Tachypnea, dyspnea, tachycardia*

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

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

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

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

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

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

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QUIZ CORNER

QUIZ YOURSELF

on this issue's features

Quiz Corner is offered by the publisher for entertainment purposes only and does not apply toward CE credit. Questions are provided by editorial staff and are not subject to peer review.

1 **CONSULT THE EXPERT** **PAGE 10**

Predictable and infrequent feline aggression should be treated with which of the following medications?

A. Trazodone
B. Fluoxetine
C. Clomipramine
D. L-theanine

2 **MANAGEMENT TREE** **PAGE 18**

When ingested, _____ should be immediately removed with either induction of emesis or endoscopic/surgical removal.

A. Objects with sharp edges
B. Batteries
C. Tricyclic antidepressants
D. Extended-release medications

3 **TOP 5** **PAGE 21**

An increase in which of the following is a common biochemical abnormality noted in boxers?

A. ALT
B. ALP
C. Creatinine
D. Lipase

4 **PROCEDURES PRO** **PAGE 52**

Which of the following statements regarding hygromas in dogs is *false*?

A. Hygromas are soft, fluid-filled masses.
B. Hygromas form over bony prominences in response to repetitive pressure or blunt trauma.
C. Hygromas typically form in young adult toy- and small-breed dogs.
D. Uncomplicated hygromas are nonpainful.

5 **IMAGE GALLERY** **PAGE 57**

True or false: When elevating the mucoperiosteal flap along the maxillary dental arcade during maxillary quadrant extractions in a cat, the infraorbital neurovascular pedicle might be encountered exiting from the infraorbital foramen.

A. True
B. False

Answer Key:
1: A 2: B 3: D 4: C 5: A

DASUQUIN® ADVANCED

JOINT HEALTH SUPPLEMENT

- #1 joint health brand recommended by veterinarians.*
- Glucosamine and chondroitin sulfate help stimulate cartilage matrix production.
- Patented ASU and ALA combination helps inhibit mediators that break down joint cartilage in dogs.

WELACTIN® advanced 3TA™

OMEGA-3 SUPPLEMENT

- Concentrated fish oil sourced from wild-caught, cold-water fish.
- Contains high levels of EPA & DHA to help support a healthy inflammatory response.

THE #1 VETERINARIAN RECOMMENDED SUPPLEMENT COMPANY*

nutramax® LABORATORIES VETERINARY SCIENCES, INC.

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*Source: Among veterinary brands. Survey conducted among small animal veterinarians who recommended oral joint health supplements. *Source: Survey conducted among small animal veterinarians who recommended animal supplements. 010L1437.01

IMPORTANT SAFETY INFORMATION: METACAM (meloxicam oral suspension) and PREVICOX (firocoxib) Chewable Tablets are for use in dogs only. METACAM (meloxicam) Solution for Injection is approved for use in dogs or cats (not indicated for osteoarthritis in cats). Repeated use of meloxicam in cats has been associated with acute renal failure and death. Do not administer additional injectable or oral meloxicam to cats. As a class, cyclooxygenase inhibitory NSAIDs like METACAM and PREVICOX may be associated with gastrointestinal, kidney, or liver side effects. Dogs should be evaluated for pre-existing conditions and currently prescribed medications prior to treatment with METACAM or PREVICOX, then monitored regularly while on therapy. Concurrent use with another NSAID, corticosteroid, or nephrotoxic medication should be avoided or monitored closely. Please refer to the package insert or product website for complete product information.

Boehringer Ingelheim

See pages 66 & 67 for product information summary.