January/February 2022

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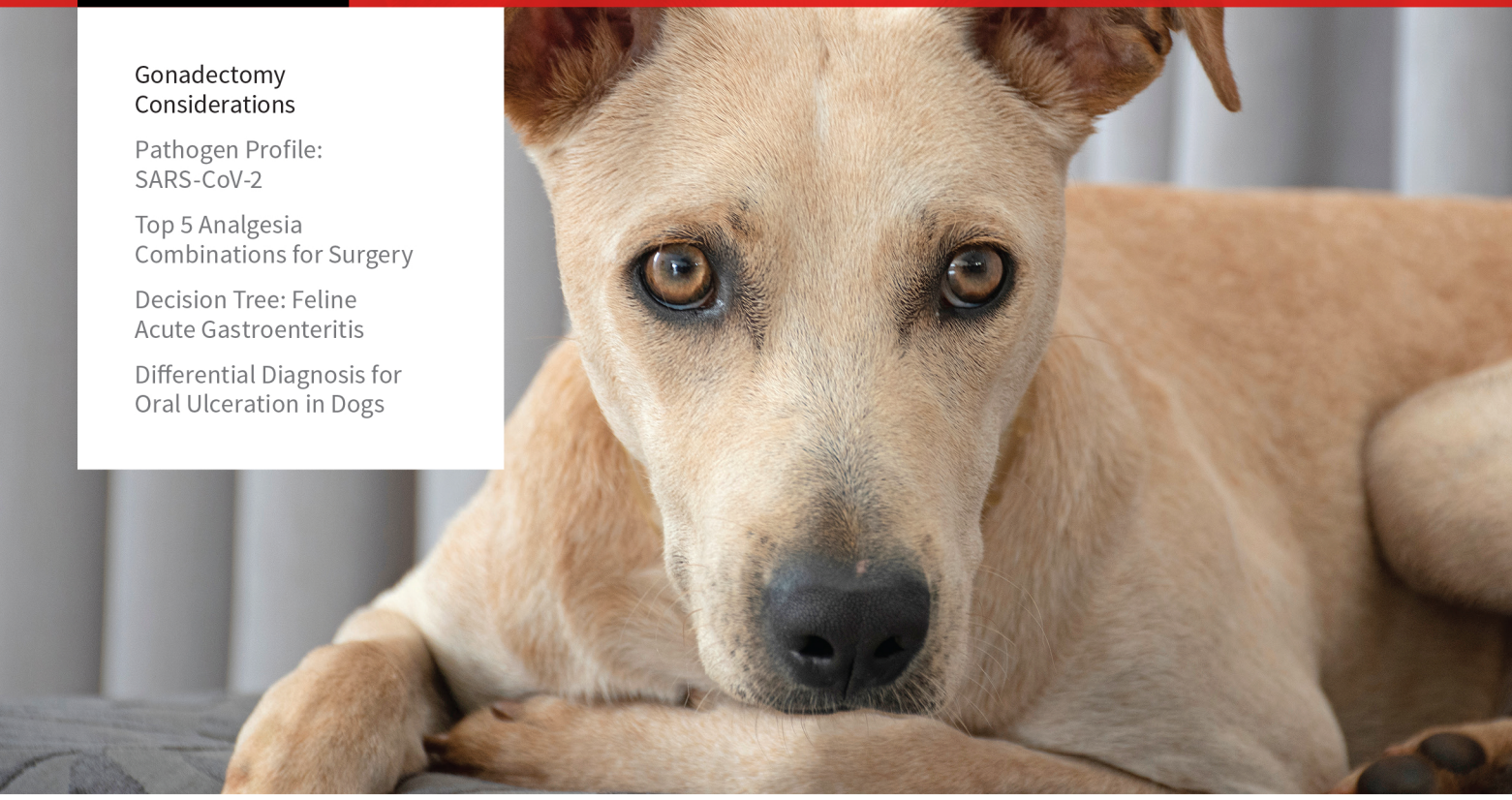
THERAPEUTIC TAIL AMPUTATION: STEP BY STEP

IN THIS ISSUE



Volume 20 Number 1

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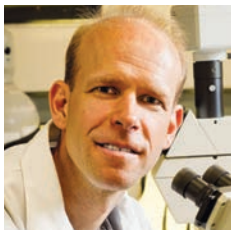

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DIAGNOSTIC/MANAGEMENT TREE PAGE 60

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Twenty years ago, a print journal and fax machine were the best way to connect with the veterinary community; today, daily newsletters, websites, social media, virtual events, podcasts, clinical support tools, and apps flank our trusted print journal as resources used regularly by nearly 200,000 veterinary professionals worldwide.

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Recently, record highs have been achieved in pet ownership, veterinary care expenditures, and capital investment. Clinics struggle with adequate staffing, and the demand for veterinary care exceeds the current supply. Professional burnout has been exacerbated by the emotional toll of a pandemic. Meanwhile, necessary policy changes lag behind the industry's changing needs. As we look to the future, our vision and role have greater purpose than ever before.

The *Clinician's Brief* of the next decade will be one reimagined to meet veterinarians where they stand in today's world, with the primary purpose of caring for veterinary professionals. We will continue to address the most important clinical topics but will also provide thought leadership on topics and challenges surrounding the profession.

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[1]2018 Pet Obesity Study. Association for *Pet Obesity Prevention*.

IN THIS ISSUE

ON THE COVER

PROCEDURES PRO
Therapeutic Tail Amputation
Marije Risselada, DVM, PhD, DECVS, DACVS (SA)

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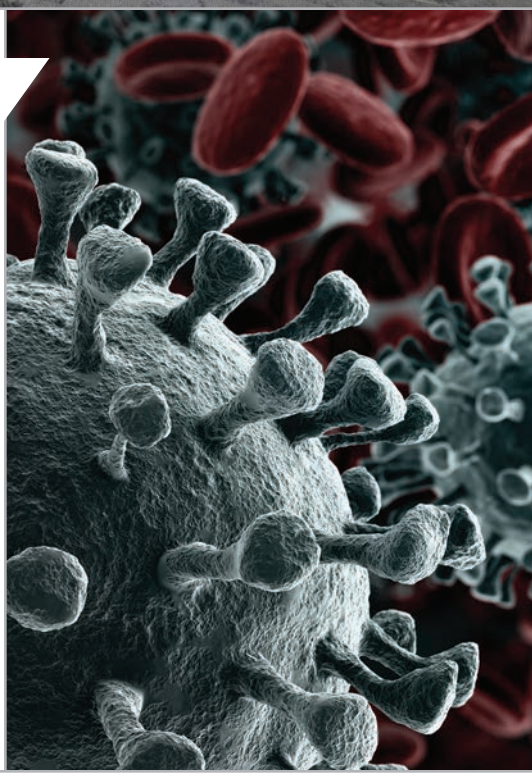
NOTICE OF CORRECTION
In the article, "Alternative Treatment for Heartworm Disease Does Not Replace Gold Standard," published in the November/December 2021 issue of *Clinician's Brief*, the result for Genchi et al, 2019, in the table was listed as "71% efficacy at 8 months (no antigens detected)." The correct result was "93% efficacy at 9 months (no antigen detected)."

Clinician's Brief regrets the error.



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[1]Kirkby Shaw, K, et al. Vet Med Sci. 2016;2:3-9.
[2]Rausch-Derra L, et al. Am J Vet Intern Med. 2015;76(10):853-859.

See page 10 for product information summary.

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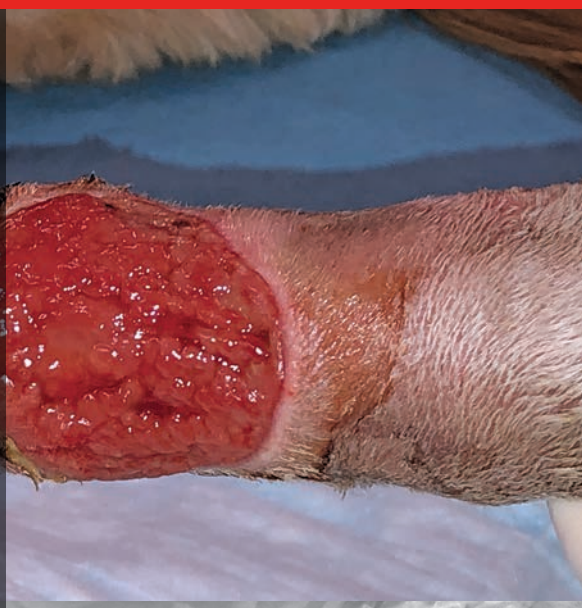

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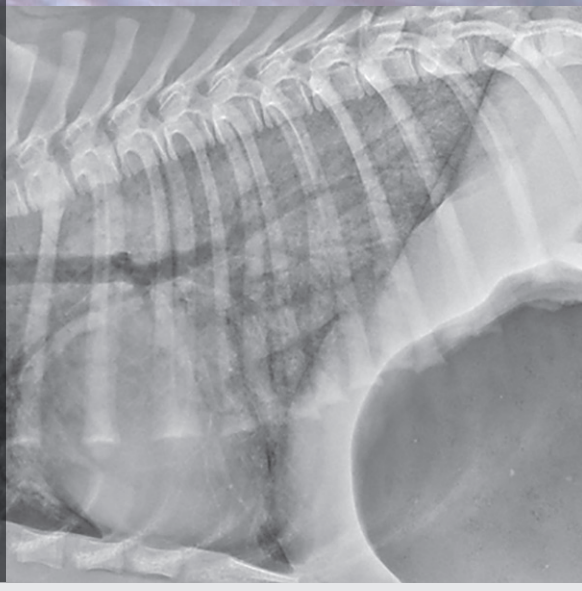

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Indication:
GALLIPRANT (grapiprant tablets) is indicated for the control of pain and inflammation associated with osteoarthritis in dogs.

Dosage and Administration:
Always provide "Information for Dog Owners" Sheet with prescription.
Use the lowest effective dose for the shortest duration consistent with individual response.

The dose of GALLIPRANT (grapiprant tablets) is 0.9 mg/lb (2 mg/kg) once daily.

Only the 20 mg and 60 mg tablets of GALLIPRANT are scored. The dosage should be calculated in half tablet increments. Dogs less than 8 lbs. (3.6 kgs) cannot be accurately dosed.

The 100 mg tablet is not scored and should not be broken in half.

See product insert for complete dosing and administration information.

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

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

Precautions:
The safe use of GALLIPRANT has not been evaluated in dogs younger than 9 months of age and less than 8 lbs (3.6 kg), dogs used for breeding, or in pregnant or lactating dogs.

Adverse reactions in dogs receiving GALLIPRANT may include vomiting, diarrhea, decreased appetite, mucoid, watery or bloody stools, and decreases in serum albumin and total protein.

If GALLIPRANT is used long term appropriate monitoring is recommended.

Concurrent use with other anti-inflammatory drugs has not been studied. Concomitant use of GALLIPRANT with other anti-inflammatory drugs, such as COX-inhibiting NSAIDs or corticosteroids, should be avoided. If additional pain medication is needed after a daily dose of GALLIPRANT, a non-NSAID/ non-corticosteroid class of analgesic may be necessary.

The concomitant use of protein-bound drugs with GALLIPRANT has not been studied. Commonly used protein-bound drugs include cardiac, anticonvulsant and behavioral medications.

Drug compatibility should be monitored in patients requiring adjunctive therapy. Consider appropriate washout times when switching from one anti-inflammatory to another or when switching from corticosteroids or COX-inhibiting NSAIDs to GALLIPRANT use.

The use of GALLIPRANT in dogs with cardiac disease has not been studied.

It is not known whether dogs with a history of hypersensitivity to sulfonamide drugs will exhibit hypersensitivity to GALLIPRANT. GALLIPRANT is a methylbenzenesulfonamide.

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

Table 1. Adverse reactions reported in the field study.

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

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

GALLIPRANT was used safely during the field studies with other concurrent therapies, including antibiotics, parasiticides and vaccinations.

To report suspected adverse drug events and/or to obtain a copy of the Safety Data Sheet (SDS) or for technical assistance, call 1-888-545-5973.

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

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

Effectiveness:
Two hundred and eighty five (285) client-owned dogs were enrolled in the study and evaluated for field safety. GALLIPRANT-treated dogs ranging in age from 2 to 16.75 years and weighing between 4.1 and 59.6 kgs (9 – 131 lbs) with radiographic and clinical signs of osteoarthritis were enrolled in a placebo-controlled, masked field study. Dogs had a 7-day washout from NSAID or other current OA therapy. Two hundred and sixty two (262) of the 285 dogs were included in the effectiveness evaluation. Dogs were assessed for improvements in pain and function by the owners using the Canine Brief Pain Inventory (CBPI) scoring system.[7] A statistically significant difference in the proportion of treatment successes in the GALLIPRANT group (63/131 or 48.1%) was observed compared to the vehicle control group (41/131 or 31.3%). GALLIPRANT demonstrated statistically significant differences in owner assessed pain and function. The results of the field study demonstrate that GALLIPRANT, administered at 2 mg/kg (0.9 mg/pound) once daily for 28 days, was effective for the control of pain and inflammation associated with osteoarthritis.

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SARS-CoV-2

J. Scott Weese, DVM, DVSc, DACVIM, FCAHS
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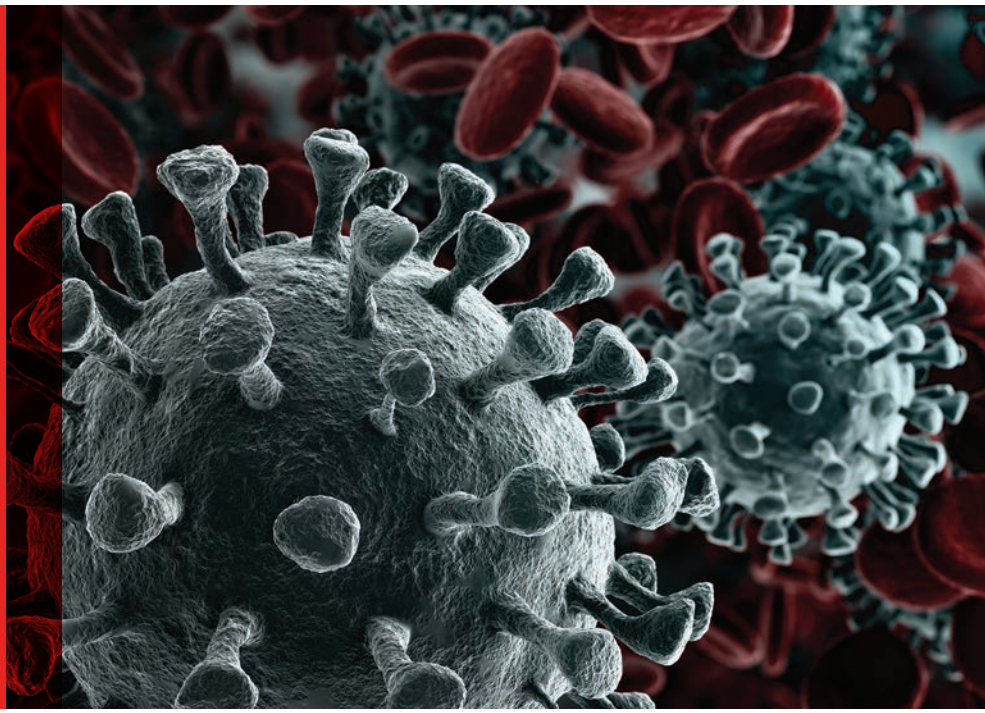

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a *Betacoronavirus* that is further classified into the subgenus *Sarbecovirus* and is distinct from canine and feline coronaviruses. Although canine respiratory coronavirus is also a *Betacoronavirus*, it is in the subgenus *Embecovirus*. Canine enteric coronavirus and FIP coronaviruses are *Alphacoronaviruses*.

Host Range

The origin of SARS-CoV-2 has not been definitively identified but is suspected to be a Chinese horseshoe bat.[1] In late 2019, SARS-CoV-2 infection to and between humans led to a worldwide pandemic with rampant transmission. Widespread human infection led to increased exposure in domestic and exotic animals and experimental infection studies that resulted in the identification of numerous susceptible animal species. Cats, dogs, ferrets, mink, deer, Asian small-clawed otters, certain species of mice, various large cats, skunks, and many nonhuman primates are susceptible to natural infection.[2-10] Additional species, including a range of rodent species[11,12] and New Zealand white rabbits,[13] have been experimentally infected. Cattle and pigs demonstrate poor experimental susceptibility to infection, suggesting that natural infection is likely of limited concern.[14,15] It should, however, be noted that viral mutation can potentially result in expansion in the host range. Care should be taken when stating a species is not susceptible.

Disease in Companion Animals

Cats

Cats are both naturally and experimentally susceptible to SARS-CoV-2,[2,5,6,16,17] and transmission between cats has been identified experimentally.[18,19] Preliminary reports have identified high seroprevalence rates in cats (≥40%) with owners diagnosed with coronavirus disease (COVID-19).[4,6] Infection in cats most often appears subclinical; however, clinical disease has been reported.[20] Mild upper respiratory tract infection is likely the most common clinical presentation, but serious infection, including fatal disease, has been identified.[20] Although

COVID-19 = coronavirus disease
SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2

there are concerns about secondary myocarditis and cardiomyopathy,[21] as occurs in humans, the risk in cats is currently unclear. Mild GI signs (eg, vomiting, diarrhea) may also occur.

Dogs

Dogs may be relatively highly susceptible to infection but appear to rarely develop SARS-CoV-2 disease. Studies of dogs with owners diagnosed with COVID-19 have identified rates (≥15%) of seroconversion that tend to be lower than the rates identified in cats but are still suggestive of relatively common human-to-dog transmission.[4,6] It is debatable whether clinical disease occurs either naturally or in experimental studies as a result of SARS-CoV-2 infection.[22] SARS-CoV-2 in dogs may be a mild, self-limiting upper respiratory tract infection, or patients may be presented with nonspecific signs (eg, lethargy).

Ferrets

It has been predicted that ferrets and mink (another mustelid species) may be highly susceptible to SARS-CoV-2 based on prior susceptibility to the original SARS virus (ie, SARS-CoV-1) and other human respiratory viruses.[9,10] In an experimental environment, ferrets and mink were highly susceptible to SARS-CoV-1,[23,24] and signs of upper (and sometimes lower) respiratory tract disease have been identified in both natural and experimental studies. Limited reports likely reflect limited testing and reporting. Transmission between ferrets has been documented experimentally[25] and in field conditions in mink.[3]

Zoonotic transmission from mink to humans has been identified.[26-28]

COVID-19 = coronavirus disease
SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2

Zoonotic Risks

Although SARS-CoV-2 originated in animals, the COVID-19 pandemic is almost exclusively the result of transmission among humans. Widespread human-to-human transmission makes studying the potential and presumably minor role of zoonotic transmission difficult. Zoonotic transmission from mink to humans has been identified.[26-28] Cat-to-cat transmission has been documented in experimental studies[18,19] and may play a role in cat outbreaks in zoos, which raises concern for potential cat-to-human transmission. Dog-to-dog transmission has not been identified experimentally,[19] and zoonotic risks from infected dogs are probably minimal to negligible.

Although there were early concerns that cats and dogs could act as mechanical vectors (fomites) through haircoat contamination, it is now understood that surfaces (of any type) pose limited risk for transmission. Viable virus has not been found on haircoats of pets that had contact with humans with COVID-19,[29] and the potential risk from contact with a haircoat is likely negligible.

Vaccination of Animals

Two vaccines are currently available for animals: a recombinant spike protein vaccine used in North America in mink and certain exotic animal species (predominantly felids and nonhuman primates) and an inactivated vaccine developed in Russia and labeled for use in various species, including dogs and cats; no published studies exist for this latter vaccine. No licenced vaccines for dogs or cats are available outside of Russia.

There is currently little to no indication that domestic dogs and cats should be vaccinated, given the mild nature of the disease, limited zoonotic risk from animals (especially when extensive human-to-human transmission is ongoing), and limited information about efficacy or safety. Cost and/or benefit decisions more clearly support vaccinating nonhuman primates and certain large cats because of their susceptibility and potential for severe disease, as well as for conservation.

It may be more relevant to vaccinate pets if more serious disease is encountered or if evidence of reasonable risk for zoonotic transmission and reduction in viral shedding in vaccinated animals emerges. This is most likely related to emergence of a new variant with greater ability to cause severe disease.

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*Preprint articles have not been peer reviewed.

References continue on page 83.

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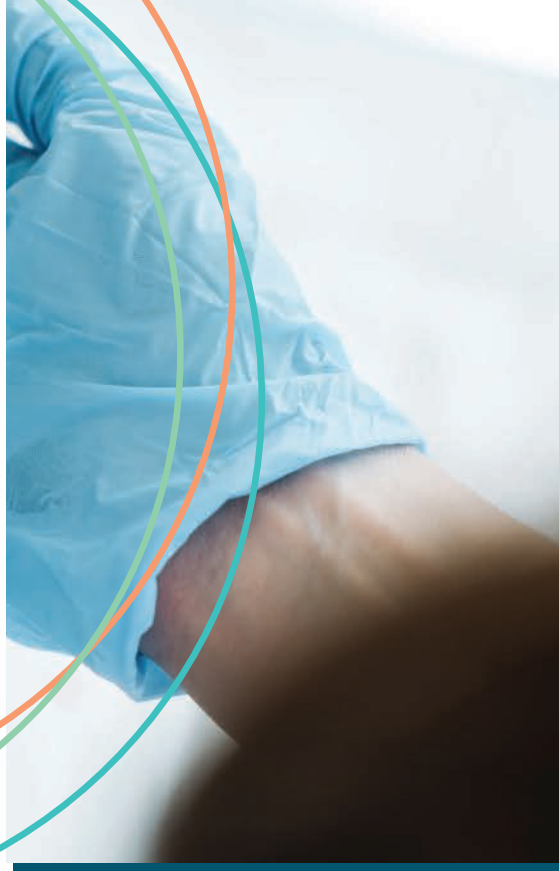

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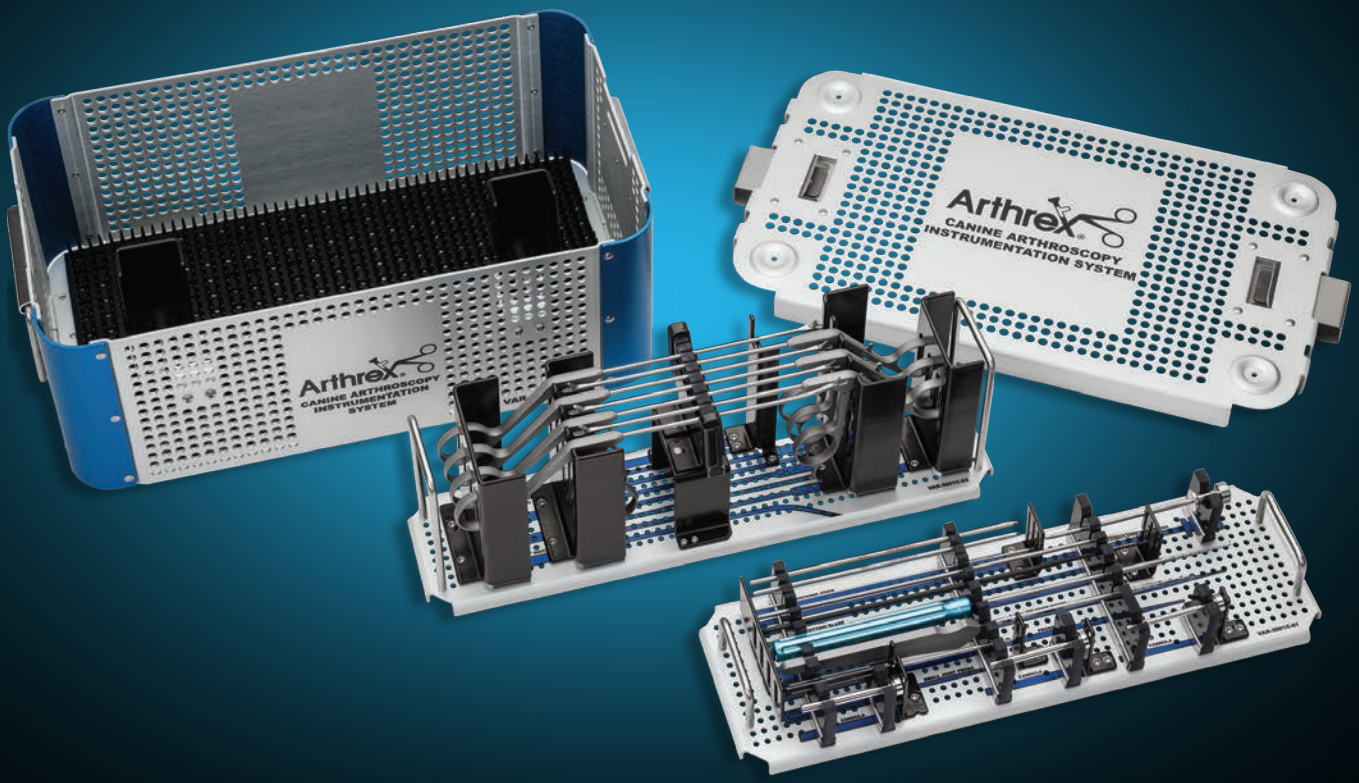

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Top 5 Analgesia Combinations for Common Surgical Procedures

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Pain management is important in surgical procedures and should be considered when developing a perianesthetic plan. Common procedures that can be painful in dogs and cats include ovariohysterectomy, neuter, dental extractions, and other basic soft tissue or orthopedic surgeries. Analgesia should be provided before, during, and after painful procedures. Patients undergoing procedures not anticipated to be painful still require sedation (eg, with an opioid) to reduce induction and inhalant requirements. If a procedure becomes painful, transition to another analgesia plan is recommended; for example, if an unexpected tooth extraction is required during routine dental cleaning, local blocks should be added for pain control.

Single-drug analgesia protocols can be effective in common surgeries, but a combination of analgesics can be more effective with a multimodal approach that targets multiple sites in the pain pathway.[1,2] There are many multimodal drug combinations designed to prevent and treat operative and postoperative pain, including opioids, NSAIDs, ketamine, alpha-2 agonists (eg, dexmedetomidine), local anesthetic agents, and oral agents not in previously mentioned drug classes.

TOP 5 ANALGESIA COMBINATIONS FOR COMMON SURGICAL PROCEDURES

1. Opioid & NSAID
2. Local Anesthesia & NSAID or Other Injectable Analgesia
3. Opioid & Alpha-2 Agonist
4. Intraoperative Analgesia Infusion
5. Oral Analgesia Combination

Following are the author's 5 most frequently used and effective combinations of analgesics for common surgeries based on current trends and availability.

1 Opioid & NSAID

Use of an injectable opioid and injectable NSAID is common for perioperative analgesia and pain management.[3] Pure mu-opioid receptor agonists (eg, morphine, hydromorphone, methadone, fentanyl) act on mu receptors at the spinal and supraspinal level and are highly effective analgesics. Pure mu agonists can manage moderate to severe pain and provide a moderate level of sedation.[4] Butorphanol (a mixed agonist/antagonist) and buprenorphine (a partial agonist) also act at spinal and supraspinal levels; however, they are generally preferred for mildly painful procedures.[1] Butorphanol is also used for its reasonable sedative effects, commonly in conjunction with dexmedetomidine or acepromazine.

NSAIDs (eg, carprofen, meloxicam, robenacoxib) are also commonly used and effectively contribute to analgesia in acute painful situations (eg, surgery).[5-7] The primary mechanism of action is inhibition of COX enzyme activity and subsequent reduction in prostaglandin synthesis that reduces inflammation. Other non-COX–mediated anti-inflammatory and analgesic activities (eg, activity at the 5-lipoxygenase pathway, activities impacting other proinflammatory enzyme pathways) have been proposed to contribute to the overall effectiveness of NSAID pain management.[6]

Opioids and NSAIDs are effective analgesics when used alone but generally provide better pain management when coadministered. A recent study demonstrated inadequate early postoperative analgesia when dogs received only opioid premedication prior to surgery.[8]

Protocols that use a pure mu agonist (eg, methadone) can be applied to other soft tissue surgeries, basic orthopedic procedures, and longer procedures. Top-up doses of opioids can be administered midsurgery when the procedure is longer than the duration of the premedication agent. For example, premedication with hydromorphone (0.1 mg/kg IM or IV) can be supplemented intraoperatively with another dose (0.05 mg/kg IV) if the procedure lasts >2 hours. NSAID administration can be preoperative or intraoperative, but waiting until the patient has returned to normal physiologic status postoperatively can help avoid potential negative impacts on renal function during anesthesia-induced hypotension.

Opioid & NSAID Sample Protocols

Dogs and cats undergoing ovariohysterectomy can benefit from opioid and NSAID protocols. Dogs can be given preoperative hydromorphone (0.05-0.1 mg/kg IM or IV) or methadone (0.1-0.25 mg/kg IM or IV), postoperative meloxicam (0.2 mg/kg SC), and at-home meloxicam (0.1 mg/kg PO every 24 hours) after the initial SC dose.

Cats can be given preoperative butorphanol (0.3-0.4 mg/kg IM, ideally followed by buprenorphine, 0.01-0.02 mg/kg IV, during or after surgery due to the mild impact of butorphanol on pain) or methadone (0.1-0.25 mg/kg IM or IV). Postoperatively, they can receive robenacoxib (2 mg/kg SC) and at-home robenacoxib (1 mg/kg PO every 24 hours for 3 days) after the initial SC dose.

2 Local Anesthesia & NSAID or Other Injectable Analgesia

Local anesthetic agents (eg, lidocaine, bupivacaine, ropivacaine) are particularly effective at providing pre-emptive analgesia because they block conduction of sensory nerve impulses via inhibition of voltage-gated sodium channels in neurons, causing complete blockade of nociceptive input from the surgical site. Local anesthesia can effectively reduce general anesthetic requirements during surgery.[1]

Combination of a local or regional block with injectable analgesics (eg, opioids, NSAIDs) can provide a complete perianesthetic pain management plan (see ***When to Use Local Anesthesia***).

When using local anesthetics, it is important to calculate the total dose to avoid exceeding maximum recommended doses and to prevent toxicosis. In cats and dogs, the maximum dose of bupivacaine 0.5% is 2 mg/kg, and the maximum dose of lidocaine 2% is 8 mg/kg. Although the reported toxic dose of topical lidocaine 2% is up to 10 mg/kg in cats, there is some variability in the literature; the maximum dose ranges from 6 to 8 mg/kg.

Local Anesthesia & NSAID or Other Injectable Analgesia Sample Protocols

Ovariohysterectomy or Exploratory Laparotomy

Dogs can be given preoperative hydromorphone (0.05-0.1 mg/kg IM or IV) or methadone (0.1-0.25 mg/kg IM or IV), as well as a preoperative incisional infiltration (ie, line block; lidocaine 2%, 4-8 mg/kg, or bupivacaine 0.5%, 1-2 mg/kg). After the procedure, meloxicam (0.2 mg/kg SC) can be administered.

Cats can be given preoperative butorphanol (0.3-0.4 mg/kg IM; ideally followed by buprenorphine, 0.01-0.02 mg/kg IV, during or after surgery due to the mild impact of butorphanol on pain) or methadone (0.1-0.25 mg/kg IM or IV). A preoperative incisional infiltration (ie, line block; lidocaine 2%, 2-4 mg/kg, or bupivacaine 0.5%, 1-2 mg/kg) can also be administered. Postoperatively, patients can be given robenacoxib (2 mg/kg SC).

Ovariohysterectomy

Before surgery, dogs can be given hydromorphone (0.05-0.1 mg/kg IM or IV) or methadone (0.1-0.25 mg/kg IM or IV). Perioperatively, an intraperitoneal splash block on the ovarian pedicle and uterine stump (lidocaine 2%, 6-8 mg/kg, or bupivacaine 0.5%, 2 mg/kg; doses divided among sites) can be administered.[13] Postoperatively, meloxicam (0.2 mg/kg SC) can be administered.

Cats can be given preoperative butorphanol (0.3-0.4 mg/kg IM; ideally followed by buprenorphine, 0.01-0.02 mg/kg IV, during or after surgery due to the mild impact of butorphanol on pain) or methadone (0.1-0.25 mg/kg IM or IV), followed by a perioperative intraperitoneal splash block on the ovarian pedicle and uterine stump (lidocaine 2%, 2-4 mg/kg, or bupivacaine 0.5%, 1-2 mg/kg; doses divided among sites).[13] Robenacoxib (2 mg/kg SC) can be administered postoperatively.

For an intraperitoneal splash block, lidocaine 2% (2-4 mg/kg) or bupivacaine 0.5% (1-2 mg/kg) should be diluted to a total volume of 0.4 to 0.6 mL/kg. Addition of an incisional line block can improve the pre-emptive quality of analgesia. Total lidocaine 2% should not exceed 6 to 8 mg/kg, and total bupivacaine 0.5% should not exceed 2 mg/kg.

Neuter

Dogs can be given preoperative butorphanol (0.2-0.4 mg/kg IM or IV), dexmedetomidine (1-3 µg/kg IV or 3-10 µg/kg IM), local anesthetic (lidocaine 2% or bupivacaine 0.5%, 0.25-0.5 mL) injected into the center of the testicle with the tip of the needle pointed at the spermatic cord,[14,15] and a line block (lidocaine 2%, 2-4 mg/kg, or bupivacaine 0.5%, 1 mg/kg) along the incision site.

WHEN TO USE LOCAL ANESTHESIA

When General Anesthesia Is Not Required for a Painful Procedure (eg, Simple Laceration Repair) and a Local Anesthetic Is Reasonable

- Sedation with oral medication or acepromazine ± butorphanol or dexmedetomidine ± butorphanol, depending on level of sedation required
- Once the patient is adequately sedated, a local anesthetic can be administered.

When Analgesia Is Needed for a Painful Procedure During General Anesthesia

- If a local or regional block is possible:
  - –Premedication: single-dose opioid (pure or partial mu agonist)
  - –Recovery and at home: NSAID
- If a local or regional block is not possible:
  - –Premedication: single-dose opioid; consideration for additional opioid dose or analgesic CRI for longer procedures
  - –Recovery and at home: NSAID

Before the procedure, cats can be given butorphanol (0.3-0.4 mg/kg IM; ideally followed by buprenorphine, 0.01-0.02 mg/kg IV, during or after surgery due to the mild impact of butorphanol on pain) or methadone (0.1-0.25 mg/kg IM or IV), as well as local anesthetic (lidocaine 2% or bupivacaine 0.5%, 0.25 mL) injected into the center of the testicle with the tip of the needle pointed at the spermatic cord.[14,15]

3 Opioid & Alpha-2 Agonist

Administration of an opioid with an alpha-2 agonist for analgesia and sedation is common in short procedures and patients in which heavier sedation is indicated. Alpha-2 agonists (eg, medetomidine, dexmedetomidine) are commonly used to produce profound sedation; they also provide effective analgesia, presumably via modulation of nociceptive signals at the level of the spinal cord. Alpha-2 agonists have high dosage requirements and adverse effects that prevent their use as sole analgesic agents; however, their analgesic effectiveness is enhanced when combined with an opioid.[9]

Dexmedetomidine as part of an analgesia plan can range from 0.5 to 10 µg/kg IM or IV based on the level of sedation needed and patient status. Lower doses (0.5-5 µg/kg) are administered IV, and higher doses (5-10 µg/kg) are administered IM. The optimal approach is generally to maximize the opioid dose and adjust the alpha-2 agonist dose to fit the patient and level of sedation needed due to the lesser impact of opioids on cardiopulmonary function. Although alpha-2 agonists provide analgesia when used alone, they are not sufficient for most procedures, and an opioid should be included to maximize analgesic benefits.

Opioid & Alpha-2 Agonist Sample Protocols

It is important to note that alpha-2 agonist doses are in µg/kg, not mg/kg.

OTM = oral transmucosal

Neuter in a Dog

Preoperatively, local anesthetic (lidocaine 2%, 0.25-0.5 mL) can be injected into the center of the testicle with the tip of the needle pointed at the spermatic cord,[14,15] a line block (lidocaine 2%, 2-4 mg/kg, or bupivacaine 0.5%, 1-2 mg/kg) can be administered along the incision site, and butorphanol (0.2-0.4 mg/kg IM or IV) and dexmedetomidine (1-3 µg/kg IV or 3-10 µg/kg IM) can be administered. After the procedure, meloxicam (0.2 mg/kg SC) can be given.

Ovariohysterectomy in a Cat

A preoperative incisional infiltration (ie, line block; lidocaine 2%, 2-4 mg/kg, or bupivacaine 0.5%, 1-2 mg/kg) or perioperative intraperitoneal splash block on the ovarian pedicle and uterine stump[13] (lidocaine 2%, 2-4 mg/kg, or bupivacaine 0.5%, 1-2 mg/kg) can be administered, along with preoperative methadone (0.25 mg/kg IM or IV) and dexmedetomidine (3-5 µg/kg IV or 5-10 µg/kg IM). Postoperatively, robenacoxib (2 mg/kg SC) can be administered.

Laceration Repair or Other Small Incisional Procedure

For dogs and cats, a preoperative local infiltration of lidocaine 2% can be administered; it may be divided among multiple sites but should not exceed a total of 6 to 8 mg/kg in dogs and 6 mg/kg in cats. Preoperative butorphanol (0.4 mg/kg IV or IM for dogs or cats) and dexmedetomidine (3-5 µg/kg IV or 5-10 µg/kg IM for dogs or cats) can also be administered.

4 Intraoperative Analgesia Infusion

Intraoperative infusion of opioids or nonopioid analgesics as a single bolus or CRI can be a useful adjunct for common surgical procedures. For example, a patient responding excessively to traction on the ovarian pedicle during ovariohysterectomy will not have a rapid response to increased inhalant anesthetic gas. Although the simplest choice may appear to be administration of an additional dose of the premedication opioid, a small dose of ketamine

(0.5-1 mg/kg IV) can provide additional analgesia and slightly deepen anesthesia without negatively impacting blood pressure or ventilation.

Ketamine is an *N*-methyl-D-aspartate receptor antagonist that is mildly analgesic at subanesthetic doses and can work synergistically with opioids to improve analgesia during acute pain scenarios (eg, surgery). Ketamine can also be administered as a perioperative infusion alone or in combination with an opioid infusion (eg, fentanyl CRI). Lidocaine IV also has analgesic properties and can reduce inhalant requirements in dogs during surgery but is not recommended in cats.[10] Most common surgical procedures are often not long enough to warrant CRI of these drugs.

Intraoperative Analgesia Infusion Sample Protocols

When traction is placed on the ovarian pedicle or uterus during ovariohysterectomy, a single bolus of ketamine (0.5-1 mg/kg IV) can be administered and repeated every 20 to 30 minutes if a CRI cannot be performed.

If a patient is responding to surgical stimulation and increasing the inhalant is contraindicated due to hypotension, a single bolus of half the premedication dose of a pure mu agonist (eg, methadone, hydromorphone) can be administered.

To reduce inhalant requirements in fragile patients (ie, those sensitive to the negative cardiovascular effects of inhaled anesthetic agents) during longer procedures (eg, orthopedic), fentanyl (2-5 µg/kg IV) and/or ketamine (1-2 mg/kg IV) can be used preoperatively. Fentanyl (5-20 µg/kg/hour CRI) or ketamine (0.5-1 mg/kg/hour CRI) can be administered for maintenance.

5 Oral Analgesia Combination

Oral analgesia combinations are generally part of a postoperative analgesia plan, but they can also be used preoperatively in patients with painful pre-existing conditions.

Potential interactions with perianesthetic analgesics should be considered. For example, buprenorphine oral transmucosal (OTM) likely reduces the initial effectiveness of pure mu agonists that are unable to bind to the receptor occupied by buprenorphine during the 6 hours following buprenorphine administration.

NSAIDs are anti-inflammatory and analgesic, but they are best used as part of multimodal analgesia with other classes of agents (eg, opioids) or other approaches (eg, local and regional anesthesia). NSAIDs are thus not optimal to manage most surgical pain alone.

Buprenorphine (cats, 0.01-0.04 mg/kg OTM; typically started at 0.02 mg/kg) is particularly useful in cats as an adjunct analgesic that can improve postoperative pain management. This drug is also effective in dogs, but the analgesic dose (up to 0.12 mg/kg OTM) can be cost prohibitive in large dogs.[11] One cost-effective option is extra-label use of more concentrated buprenorphine (1.8 mg/mL); this article refers to the buprenorphine 0.3 mg/mL product.

Gabapentin (5-20 mg/kg PO every 8 hours) is an adjunct perioperative oral analgesic agent that can also be used as outpatient treatment in dogs and cats. The mechanism of analgesic action is not well understood but is thought to be via binding voltage-gated calcium channels.[12] Several studies have examined perioperative use of gabapentin for analgesia in dogs and cats, but none have demonstrated evidence of significant analgesia.[12] There is some evidence that gabapentin may improve analgesia when used as an adjunct with NSAIDs or opioids in small animals.[12]

Conclusion

The analgesic combinations described in this article are not mutually exclusive. Procedure type, invasiveness, and duration; pre-existing conditions; anticipated perianesthetic complications; and best practices for anesthesia management

should be considered. Opioids, NSAIDs, alpha-2 agonists, other analgesic infusions, and other oral drug combinations should be selected to achieve optimal perianesthetic pain management, and local anesthesia should be part of multimodal analgesia when possible.

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YOU READ THE ARTICLE. NOW GET CREDIT FOR IT.

Which of the following statements regarding local anesthetics is *false*?

A. Local anesthetics do not affect general anesthetic requirements.

B. Local anesthetics effectively provide pre-emptive analgesia.

C. Local anesthetics inhibit voltage-gated sodium channels in neurons.

D. Combining local anesthesia with injectable analgesia can provide complete perianesthetic pain management.

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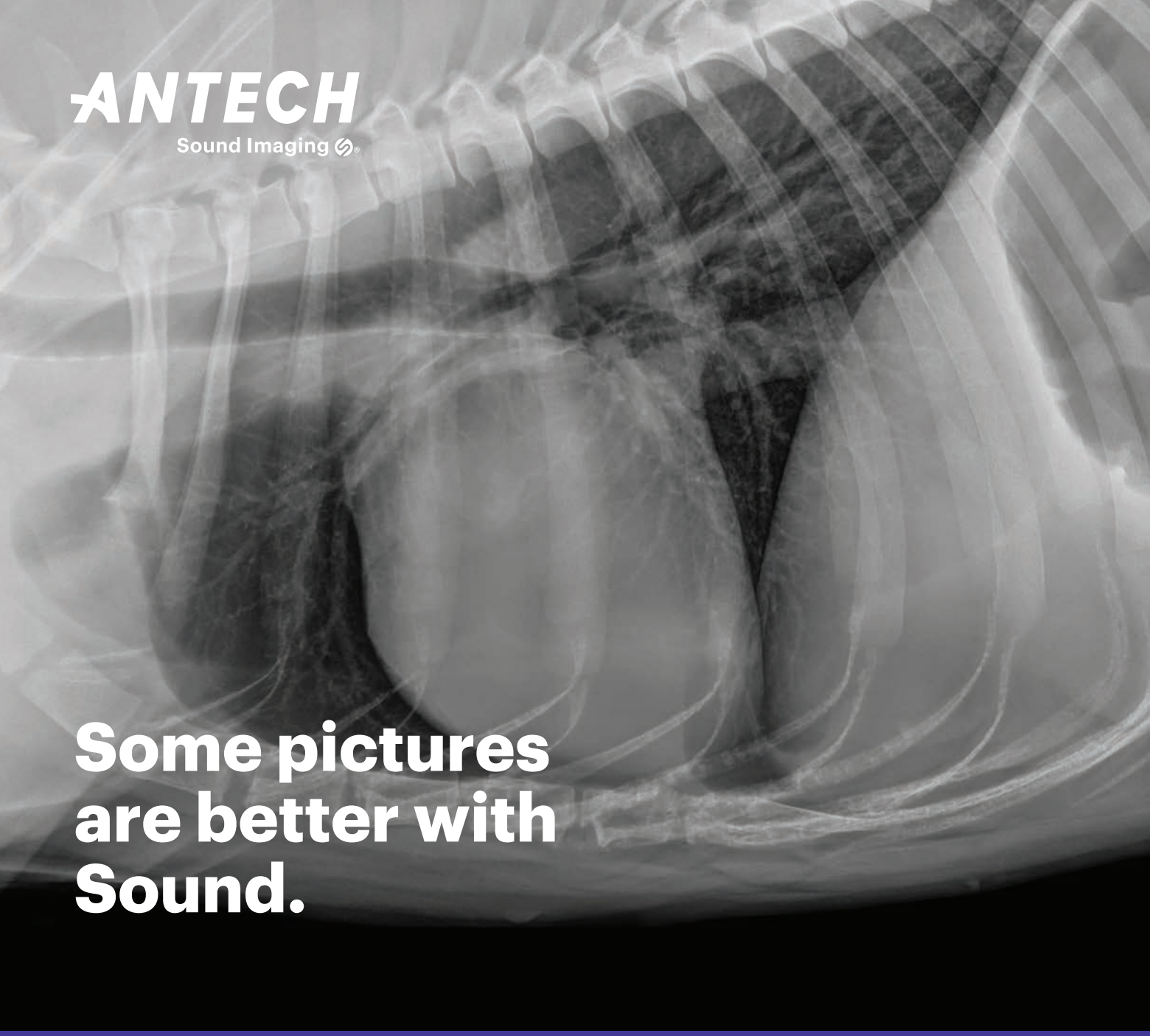

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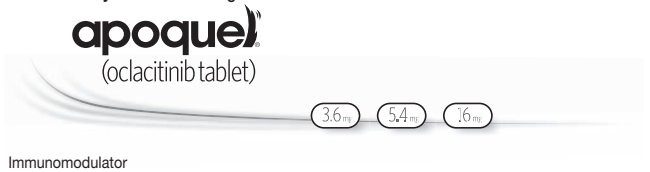

Immunomodulator

For oral use in dogs only

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

Indications: Control of pruritus associated with allergic dermatitis and control of atopic dermatitis in dogs at least 12 months of age.

Dosage and Administration: The dose of APOQUEL (oclacitinib maleate) tablets is 0.18 to 0.27 mg oclacitinib/lb (0.4 to 0.6 mg oclacitinib/kg) body weight, administered orally, twice daily for up to 14 days, and then administered once daily for maintenance therapy. APOQUEL may be administered with or without food.

Dosing Chart

Weight Range (in lb)		Weight Range (in Kg)		Number of Tablets to be Administered		
Low	High	Low	High	3.6 mg Tablets	5.4 mg Tablets	16 mg Tablets
6.6	9.9	3.0	4.4	**0.5**	-	-
10.0	14.9	4.5	5.9	-	**0.5**	-
15.0	19.9	6.0	8.9	**1**	-	-
20.0	29.9	9.0	13.4	-	**1**	-
30.0	44.9	13.5	19.9	-	-	**0.5**
45.0	59.9	20.0	26.9	-	**2**	-
60.0	89.9	27.0	39.9	-	-	**1**
90.0	129.9	40.0	54.9	-	-	**1.5**
130.0	175.9	55.0	80.0	-	-	**2**

Warnings:
APOQUEL is not for use in dogs less than 12 months of age (see **Animal Safety**).

APOQUEL modulates the immune system.

APOQUEL is not for use in dogs with serious infections.

APOQUEL may increase susceptibility to infection, including demodicosis, and exacerbation of neoplastic conditions (see **Precautions, Adverse Reactions, Post-Approval Experience and Animal Safety**).

New neoplastic conditions (benign and malignant) were observed in dogs treated with APOQUEL during clinical studies and have been reported in the post-approval period (see **Adverse Reactions and Post-Approval Experience**).

Consider the risks and benefits of treatment prior to initiating APOQUEL in dogs with a history of recurrent serious infections or recurrent demodicosis or neoplasia (see **Adverse Reactions, Post-Approval Experience**, and **Animal Safety**).

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

Human Warnings:
This product is not for human use. Keep this and all drugs out of reach of children. For use in dogs only. Wash hands immediately after handling the tablets. In case of accidental eye contact, flush immediately with water or saline for at least 15 minutes and then seek medical attention. In case of accidental ingestion, seek medical attention immediately.

Precautions:
Dogs receiving APOQUEL should be monitored for the development of infections, including demodicosis, and neoplasia.

The use of APOQUEL has not been evaluated in combination with glucocorticoids, cyclosporine, or other systemic immunosuppressive agents.

APOQUEL is not for use in breeding dogs, or pregnant or lactating bitches.

Adverse Reactions:
Control of Atopic Dermatitis
In a masked field study to assess the effectiveness and safety of oclacitinib for the control of atopic dermatitis in dogs, 152 dogs treated with APOQUEL and 147 dogs treated with placebo (vehicle control) were evaluated for safety. The majority of dogs in the placebo group withdrew from the 112-day study by Day 16. Adverse reactions reported (and percent of dogs affected) during Days 0-16 included diarrhea (4.6% APOQUEL, 3.4% placebo), vomiting (3.9% APOQUEL, 4.1% placebo), anorexia (2.6% APOQUEL, 0% placebo), new cutaneous or subcutaneous lump (2.6% APOQUEL, 2.7% placebo), and lethargy (2.0% APOQUEL, 1.4% placebo). In most cases, diarrhea, vomiting, anorexia, and lethargy spontaneously resolved with continued dosing. Dogs on APOQUEL had decreased leukocytes (neutrophil, eosinophil, and monocyte counts) and serum globulin, and increased cholesterol and lipase compared to the placebo group but group means remained within the normal range. Mean lymphocyte counts were transiently increased at Day 14 in the APOQUEL group.

Dogs that withdrew from the masked field study could enter an unmasked study where all dogs received APOQUEL. Between the masked and unmasked study, 283 dogs received at least one dose of APOQUEL. Of these 283 dogs, two dogs were withdrawn from study due to suspected treatment-related adverse reactions: one dog that had an intense flare-up of dermatitis and severe secondary pyoderma after 19 days of APOQUEL administration, and one dog that developed generalized demodicosis after 28 days of APOQUEL administration. Two other dogs on APOQUEL were withdrawn from study due to suspected or confirmed malignant neoplasia and subsequently euthanized, including one dog that developed signs associated with a heart base mass after 21 days of APOQUEL administration, and one dog that developed a Grade III mast cell tumor after 60 days of APOQUEL administration.

One of the 147 dogs in the placebo group developed a Grade I mast cell tumor and was withdrawn from the masked study. Additional dogs receiving APOQUEL were hospitalized for diagnosis and treatment of pneumonia (one dog), transient bloody vomiting and stool (one dog), and cystitis with urolithiasis (one dog).

In the 283 dogs that received APOQUEL, the following additional clinical signs were reported after beginning APOQUEL (percentage of dogs with at least one report of the clinical sign as a non-pre-existing finding): pyoderma (12.0%), non-specified dermal lumps (12.0%), otitis (9.9%), vomiting (9.2%), diarrhea (6.0%), histiocytoma (3.9%), cystitis (3.5%), anorexia (3.2%), lethargy (2.8%), yeast skin infections (2.5%), pododermatitis (2.5%), lipoma (2.1%), polydipsia (1.4%), lymphadenopathy (1.1%), nausea (1.1%), increased appetite (1.1%), aggression (1.1%), and weight loss (0.7).

Control of Pruritus Associated with Allergic Dermatitis
In a masked field study to assess the effectiveness and safety of oclacitinib for the control of pruritus associated with allergic dermatitis in dogs, 216 dogs treated with APOQUEL and 220 dogs treated with placebo (vehicle control) were evaluated for safety. During the 30-day study, there were no fatalities and no adverse reactions requiring hospital care. Adverse reactions reported (and percent of dogs affected) during Days 0-7 included diarrhea (2.3% APOQUEL, 0.9% placebo), vomiting (2.3% APOQUEL, 1.8% placebo), lethargy (1.8% APOQUEL, 1.4% placebo), anorexia (1.4% APOQUEL, 0% placebo), and polydipsia (1.4% APOQUEL, 0% placebo). In most of these cases, signs spontaneously resolved with continued dosing. Five APOQUEL group dogs were withdrawn from study because of: darkening areas of skin and fur (1 dog); diarrhea (1 dog); fever, lethargy and cystitis (1 dog); an inflamed footpad and vomiting (1 dog); and diarrhea, vomiting, and lethargy (1 dog). Dogs in the APOQUEL group had a slight decrease in mean white blood cell counts (neutrophil, eosinophil, and monocyte counts) that remained within the normal reference range. Mean lymphocyte count for dogs in the APOQUEL group increased at Day 7, but returned to pretreatment levels by study end without a break in APOQUEL administration. Serum cholesterol increased in 25% of APOQUEL group dogs, but mean cholesterol remained within the reference range.

Continuation Field Study
After completing APOQUEL field studies, 239 dogs enrolled in an unmasked (no placebo control), continuation therapy study receiving APOQUEL for an unrestricted period of time. Mean time on this study was 372 days (range 1 to 610 days). Of these 239 dogs, one dog developed demodicosis following 273 days of APOQUEL administration. One dog developed dermal pigmented viral plaques following 266 days of APOQUEL administration. One dog developed a moderately severe bronchopneumonia after 272 days of APOQUEL administration; this infection resolved with antimicrobial treatment and temporary discontinuation of APOQUEL. One dog was euthanized after developing abdominal ascites and pleural effusion of unknown etiology after 450 days of APOQUEL administration. Six dogs were euthanized because of suspected malignant neoplasms: including thoracic metastatic, abdominal metastatic, splenic, frontal sinus, and intracranial neoplasms, and transitional cell carcinoma after 17, 120, 175, 49, 141, and 286 days of APOQUEL administration, respectively. Two dogs each developed a Grade II mast cell tumor after 52 and 91 days of APOQUEL administration, respectively. One dog developed low grade B-cell lymphoma after 392 days of APOQUEL administration. Two dogs each developed an apocrine gland adenocarcinoma (one dermal, one anal sac) after approximately 210 and 320 days of APOQUEL administration, respectively. One dog developed a low grade oral spindle cell sarcoma after 320 days of APOQUEL administration.

Post-Approval Experience (2020):
The following adverse events are based on post-approval adverse drug experience reporting for APOQUEL. 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 in dogs are listed in decreasing order of reporting frequency.

Vomiting, lethargy, anorexia, diarrhea, elevated liver enzymes, dermatitis (i.e. crusts, pododermatitis, pyoderma), seizures, polydipsia, and demodicosis.

Benign, malignant, and unclassified neoplasms, dermal masses (including papillomas and histiocytomas), lymphoma and other cancers have been reported.

Death (including euthanasia) has been reported.

Contact Information:
To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet, contact Zoetis Inc. at 1-888-963-8471 or www.zoetis.com.

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

Storage Conditions:
APOQUEL should be stored at controlled room temperature between 20° to 25°C (68° to 77°F) with excursions between 15° to 40°C (59° to 104°F).

How Supplied:
APOQUEL tablets contain 3.6 mg, 5.4 mg, or 16 mg of oclacitinib as oclacitinib maleate per tablet. Each strength tablets are packaged in 100 and 250 count bottles. Each tablet is scored and marked with AQ and either an S, M, or L that correspond to the different tablet strengths on both sides.

Approved by FDA under NADA # 141-345

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Reference: 1. Data on file, Unique Patient Count from Launch, 2021, Zoetis Inc.

See page 24 for product information summary.

Gonadectomy in Dogs: Considerations & Review

Karen Tobias, DVM, MS, DACVS
University of Tennessee

Gonadectomy is the most frequently performed elective veterinary surgery (estimated prevalence of >60% in dogs and cats) in the United States[1] and is commonly recommended for population control, reduction of hormonally driven behaviors, disease treatment or prevention, and pet owner convenience.[1-4]

In the United States, canine gonadectomy has traditionally been performed at ≈4 to 6 months of age, after puppies complete their vaccine series. From a technical perspective, surgery at this age or younger is easy, fast, and safe because of small patient size, lack of body fat, and rapid recovery; however, recent studies suggest gonadectomy before skeletal maturity can have adverse effects, particularly in certain dog breeds.[2,4]

More owners and clinicians are thus reconsidering their opinions on timing of gonadectomy and whether it should be performed. There are no randomized, controlled, lifetime studies to provide unequivocal evidence on appropriate timing of gonadectomies[3]; therefore, the decision as to when and if a patient should be neutered should be based on the individual patient, owner, and available data.

Hormone-Associated Conditions Treated or Prevented by Gonadectomy

Conditions preventable or treatable by gonadectomy include testicular, ovarian, and uterine cancers; pyometra; prostatic hyperplasia; and endometrial polyps.[5,6] Gonadectomy also improves the chance for successful treatment of hormonally induced conditions (eg, prostatic abscesses and cysts,[7] vaginal prolapse and hyperplasia,[8] perianal adenomas[9]). Ovariectomy may contribute to control of diabetes mellitus[10] and regression of vaginal leiomyoma.[11]

Ovariectomy & Risk for Mammary Neoplasia

Gonadectomy before sexual maturity reportedly reduces the overall risk for mammary tumor development[12-14]; however, a systematic review found moderate to high risk for bias in published canine studies.[14]

The most quoted—and misquoted—study regarding mammary tumors and gonadectomy reported that dogs spayed before the first or second estrous cycle had 0.5% or 8%, respectively, of the risk of intact, multiestrous dogs, and that dogs spayed after 2 or more estrous cycles had a 26% relative risk.[13] This information can be misinterpreted by assuming the actual rates of mammary cancer are 0.5%, 8%, and 26% of female dogs, depending on the timing of ovary removal; however, these numbers represent relative risk as compared with intact dogs. Application of these statistics therefore requires knowledge of mammary tumor incidence in intact females. For example, one study reported an annual incidence of 250 cases per 100,000 dogs, 73.4% of which were intact.[15] Based on this study, the average annual incidence for intact females would therefore be 184 out of 100,000 (0.18%) dogs. Using the relative risk percentages from the study,[13] the estimated annual incidence per 100,000 dogs spayed before their first, second, or third estrous cycle would be 1 (0.001%), 15 (0.015%), and 48 (0.048%), respectively, in that population.

Risk for Mammary Tumor Development

In patients in which risk for mammary cancer is the underlying reason prepubertal gonadectomy is recommended, breed predisposition to the disease should be considered. According to a Swedish insurance study of >260,000 female dogs, mammary tumors were most often reported in Leonbergers, Doberman pinschers, Bernese mountain dogs, Welsh terriers, English springer spaniels, American cocker spaniels, and boxers.[16] For each of these breeds, the estimated likelihood of developing mammary tumors over a lifetime was ≥35%; conversely, estimated likelihood was ≤5% for basenjis, collies, Finnish Lapphunds, Lancashire heelers, Norwegian Buhunds, Norwich terriers, Pomeranians, pugs, and Siberian huskies.[16]

In another study of >7,000 female dogs in the United States, no mammary cancers were reported in intact or gonadectomized Bernese mountain dogs, boxers, miniature schnauzers, pugs, Saint Bernards, Shetland sheepdogs, or West Highland white terriers, but a high incidence was reported in American cocker spaniels and English springer spaniels.[4] Based on these studies, owners of cocker spaniels and English springer spaniels may be counseled to consider ovariectomy before the first or second estrous cycle; however, mammary cancer may not play a decision-making role for owners of West Highland white terriers or Shetland sheepdogs. The discrepancy regarding Bernese mountain dogs could reflect differences in regional genetics or follow-up: the study of Swedish dogs[16] followed patients to 10 years of age, whereas in the US-based study,[4] mean age at follow-up was <6 years.

Ovariectomy for Pyometra Prevention

As with mammary tumors, timing of, or even need for, gonadectomy for pyometra prevention may depend on the breed of the patient.[16,17] Pyometra usually occurs in dogs >4 years of age and is therefore preventable with ovariectomy by this age in most breeds; however, Dogues de Bordeaux may be presented at a younger age (mean, 3.3 years).[16,17] Overall, ≈19% of intact females develop pyometra by 10 years of age, but the proportional hazard is ≥50% in Bernese mountain dogs, Bouvier des Flandres, bull terriers, Irish wolfhounds, keeshonds, Leonbergers, Newfoundlands, rottweilers, and Staffordshire bull terriers.[16] Owners of high-risk breeds who believe there is no right time for gonadectomy may need to be counseled on the signs and complications of pyometra to aid in decision-making.

Increased Risk for Joint Disease

For some dog breeds, particularly large breeds, gonadectomy increases the risk for joint disorders by 2 to 5 times that of intact dogs.[4,17-20] For example, in golden retrievers, joint disease was diagnosed in 27% of males neutered before 6 months

of age and in 5% of males left intact.[4,19] Rates of joint disease in male and female German shepherd dogs gonadectomized at <1 year of age were 21% and 16%, respectively, compared with 7% and 5% in dogs left intact.[20]

Not all large breeds are affected equally. Neutering before 6 to 12 months of age was associated with significant increases in joint disorders in male Bernese mountain dogs, Labrador retrievers, rottweilers, and female Saint Bernards but not in collies, Doberman pinschers, Great Danes, or Irish wolfhounds.[4]

Effects of gonadectomy on the risk for joint disease can also be related to sex. For example, neutering before one year of age increased the risk for joint disease in male cocker spaniels, miniature poodles, and beagles but not in females of those same breeds.[4]

Increased Risk for Urinary Incontinence

Although urinary incontinence does not directly cause death, it may result in euthanasia because of quality-of-life issues for owners. Urinary incontinence is most often reported in spayed, large-breed dogs and is rare in intact dams.[18,21-26]

A systematic review found that most canine urinary incontinence and timing of gonadectomy studies had a moderate to high number of errors that biased the conclusions; however, weak evidence indicated that ovariectomy, particularly before 3 months of age, increased the risk for incontinence.[23] In a more recent study, most cases of urinary incontinence occurred in dogs spayed at <1 year of age, with some breeds at significantly greater risk.[4] For example, urinary incontinence was diagnosed in 25% of Doberman pinschers spayed before 6 months of age and in 19% of those spayed between 1 and 2 years of age.[4]

Other breeds with high rates of urinary incontinence after spaying included English springer spaniels, German shepherd dogs, rottweilers, Shetland sheepdogs, and West Highland white terriers.[4] Predisposed breeds may benefit from longer hormone exposure with intact ovaries.

Urinary incontinence is most often reported in spayed, large-breed dogs and is rare in intact dams.[18,21-26]

Possible Increased Risk for Nonreproductive Cancer

Other than tumors of the reproductive tract, it is difficult to determine whether gonadectomy increases the risk for cancer, as gonadectomized dogs often live longer, which increases the risk for cancer.[3,18] Some studies indicate that the effects of gonadectomy on nonreproductive cancer risks are breed- or gender-specific. For example, gonadectomized vizslas developed mast cell tumors at an earlier age than intact vizslas, and gonadectomized female golden retrievers were at increased risk, whereas males were not.[4,19,27]

Complications & Cost of Convenience & Delayed Surgeries

Some owners consider elective gonadectomy unacceptable or deforming; however, gonad-sparing surgeries to permanently prevent reproductive capabilities or adverse effects of estrus may still be requested. These convenience surgeries can have positive and negative effects. For example, male dogs can be vasectomized to prevent delivery of sperm during copulation. Although vasectomy is a simple surgery with few complications,[28,29] vasectomized dogs continue to have effects of testosterone, including libido-driven behaviors and prostatic hyperplasia.[3]

Ovary-sparing hysterectomy requires removal of the entire uterine horns and uterine body.[28] Resection of the cervix is also recommended because glandular endometrial tissue can extend into the cervix, which could result in vaginal discharge, endometritis, or stump pyometra.[30] Hysterectomy requires a longer incision than ovariohysterectomy because of the need for complete cervical resection, careful dissection to spare the urethra, and complete removal of the uterine horn tips. Ovary-sparing hysterectomy has no published long-term follow-up, but dams could suffer life-threatening conditions (eg, vaginal rupture, sperm peritonitis) if allowed to mate.[28] Vulvar and behavioral signs of estrus and attraction to males should be expected, and vaginal discharge could occur if glandular tissue remains.

Delaying neutering increases anesthetic costs because of increased patient size. Ovariohysterectomy in adult dogs is more expensive and more difficult than in puppies, and complication rates are higher with larger patients and longer surgeries.[31]

Counseling Is Required

Owners of dogs left intact may need counseling for managing libido-driven behaviors of males and isolating females during estrus. Owners may opt to place belly bands (ie, washable wraps that catch urine) on male dogs that mark indoors or diapers on female dogs that have vaginal discharge. Female dogs should not be taken to the park during receptive periods, nor should they be left alone in yards with low or electronic fences. Intact dogs should be leash- and crate-trained to provide extra control. Gonadectomized dogs have an increased risk for obesity and, therefore, need to be fed and exercised appropriately to prevent weight gain.[3]

In My Opinion …

Dogs should be allowed to reach musculoskeletal maturity (ie, be fully grown, with a fully functional urethral sphincter) before being neutered. Breed type and temperament should also be considered.

Rottweilers provide an excellent case study for using research to determine timing of gonadectomy. In one longevity study, rate of mammary cancer in rottweilers was 7.9%, with a median age of 8.5 years at the time of diagnosis and a 37% case fatality; the rate of pyometra was 6.6%, with a median age of 5.4 years and case fatality of 7%.[32] These results indicate that prepubertal or adolescent ovariectomy could improve outcome; however, ovary exposure >4.2 years was associated with a lifespan 17 months longer than for dogs with shorter ovary exposure.[32] Life expectancy for females that developed mammary cancer was similar to the overall population. Bone sarcoma and lymphoma, however, had significant negative effects on life expectancy.[32]

Rottweilers have a 12.6% risk for bone sarcoma, and dogs that undergo gonadectomy before 1 year of age have an incidence rate of >25% compared with rates of 7.6% to 10.5% if left intact or gonadectomized after 3.5 to 5 years of age.[33] Because bone sarcoma has a mortality rate >90%, leaving a rottweiler intact for at least 4 years is worth the risk for mammary tumors. This also may decrease the risk for urinary incontinence. The rate of urinary incontinence was 1% in intact female rottweilers and 4% and 6% for those spayed at <6 months and 6 to 11 months, respectively.[4] Research may not always be the deciding factor. In the author's opinion, if a dog becomes aggressive during estrous cycles and attacks humans or other animals, the ovaries should be removed immediately and without hesitation.

Continues ▶

Delaying neutering increases anesthetic costs because of increased patient size.

Conclusion

Multiple factors, including breed and age of the dog and inclinations and needs of the owner, should be considered when determining whether to perform gonadectomy, as well as the appropriate timing. Whether a dog is neutered or left intact, owners should be informed of common breed and sex conditions, and the dog should be examined for those conditions on subsequent physical examinations.

There is no single or definitive source of information on effects of gonadectomy for each breed, and most current articles have some bias. Current evidence should be evaluated and the positives and negatives should be considered for each patient and owner before a recommendation is made.

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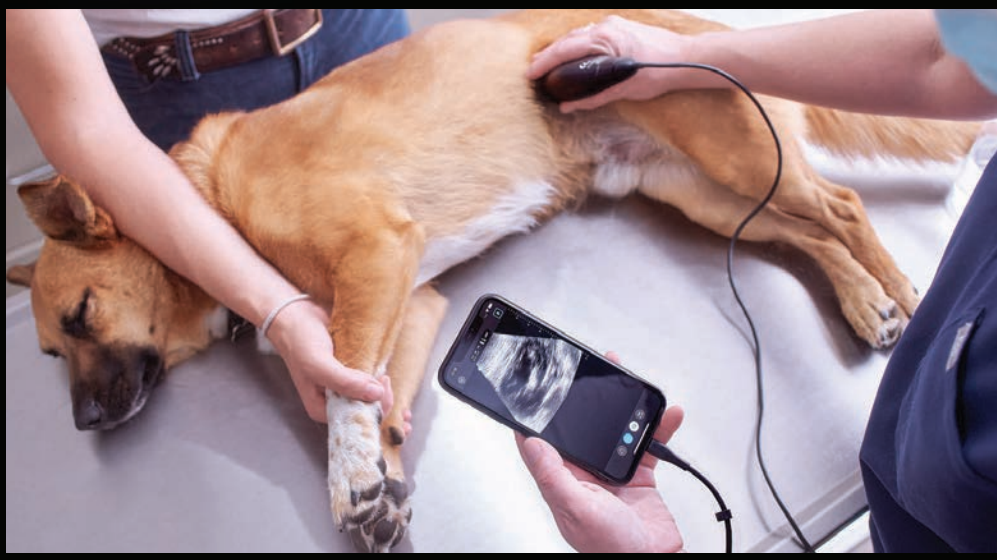

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85%
considered it very easy
to somewhat easy to give two chewables per month.[1]

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Interceptor Plus Indications

Interceptor Plus is indicated for the prevention of heartworm disease caused by *Dirofilaria immitis* and for the treatment and control of adult roundworm (*Toxocara canis*, *Toxascaris leonina*), adult hookworm (*Ancylostoma caninum*), adult whipworm (*Trichuris vulpis*), and adult tapeworm (*Taenia pisiformis*, *Echinococcus multilocularis*, *Echinococcus granulosus* and *Dipylidium caninum*) infections in dogs and puppies 6 weeks of age or older and 2 pounds of body weight or greater.

Interceptor Plus Important Safety Information

Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention. Prior to administration of Interceptor Plus, dogs should be tested for existing heartworm infections. The safety of Interceptor Plus has not been evaluated in dogs used for breeding or in lactating females. The following adverse reactions have been reported in dogs after administration of milbemycin oxime or praziquantel: vomiting, diarrhea, depression/lethargy, ataxia, anorexia, convulsions, weakness, and salivation. For full prescribing information see Interceptor Plus package insert.

Credelio Indications

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

Credelio Important Safety Information

Lotilaner 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 this class of drugs, even in dogs without a history of seizures. Use with caution in dogs with a history of seizures or neurologic disorders. The safe use of Credelio in breeding, pregnant or lactating dogs has not been evaluated. The most frequently reported adverse reactions are weight loss, elevated blood urea nitrogen, polyuria, and diarrhea. For full prescribing information see Credelio package insert.

[1]Elanco Animal Health. Data on file.

*Simparica Trio protects against heartworm disease, roundworm and hookworm (*A. caninum*, *U. stenocephala*).

See pages 34 & 35 for product information summary.

Elanco

Credelio
(lotilaner)

Chewable Tablets

For oral use in dogs

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

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

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

Dosage and Administration:
CREDELIO is given orally once a month, at the minimum dosage of 9 mg/lb (20 mg/kg).

Dosage Schedule:

Body Weight	Lotilaner Per Chewable Tablet (mg)	Chewable Tablets Administered
4.4 to 6.0 lbs	56.25	One
6.1 to 12.0 lbs	112.5	One
12.1 to 25.0 lbs	225	One
25.1 to 50.0 lbs	450	One
50.1 to 100.0 lbs	900	One
Over 100.0 lbs	Administer the appropriate combination of chewable tablets	

CREDELIO must be administered with food (see **Clinical Pharmacology**). Treatment with CREDELIO can begin at any time of the year and can continue year-round without interruption.

See product insert for complete dosing and administration information.

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

Warnings:
Not for human use. Keep this and all drugs out of the reach of children. Keep CREDELIO in a secure location out of reach of dogs, cats, and other animals to prevent accidental ingestion or overdose.

Precautions:
Lotilaner 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.
The safe use of CREDELIO in breeding, pregnant or lactating dogs has not been evaluated.

Adverse Reactions:
In a well-controlled U.S. field study, which included 284 dogs (198 dogs treated with CREDELIO and 86 dogs treated with an oral active control), there were no serious adverse reactions.

Over the 90-day study period, all observations of potential adverse reactions were recorded. Reactions that occurred at an incidence of 1% or greater are presented in the following table.

Dogs with Adverse Reactions in the Field Study

Adverse Reaction (AR)	CREDELIO Group: Number (and Percent) of Dogs with the AR (n=198)	Active Control Group: Number (and Percent) of Dogs with the AR (n=86)
Weight Loss	3 (1.5%)	2 (2.3%)
Elevated Blood Urea Nitrogen (BUN)	2 (1.0%)*	0 (0.0%)
Polyuria	2 (1.0%)*	0 (0.0%)
Diarrhea	2 (1.0%)	2 (2.3%)

*Two geriatric dogs developed mildly elevated BUN (34 to 54 mg/dL; reference range: 6 to 31 mg/dL) during the study. One of these dogs also developed polyuria and a mildly elevated potassium (6.5 mEq/L; reference range: 3.6 to 5.5 mEq/L) and phosphorous (6.4 mg/dL; reference range: 2.5 to 6.0 mg/dL). The other dog also developed a mildly elevated creatinine (1.7 to 2.0 mg/dL; reference range: 0.5 to 1.6 mg/dL) and weight loss.

In addition, one dog experienced intermittent head tremors within 1.5 hours of administration of vaccines, an ear cleaning performed by the owner, and its first dose of CREDELIO. The head tremors resolved within 24 hours without treatment. The owner elected to withdraw the dog from the study.

In an Australian field study, one dog with a history of seizures experienced seizure activity (tremors and glazed eyes) six days after receiving CREDELIO. The dog recovered without treatment and completed the study. In the U.S. field study, two dogs with a history of seizures received CREDELIO and experienced no seizures throughout the study.

In three well-controlled European field studies and one U.S. laboratory study, seven dogs experienced episodes of vomiting and four dogs experienced episodes of diarrhea between 6 hours and 3 days after receiving CREDELIO.

To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Elanco US Inc. at 1-888-545-5973. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or http://www.fda.gov/reportanimalae.

Effectiveness:
In well-controlled European laboratory studies, CREDELIO began to kill fleas four hours after administration or infestation, with greater than 99% of fleas killed within eight hours after administration or infestation for 35 days. In a well-controlled U.S. laboratory study, CREDELIO demonstrated 100% effectiveness against adult fleas 12 hours after administration or infestation for 35 days.

In a 90-day well-controlled U.S. field study conducted in households with existing flea infestations of varying severity, the effectiveness of CREDELIO against fleas on Days 30, 60 and 90 compared to baseline was 99.5%,100% and 100%, respectively. Dogs with signs of flea allergy dermatitis showed improvement in erythema, papules, scaling, alopecia, dermatitis/pyodermatitis and pruritus as a direct result of eliminating fleas.

In a well-controlled laboratory study, CREDELIO killed fleas before they could lay eggs, thus preventing subsequent flea infestations for 30 days after the start of treatment of existing flea infestations.

In well-controlled laboratory studies, CREDELIO demonstrated > 97% effectiveness against *Amblyomma americanum, Dermacentor variabilis, Ixodes scapularis* and *Rhipicephalus sanguineus* ticks 48 hours after administration or infestation for 30 days. In a well-controlled European laboratory study, CREDELIO started killing *Ixodes ricinus* ticks within four hours after administration.

Storage Information:
Store at 15-25°C (59 -77°F), excursions permitted between 5 to 40°C (41 to 104°F).

How Supplied:
CREDELIO is available in five chewable tablet sizes for use in dogs: 56.25, 112.5, 225, 450, and 900 mg lotilaner.
Each chewable tablet size is available in color-coded packages of 1, 3 or 6 chewable tablets.

Approved by FDA under NADA # 141-494

Manufactured for:
Elanco US Inc
Greenfield, IN 46140 USA
Credelio.com

Rev. date 05/2020

INTERCEPTOR™ PLUS

(milbemycin oxime/praziquantel)

Caution

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

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

Indications

INTERCEPTOR PLUS is indicated for the prevention of heartworm disease caused by *Dirofilaria immitis*; and for the treatment and control of adult roundworm (*Toxocara canis, Toxascaris leonina*), adult hookworm (*Ancylostoma caninum*), adult whipworm (*Trichuris vulpis*), and adult tapeworm (*Taenia pisiformis, Echinococcus multilocularis, Echinococcus granulosus, and Dipylidium caninum*) infections in dogs and puppies two pounds of body weight or greater and six weeks of age and older.

Dosage and Administration

INTERCEPTOR PLUS should be administered orally, once every month, at the minimum dosage of 0.23 mg/lb (0.5 mg/kg) milbemycin oxime, and 2.28 mg/lb (5 mg/kg) praziquantel. For heartworm prevention, give once monthly for at least 6 months after exposure to mosquitoes (see **EFFECTIVENESS**).

Dosage Schedule

Body Weight	Milbemycin Oxime per chewable	Praziquantel per chewable	Number of chewables
2 to 8 lbs.	2.3 mg	22.8 mg	One
8.1 to 25 lbs.	5.75 mg	57 mg	One
25.1 to 50 lbs.	11.5 mg	114 mg	One
50.1 to 100 lbs.	23 mg	228 mg	One
Over 100 lbs.	Administer the appropriate combination of chewables.		

INTERCEPTOR PLUS may be offered to the dog by hand or added to a small amount of dog food. The chewables should be administered in a manner that encourages the dog to chew, rather than to swallow without chewing. Chewables may be broken into pieces and fed to dogs that normally swallow treats whole. Care should be taken that the dog consumes the complete dose, and treated animals should be observed for a few minutes after administration to ensure that no part of the dose is lost or rejected. If it is suspected that any of the dose has been lost, redosing is recommended.

Heartworm Prevention:

INTERCEPTOR PLUS should be administered at monthly intervals beginning within 1 month of the dog's first seasonal exposure to mosquitoes and continuing until at least 6 months after the dog's last seasonal exposure (see **EFFECTIVENESS**). INTERCEPTOR PLUS may be administered year-round without interruption.

When switching from another heartworm preventative product to INTERCEPTOR PLUS, the first dose of INTERCEPTOR PLUS should be given within a month of the last dose of the former product.

Intestinal Nematode and Cestode Treatment and Control:

Dogs may be exposed to and can become infected with roundworms, whipworms, hookworms, and tapeworms throughout the year, regardless of season or climate. Clients should be advised of appropriate measures to prevent reinfection of their dog with intestinal parasites. Because the prepatent period for *E. multilocularis* may be as short as 26 days, dogs treated at the labeled monthly intervals may become reinfected and shed eggs between treatments.

See product insert for complete dosing and administration information.

Contraindications

There are no known contraindications to the use of INTERCEPTOR PLUS.

Warnings

Not for use in humans. Keep this and all drugs out of the reach of children.

Precautions

Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention (see **EFFECTIVENESS**).

Prior to administration of INTERCEPTOR PLUS, dogs should be tested for existing heartworm infections. At the discretion of the veterinarian, infected dogs should be treated to remove adult heartworms. INTERCEPTOR PLUS is not effective against adult *D. immitis*.

Mild, transient hypersensitivity reactions, such as labored breathing, vomiting, hypersalivation, and lethargy, have been noted in some dogs treated with milbemycin oxime carrying a high number of circulating microfilariae. These reactions are presumably caused by release of protein from dead or dying microfilariae.

Do not use in puppies less than six weeks of age.

Do not use in dogs or puppies less than two pounds of body weight.

The safety of INTERCEPTOR PLUS has not been evaluated in dogs used for breeding or in lactating females. Studies have been performed with milbemycin oxime alone (see **ANIMAL SAFETY**).

Adverse Reactions

The following adverse reactions have been reported in dogs after administration of milbemycin oxime or praziquantel: vomiting, diarrhea, depression/lethargy, ataxia, anorexia, convulsions, weakness, and salivation.

To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Elanco US, Inc. at 1-888-545-5973. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or http://www.fda.gov/reportanimalae.

Effectiveness

Heartworm Prevention:

In a well-controlled laboratory study, INTERCEPTOR PLUS was 100% effective against induced heartworm infections when administered once monthly for 6 consecutive months. In well-controlled laboratory studies, neither one dose nor two consecutive doses of INTERCEPTOR PLUS provided 100% effectiveness against induced heartworm infections.

Intestinal Nematodes and Cestodes Treatment and Control:

Elimination of the adult stage of hookworm (*Ancylostoma caninum*), roundworm (*Toxocara canis, Toxascaris leonina*), whipworm (*Trichuris vulpis*) and tapeworm (*Echinococcus multilocularis, Echinococcus granulosus, Taenia pisiformis and Dipylidium caninum*) infections in dogs was demonstrated in well-controlled laboratory studies.

Palatability

In a field study of 115 dogs offered INTERCEPTOR PLUS, 108 dogs (94.0%) accepted the product when offered from the hand as if a treat, 1 dog (0.9%) accepted it from the bowl with food, 2 dogs (1.7%) accepted it when it was placed in the dog's mouth, and 4 dogs (3.5%) refused it.

Animal Safety

INTERCEPTOR PLUS:

Safety studies in pregnant dogs demonstrated that doses of 0.6X the maximum exposure dose of INTERCEPTOR PLUS, (1.5 mg/kg of milbemycin oxime), administered daily from mating through weaning, resulted in measurable concentrations of milbemycin oxime in milk. Puppies nursing these females demonstrated milbemycin oxime-related effects (depression, decreased activity, diarrhea, dehydration, nasal discharge). A subsequent study, which evaluated the daily administration of 0.6X the maximum exposure dose of INTERCEPTOR PLUS, from mating until one week before weaning, demonstrated no effects on the pregnant females or their litters. A study, in which pregnant females were dosed once, at 0.6X the maximum exposure dose of INTERCEPTOR PLUS before, on the day of, or shortly after whelping, resulted in no effects on the puppies.

Some nursing puppies, at 2, 4, and 6 weeks of age, administered oral doses of 9.6 mg/kg milbemycin oxime (3.8X the maximum exposure dose of INTERCEPTOR PLUS) exhibited tremors, vocalization, and ataxia. These effects were all transient and puppies returned to normal within 24 to 48 hours. No effects were observed in puppies administered 0.5 mg/kg milbemycin oxime (minimum label dose).

Storage Information

Store at room temperature, between 59° and 77°F (15-25°C).

How Supplied

INTERCEPTOR PLUS is available in four strengths, formulated according to the weight of the dog. Each strength is available in color-coded packages of six or twelve chewable tablets each. The tablets containing 2.3 mg milbemycin oxime/22.8 mg praziquantel or 5.75 mg milbemycin oxime/57 mg praziquantel are also available in color coded packages of one chewable tablet each.

Manufactured for: Elanco US Inc.
Greenfield, IN 46140, USA

Approved by FDA under NADA # 141-338

Revision date: May 2020

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.

Best Practices for Diagnosis and Intervention in Canine MMVD

Bruce Keene, DVM, MSc, DACVIM (Cardiology)
Jane Lewis Seaks Distinguished Professor of Companion Animal Medicine
College of Veterinary Medicine, North Carolina State University

Q Myxomatous mitral valve disease (MMVD) is the most common heart disease in dogs in many parts of the world. Which dogs are at greatest risk—and why?

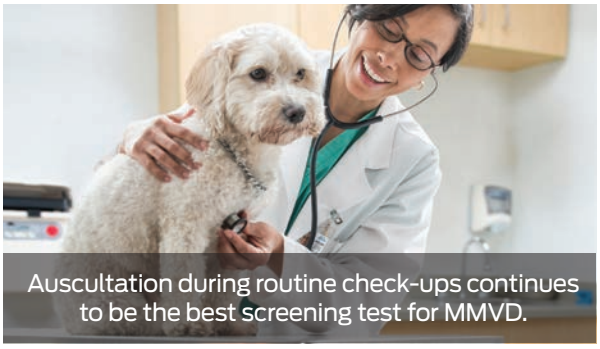
A There is a **genetic** component to the development of the pathological changes that lead to MMVD, with a variety of genes influencing its development.[1] Certain **breeds**—many of them smaller dogs under 15 to 20 kilograms in body weight—are at greater risk. These include Cavalier King Charles Spaniels, Dachshunds, Miniature Poodles and Chihuahuas.[2,3] While it is less common, large-breed dogs can also develop MMVD, and when they do, the disease seems to progress faster than in small-breed dogs.[4] MMVD is also more common in **male** dogs than female, at a ratio of about 1.5 to 1.[5]

Dogs initially acquire the pathologic lesion in the valve that leads to the disease, then over time develop the leaky valve that causes the typical heart murmur. The **age** of the dog when it develops mitral valve regurgitation is critical because there typically is a 3- to 5-year span of time between initial detection of a heart murmur and the onset of clinical signs associated with heart failure. Not all dogs that develop MMVD progress to clinical signs of heart failure.[6] Cavalier King Charles Spaniels are at special risk because they often develop MMVD at a much earlier age (i.e., 5 or 6) than other dogs. Their disease doesn't necessarily progress faster, but it begins much earlier in life.

Q Given that not every practitioner has access to echocardiography and other advanced diagnostics, what screening steps and follow-up do you recommend?

A Heart murmurs in dogs can be detected during routine checkups via auscultation so, practically speaking, the best screening test for MMVD continues to be listening with a stethoscope. Dogs with soft intensity grade 1 and 2 murmurs do not need an extensive work-up, and there is no reason to alarm their owners. Practitioners can simply inform owners that they will be keeping an eye on the situation through yearly follow-ups.

If the murmur is louder than a grade 2/6, the ACVIM consensus panel guidelines on MMVD recommend baseline imaging.[7] Echocardiography is the gold standard for measuring left atrial size and ventricular size and evaluating the mitral valve, but imaging can be as simple as chest radiographs. It is also important to ensure the dog's blood pressure is normal, since the onset of systemic hypertension can worsen mitral regurgitation and accelerate the progression of mitral valve disease, and basic blood work is recommended to rule out anemia and kidney disease. If these tests are normal and the heart size as determined by the Vertebral Left Atrial Score is less than 2.8, with a breed-adjusted Vertebral Heart Score less than 10.5, no further evaluation is typically needed.



Auscultation during routine check-ups continues to be the best screening test for MMVD.

Q What have recent studies revealed about interventions for dogs with MMVD?

A The EPIC Study clearly demonstrated the benefits of pimobendan administration to dogs with preclinical MMVD.[8] Timely administration of this medication can extend the asymptomatic period of the disease by about 15 months. For most owners, this time is significant, because a dog's best quality of life is always going to be before he or she develops clinical signs of heart failure. Our goal is to prolong that period. In later stages of the disease, we've learned that switching dogs that have become refractory to diuretic therapy from furosemide to torsemide[8] can provide many patients with months of more comfortable life.

Finally, we're beginning to see success with surgical mitral valve repair. Currently this involves open-heart surgery, which makes it cost-prohibitive for most owners. My hope is that in the coming years we will have a minimally invasive option that will be more affordable and accessible.

> "[A] dog's best quality of life is always going to be before he or she develops clinical signs of heart failure. Our goal is to prolong that period."

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Research Shows Potential for Cardiac Nutrition Breakthrough in Management of Canine MMVD Patients

Qinghong Li, PhD
Senior Principal Scientist
Nestlé Purina PetCare

The journey to discover new ways for nutrition to help dogs with myxomatous mitral valve disease (MMVD) has been a long one at Purina. As the principal investigator for this research at Purina, I have traveled this journey since our team began studying MMVD more than 10 years ago.

Identifying a nutrition target for dogs with MMVD

Before a solution to a problem can be found, it is essential to first analyze the problem itself. Purina scientists applied metabolomic and transcriptomic technologies to study the molecular pathways in dogs with preclinical MMVD compared to healthy dogs as a means of better understanding how the disease develops. From analyzing gene expression and metabolite profiles in affected dogs, researchers learned that **dogs with early MMVD do not produce energy as efficiently as dogs with healthy hearts** and this **energy deficiency plays a causal role in the pathogenesis of the disease.**[1]

Long-chain fatty acids, which are oxidized and converted by mitochondria to adenosine triphosphate (ATP), are the heart's primary energy source; however, using metabolomics and transcriptomic technologies, Purina scientists found that dogs with MMVD experienced altered energy metabolism in cardiac tissues, as well as an increase in markers of oxidative stress and inflammation.[1]

Meanwhile, by studying the gut microbiota of dogs at all stages of MMVD, we have learned that dysbiosis is a factor in the disease's development. Shifts in the gut microbiota begin in the early, preclinical stages of MMVD, with dysbiosis increasing with the severity of the disease.[2,3]

Dietary intervention makes a difference in dogs with early MMVD.

With nutrition targets identified, Purina researchers next focused their research on developing a cardiac protection blend, or CPB [see "Cardiac Protection Blend Addresses Energy Crisis in Dogs with MMVD"], that could be fed to dogs in hopes of slowing the progression of MMVD while the disease is still at an early stage. A six-month dietary study demonstrated the efficacy of a diet containing the CPB in helping reduce left atrial enlargement and stabilize mitral regurgitation, as well as slowing the progression of mitral valve disease in dogs at early stages.[4]

At the beginning of the study, 19 dogs with stage B1 or B2 MMVD as established by the ACVIM consensus guidelines for MMVD and 17 age-, sex-, body condition- and breed-matched healthy dogs were enrolled. In each health group, half of the dogs were randomly designated as control dogs while the other half were fed the CPB for six months. Key findings were:

- **No dogs in the CPB-fed group showed progression of MMVD,** but more than one-third of the control dogs progressed from B1 to B2.
- **The CPB-fed dogs had about a 3% average left atrial size reduction** while the control-fed dogs showed an average 10% increase in left atrial size from baseline.
- **30% of dogs in the CPB-fed group showed improvement in mitral regurgitation.**
- No change was noted in the healthy dogs.

Nutritional intervention supports cardiac function at a cellular level.

Having observed clinical changes in dogs with early-stage MMVD through dietary intervention in the six-month study, investigators further supported these findings by examining metabolomic changes in the dogs that were supplemented with the CPB. Analysis of blood samples from these dogs identified metabolites suggesting that **improvement in energy metabolism, decreased oxidative stress** and **decreased inflammation** were benefits of the dietary intervention.[5]

Purina scientists continue to research benefits of dietary intervention for MMVD patients.

Purina continues to work with internal and external collaborators on clinical trials to investigate and analyze the effects of MMVD on dogs and how early intervention with the CPB can benefit these patients.

MATTERS OF THE HEART:
How prevalent is MMVD?

It is estimated that approximately **10% of dogs** seen in primary care veterinary practices in North America have heart disease.[1] Of these, approximately **75% have MMVD.[1]**

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5. *Li Q, Laflamme DP, Bauer JE. Serum untargeted metabolomic changes in response to diet intervention in dogs with preclinical myxomatous mitral valve disease. PloS One. 2020;15(6), e0234404. Doi: 10.1371/journal.pone.0234404*

**Keene BW, Atkins CE, Bonagura JD, et al. ACVIM consensus guidelines for the diagnosis and treatment of myxomatous mitral valve disease in dogs. J Vet Int Med. 2019; 33(3), 1127-1140.*

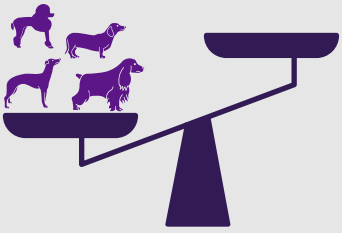
†Parker HG, Kilroy-Glynn P. Myxomatous mitral valve disease in dogs: does size matter? J Vet Cardiology. 2012; 14(1), 19-29.

Cardiac Protection Blend Addresses Energy Crisis in Dogs with MMVD

Jason Gagné, DVM, DACVIM (Nutrition)
Director of Veterinary Technical Communications
Nestlé Purina PetCare

Nutritional intervention for dogs with MMVD is not a new concept. For years, veterinarians have recommended cardiac diets for dogs in clinical heart failure to help control the clinical signs of disease. Historically, however, no nutritional changes were recommended for dogs with myxomatous mitral valve disease until patients reached at least stage B2.

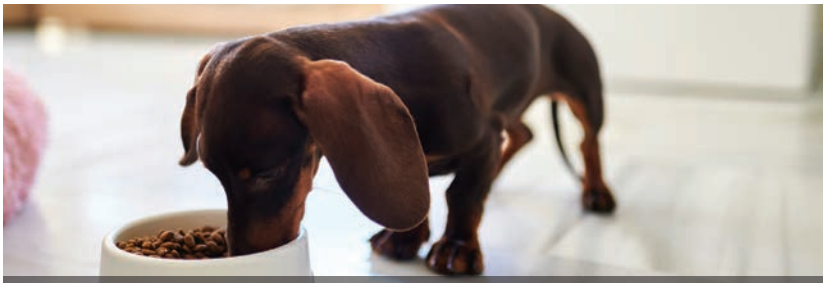
MMVD IS PRIMARILY A DISEASE OF SMALLER, OLDER DOGS.



Up to 85% of small-breed dogs show evidence of valvular lesions by **age 13**.* Commonly affected dog breeds include[1]: Cavalier King Charles Spaniels, Dachshunds, Miniature and Toy Poodles and Whippets.

At this point, mild sodium restriction has been advised, followed by further sodium restriction as the disease progresses. High palatability and anti-inflammatory properties have been other common attributes of cardiac diets.

With the launch of Purina® Pro Plan® Veterinary Diets CC CardioCare™ for dogs, veterinarians can intervene earlier in the disease process



The Cardiac Protection Blend in CC CardioCare was formulated for nutritional management of dogs with early-stage MMVD.

—specifically, when dogs are at Stage B1, as evidenced by a heart murmur without evidence of cardiac remodeling. The nutrients in Purina's Cardiac Protection Blend (CPB) were formulated to specifically address the metabolic changes that occur in early MMVD.

This CPB is composed of **amino acids, omega-3 fatty acids, magnesium, vitamin E** and **medium-chain triglycerides (MCTs).** This blend has been shown to:

- Improve mitral regurgitation (MR) in 30% of dogs with early-stage mitral valve disease
- Increase serum omega-3 and decrease omega-6 fatty acid concentrations to help nutritionally manage dogs with cardiac conditions
- Increase serum arginine and citrulline (which are precursors of nitric oxide) to promote vasodilation
- Improve energy use as signified by biomarkers of fatty acid oxidation

The specific cardiac benefits of this dietary approach for dogs with early-stage MMVD include **supporting cardiac function, slowing the progression of mitral valve disease,** helping to **stabilize MR and reduce left atrial enlargement** in dogs at early stages, and helping to **stabilize cardiac parameters as measured by echocardiography.**

CC CardioCare may also benefit dogs in congestive heart failure (Stages C and D) and dogs with other conditions that benefit from moderate sodium reduction.

Key Takeaways

- MMVD is the most common heart disease in dogs, but not all affected dogs progress to clinical signs of heart failure.
- Studies conducted by Purina researchers, along with university researchers, have demonstrated that early nutritional intervention has the potential to help slow the progression of disease in dogs with MMVD.
- The Cardiac Protection Blend (CPB) in the new CC CardioCare diet, which is designed for dogs with early MMVD, includes a blend of amino acids, omega-3 fatty acids, magnesium, vitamin E and medium-chain triglycerides (MCTs).

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Advancing Science for Pet Health

Purina Institute Offers CentreSquare™ Resources for Clinics

CentreSquare is a new online toolkit of resources developed by the Purina Institute to facilitate client-friendly nutrition conversations. Visit **www.purinainstitute.com/centresquare** or scan the QR code to explore this new resource and access bite-sized nutrition content for your clients and staff. To learn more about Purina's research on canine myxomatous mitral valve disease, click on **"Therapeutic Nutrition"** and **"Cardiovascular Disorders"**.

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VETERINARY DIETS

WHAT IF...

YOU COULD SLOW THE PROGRESSION OF EARLY STAGE MITRAL VALVE DISEASE?

Introducing **CC CardioCare™, a revolutionary diet that helps protect a dog's heart** at the first signs of mitral valve disease.

Slows the progression of mitral valve disease in dogs at early stages

Helps reduce left atrial enlargement associated with early stage mitral valve disease

Contains a Cardiac Protection Blend composed of amino acids and fatty acids (omega-3 and medium-chain triglycerides), magnesium and vitamin E

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Oromucosal Dexmedetomidine to Reduce Stress at the Clinic

Tina Wismer, DVM, MS, DABVT, DABT
ASPCA Animal Poison Control Center
Urbana, Illinois

In the literature

Hauser H, Campbell S, Korpivaara M, Stefanovski D, Quinlan M, Siracusa C. In-hospital administration of dexmedetomidine oromucosal gel for stress reduction in dogs during veterinary visits: a randomized, double-blinded, placebo-controlled study. *J Vet Behav*. 2020;39:77-85.

FROM THE PAGE ...

A significant percentage (78.5%) of dogs exhibit fearful behaviors during visits to the clinic.[1] Increasing patient comfort in the clinic is important to pet owners and clinicians; thus, prescribed anxiolytics and sedatives (extra-label) to be given before visits to the clinic have become increasingly common.[2-4]

This randomized, crossover, double-blinded, placebo-controlled study* evaluated the use of oromucosal dexmedetomidine gel in the clinic to decrease stress in dogs. Study patients were known to have anxiety and/or fear when at the clinic. Aggressive dogs were not included. Owners, clinicians, and observers (who used an ethogram with predetermined stress-related behaviors to assess the dogs) were blinded as to which dogs received dexmedetomidine oromucosal gel (125 µg/m^2) or a placebo control gel, which was identical in appearance to the dexmedetomidine gel. After a wait time of 20 minutes to allow the drug to take effect, interactions between each dog and the owner and staff were recorded on video. Dogs served as their own control, as they returned 14 to 21 days later and were given the alternative medication or placebo. Observers noted a significant decrease in signs of stress in patients, but owners and clinicians did not.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Owners and clinicians may not be familiar with all the signs of fear and anxiety in dogs and may miss subtle changes.
2. Dexmedetomidine may have a better effect when given at home (before arrival at the clinic), possibly because the 20-minute wait time for the drug to take effect can be stressful for patients in an unfamiliar environment.
3. In dogs known to be fearful, it may be beneficial to delay examination/treatment and send medication home to be administered before the next visit to the clinic.

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*This study was funded by Zoetis Animal Health.

External Repair of Lizard Mandibles

Rob L. Coke, DVM, DACZM, DABVP (Reptile & Amphibian), CVA
San Antonio Zoo
San Antonio, Texas

In the literature

McDermott CT. External coaptation for mandibular fractures in bearded dragons (*Pogona vitticeps*): 2 cases. *J Exotic Pet Med*. 2021;36:28-33.

FROM THE PAGE ...

Mandibular fracture repair in small animal patients, including reptiles, is difficult, as the procedure must balance repair stability with the patient's ability to eat and maintain metabolism.

This case series describes medical management and external coaptation of unilateral mandibular fracture in 2 bearded dragons (*Pogona vitticeps*). The author used principles of veterinary dentistry to facilitate bone healing.

Analgesia and anesthesia were administered, fractures were aligned, and soft tissue defects were repaired in both patients. A metal wire (ie, section of a paperclip) was fashioned around the jawline to provide a base for stabilization. Dental acrylic was applied to adhere the wire to exterior mandibular skin. During treatment, additional dental acrylic was applied several times to re-adhere the wire to the skin.

A surgical tape splint was used as an adjunct to fracture stabilization. Because reptiles have a lower rate of metabolism, the splint was left on for the full duration of healing but was temporarily removed (and replaced) every 48 hours for tube feeding, which was continued until external stabilization was no longer necessary. Esophagostomy tube placement was not necessary.

External coaptation was successful in both cases, and patients achieved functional healing in 7 to 9 weeks.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. External coaptation using a metal wire and dental acrylic is a viable option for open, unilateral, simple mandibular fractures in bearded dragons.
2. Dental acrylics and ultraviolet healing lights for dentistry are increasingly common in veterinary clinics and are easily obtained from most veterinary suppliers.
3. Although reptiles typically heal more slowly than mammals, many fractures can be managed without direct surgical intervention.
4. Tube feeding is critical for meeting caloric requirements for basal metabolic rate and healing. Multiple commercial and home-prepared diets are available.

Suggested Reading

Kischinovsky M, Divers SJ. Oral cavity, mandible, maxilla, and beak. In: Divers SJ, Stahl SJ. *Mader's Reptile and Amphibian Medicine and Surgery*. 3rd ed. Elsevier; 2019:1033-1039.

Taney K, Smithson C. Oral surgery—fracture and trauma repair. In: Lobprise HB, Dodd JR, eds. *Wiggs's Veterinary Dentistry: Principles and Practice.* 2nd ed. Wiley-Blackwell; 2019:265-288.

Microsporidia in Cats: An Emerging Zoonotic Pathogen

Brandy A. Burgess, DVM, MSc, PhD, DACVIM (LAIM), DACVPM
University of Georgia

In the literature

Taghipour A, Ghodsian S, Shajarizadeh M, Sharbatkhori M, Khazaei S, Mirjalali H. Global prevalence of microsporidia infection in cats: a systematic review and meta-analysis of an emerging zoonotic pathogen. *Prev Vet Med.* 2021;188:105278.

FROM THE PAGE ...

Microsporidiosis is an emerging zoonotic concern, and cats may have a role in the environmental dispersion of microsporidia and the epidemiology of human microsporidiosis.

This systemic review and meta-analysis evaluated the worldwide prevalence of microsporidia infection and genetic diversity of organisms among owned and stray cats. A systematic search was conducted to identify relevant literature: 30 studies representing 34 datasets were included.

In general, prevalence estimates varied by continent and detection method used. The highest prevalence estimates were derived from microscopy-based studies (29.7%), and then serology (11%) and molecular techniques (8.2%). Among molecular-based studies (n = 23), pooled prevalence estimates were the highest in Africa, followed by the Americas, Europe, Asia, and Oceania. The most commonly identified microsporidia species were *Enterocytozoon bieneusi* and, from there, *Encephalitozoon intestinalis* and *Encephalitozoon cuniculi*. Prevalence estimates did not significantly differ among owned and stray cats.

This systematic review highlights the paucity of data from both industrialized and developing countries in supporting evidence-based prevention and control recommendations. The epidemiology of microsporidia should be a continued area of research worldwide.

... TO YOUR PATIENTS

Key pearls to put into practice:

1 Although microscopic detection is commonly used, identifying microsporidia spores using this method can be difficult, and misdiagnosis may result. Molecular-based detection methods are thus considered the standard for detection and identification of microsporidia.

2 *E cuniculi* is a pathogen in rabbits commonly reported in this review that has been associated with uveitis and cataracts in cats; consideration should be given to this as a differential diagnosis.

3 Cats are a potential reservoir for microsporidia infections that may pose a health risk to humans, particularly those who are immunocompromised. Clinicians should work with physicians to provide guidance to immunocompromised owners on safely sharing their households with cats.

Suggested Reading

Addie DD, Tasker S, Boucraut-Baralon C, et al. *Encephalitozoon cuniculi* infection in cats: European guidelines from the ABCD on prevention and management. *J Feline Med Surg*. 2020;22(11):1084-1088.

Benz P, Maass G, Csokai J, et al. Detection of *Encephalitozoon cuniculi* in the feline cataractous lens. *Vet Ophthalmol*. 2011;14(Suppl 1):37-47.

Stentiford GD, Becnel JJ, Weiss LM, et al. Microsporidia – emergent pathogens in the global food chain. *Trends Parasitol*. 2016;32(4):336-348.

Entyce™

(capromorelin oral solution)

30 mg/mL

For oral use in dogs only

Appetite Stimulant

Caution:

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

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

Indication:

ENTYCE (capromorelin oral solution) is indicated for appetite stimulation in dogs.

Dosage and Administration:

Administer ENTYCE orally at a dose of 3 mg/kg (1.4 mg/lb) body weight once daily.

To administer ENTYCE, gently shake the bottle, and then withdraw the appropriate amount of solution using the provided syringe.

Rinse syringe between treatment doses.

The effectiveness of ENTYCE has not been evaluated beyond 4 days of treatment in the clinical field study (See Effectiveness).

See product insert for complete dosing and administration information.

Contraindications:

ENTYCE should not be used in dogs that have a hypersensitivity to capromorelin.

Warnings:

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

Consult a physician in case of accidental ingestion by humans. **For use in dogs only**

Precautions:

Use with caution in dogs with hepatic dysfunction. ENTYCE is metabolized by CYP3A4 and CYP3A5 enzymes (See Clinical Pharmacology).

Use with caution in dogs with renal insufficiency. ENTYCE is excreted approximately 37% in urine and 62% in feces (See Adverse Reactions and Clinical Pharmacology).

The safe use of ENTYCE has not been evaluated in dogs used for breeding or pregnant or lactating bitches.

Adverse Reactions:

In a controlled field study, 244 dogs were evaluated for safety when administered either ENTYCE or a vehicle control (solution minus capromorelin) at a dose of 3 mg/kg once daily for 4 days. Enrolled dogs had a reduced or absent appetite for a minimum of 2 days prior to day 0 and had various medical conditions: arthritis (40); gastrointestinal disease (24); allergy (22); dental disease (22); cardiovascular disease (16); renal disease (13); and others. Some dogs may have experienced more than one of the adverse reactions during the study.

The following adverse reactions were observed:

Table 1: Adverse Reactions reported in dogs administered ENTYCE oral solution compared to vehicle control

Adverse Reactions	ENTYCE (n = 171) n (%)	Vehicle Control (n = 73) n (%)
GASTROINTESTINAL		
Diarrhea	12 (7.0 %)	5 (6.8 %)
Vomiting	11 (6.4 %)	4 (5.5 %)
Hypersalivation	4 (2.3 %)	0 (0.0 %)
Abdominal discomfort	2 (1.2 %)	0 (0.0 %)
Flatulence	2 (1.2 %)	0 (0.0 %)
Nausea	2 (1.2 %)	0 (0.0 %)
CLINICAL PATHOLOGY		
Elevated blood urea nitrogen	7 (4.1 %)	2 (2.7 %)
Elevated phosphorus	4 (2.3 %)	1 (1.4 %)
Elevated creatinine	1 (0.6 %)	1 (1.4 %)
OTHER		
Polydipsia	7 (4.1 %)	1 (1.4 %)
Lethargy/depression	2 (1.2 %)	0 (0.0 %)

The following adverse reactions were reported in < 1% of dogs administered ENTYCE: hyperactivity, increase fecal volume, increase gut sounds, and polyuria.

To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Elanco US Inc. at 1-888-545-5973. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or http://www.fda.gov/reportanimalae.

Effectiveness:

Laboratory Effectiveness Study: Twenty four healthy Beagle dogs (6 dogs per sex in each group) with normal appetite were randomized into two groups and dosed daily with ENTYCE (capromorelin oral solution) at 3 mg/kg/day or vehicle control (solution minus capromorelin) to compare food intake over a 4-day period. The dogs were 13 months of age and weighed between 6.5 and 12.5 kg at the time of randomization. Six dogs administered ENTYCE repeatedly exhibited salivation post dosing and two dogs administered vehicle control exhibited salivation only one time on study day 0. Emesis was observed in one dog administered ENTYCE on study day 1. Dogs administered ENTYCE at a dose of 3 mg/kg/day for 4 consecutive days had statistically significantly increased food consumption compared to the vehicle control group ($p < 0.001$).

Clinical Field Study: Effectiveness was evaluated in 177 dogs (121 dogs in the ENTYCE group and 56 dogs in the vehicle control group) in a double-masked, vehicle controlled field study. Dogs with a reduced appetite or no appetite, with various medical conditions, for a minimum of 2 days prior to day 0 were enrolled in the study. The dogs ranged in age from 4 months to 18 years. Dogs were randomized to treatment group and dosed once daily for 4 days with ENTYCE at 3 mg/kg or vehicle control. Dogs were assessed for appetite by owners on day 0 and day 3 ± 1 using an "increased", "no change" or "decreased" scoring system. Dogs were classified as a treatment success if the owner scored their dog's appetite as "increased" on day 3 ± 1. The success rates of the two groups were significantly different ($p = 0.0078$); 68.6% (n = 83) of dogs administered ENTYCE were successes, compared to 44.6% (n = 25) of the dogs in the vehicle control group.

Storage Conditions:

Store at or below 86° F (30° C)

How Supplied:

30 mg/mL flavored solution in 10 mL, 15 mL and 30 mL bottles with measuring syringe

Approved by FDA under NADA # 141-457

Manufactured for:
Elanco US Inc.
Greenfield, IN 46140, USA
Revised: September 2020

Entyce®
(capromorelin oral solution)

THIS IS MORE THAN A MEAL

Entyce supports dogs facing long-term health challenges by **addressing inappetence**, which is **essential** for improving nutrition.[1]

Almost seven out of ten* owners reported their dog's appetite increased in just four days[2] and dogs can **safely take Entyce throughout their treatment** journey.

Stamina starts with appetite

INDICATION: For appetite stimulation in dogs.

IMPORTANT SAFETY INFORMATION: For use in dogs only. Do not use in dogs that have a hypersensitivity to capromorelin. Use with caution in dogs with hepatic dysfunction or renal insufficiency. The safe use of Entyce has not been evaluated in breeding, pregnant or lactating dogs. The most common adverse reactions included diarrhea, vomiting, elevated blood urea nitrogen, polydipsia, and hypersalivation. Please see accompanying brief summary, on page 40, for prescribing information.

The effectiveness of Entyce has not been evaluated beyond 4 days of treatment in the clinical field study.

*Compared to 4.5/10 control dogs. Study enrolled client-owned dogs (N=244) with decreased appetite for at least 2 days, including dogs with a variety of comorbid conditions. The dogs were randomized 2:1 to receive Entyce 3 mg/kg (n=171) or vehicle control (n=73) for 4 days. 177 inappetent dogs were assessed for effectiveness. All dogs enrolled in the study were evaluated for adverse reactions throughout the study.[2]

References: 1. Zollers B *et al. BMC Vet Res* 2017; 13(10): 1–5. **2.** Zollers B *et al. J Vet Intern Med* 2016; 30(6): 1851–1857.

PM-US-21-1049

Elanco™

Traumatic Abdominal Wall Rupture in Cats: Diagnosis & Management

Dale E. Bjorling, DVM, MS, DACVS
University of Wisconsin–Madison

In the literature

Hennet JM, Williams J. Traumatic abdominal wall rupture in cats: decision-making and recommended repair techniques. *J Feline Med Surg.* 2021;23(3):234-240.

FROM THE PAGE ...

Rupture of the abdominal wall in cats is relatively uncommon and typically the result of trauma that causes damage to abdominal viscera, perforation of the abdominal wall, and potential injuries to other anatomic areas.

This study describes a logical, comprehensive approach for management of traumatic abdominal wall rupture in cats in which evaluation and management should focus on assessment of internal injuries and stabilization. The entire cat should be examined for possible accompanying injuries of the limbs, thorax, head, and neck. Surgical repair is typically delayed until the patient is sufficiently

stable to tolerate general anesthesia. Exceptions may include patients with internal organ injury, with extensive abdominal contamination, or that cannot be stabilized due to displaced viscera.

Disruption of the abdominal wall can be diagnosed through physical examination, but imaging (eg, radiography, ultrasonography) is also often required.

Surgical repair typically involves preplacement of monofilament absorbable or nonabsorbable sutures in an interrupted pattern. A tension-relieving suture pattern (eg, horizontal mattress) is commonly preferred. Because the abdominal defect often does not include structures with high connective tissue content, the defect is repaired by closing muscle layers; secure suture placement should be ensured. Synthetic mesh or muscle flaps may be needed to close the defect during repair of chronic abdominal wall rupture or if trauma has destroyed available local tissue. Muscle flaps are typically preferred due to the potential for complications (eg, infection, dehiscence, seroma) associated with synthetic mesh.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Systemic stabilization should be the highest priority in cats with acute injuries. Viscera displaced from the abdominal cavity can often be gently relocated and held in place, at least temporarily, with external bandages.
2. Diagnosis of traumatic abdominal wall rupture in cats, particularly in those with chronic rupture, may require imaging.
3. Repair of the defect can typically be achieved using local tissues. Transposition of muscle flaps or use of synthetic mesh may be required for larger defects.

See page 44 for product information summary.

Research Note: **Prognostic Markers of Acute Pancreatitis**

In humans, neutrophil:lymphocyte ratio (NLR) and platelet:lymphocyte ratio (PLR) are prognostic markers in cancer and inflammatory processes. This prospective study evaluated whether NLR and PLR were correlated with severity and clinical outcomes in cats ($n = 41$) and dogs ($n = 67$) with acute pancreatitis. Diagnosis of pancreatitis was based on clinical signs, elevated canine or feline pancreas-specific lipase, and ultrasound findings. Days from diagnosis to clinical recovery were tabulated, and severity of disease was assessed using a standardized index adapted from human medicine. Study results demonstrated that NLR and PLR were significantly higher in dogs and cats with pancreatitis versus healthy control patients; however, there was no correlation with disease severity. Increased PLR was associated with a longer recovery time in both species. NLR and PLR may provide useful information regarding the course of pancreatitis in cats and dogs.

Source

Neumann S. Neutrophil-to-lymphocyte and platelet-to-lymphocyte ratios in dogs and cats with acute pancreatitis. *Vet Clin Pathol*. 2021;50(1):45-51.

Atenolol Use in Cats with Subclinical Hypertrophic Cardiomyopathy

Rebecca Quinn, DVM, DACVIM (SAIM, Cardiology)
Cape Cod Veterinary Specialists
Buzzards Bay, Massachusetts

In the literature

Coleman AE, DeFrancesco TC, Griffiths EH, et al. Atenolol in cats with subclinical hypertrophic cardiomyopathy: a double-blind, placebo-controlled, randomized clinical trial of effect on quality of life, activity, and cardiac biomarkers. *J Vet Cardiol.* 2020;30:77-91.

Evidence-based data supporting specific and ideal therapies for subclinical feline HCM are lacking.

FROM THE PAGE ...

Hypertrophic cardiomyopathy (HCM) is the most common cardiovascular disorder in cats, affecting up to 29.4% of feline patients.[1] Cats with clinical signs of HCM are often treated with diuretics, angiotensin-converting–enzyme inhibitors, beta blockers, or antiplatelet and anticoagulant medications.[2] However, evidence-based data supporting specific and ideal therapies for subclinical feline HCM are lacking. Diagnostic findings for subclinical HCM include thickened left ventricular walls and left atrial dilation in the absence of other disease (eg, congenital heart disease, hyperthyroidism, systemic hypertension).

This study* evaluated pet owner-perceived quality of life and activity levels in cats with subclinical HCM and lifestyle-matched healthy controls, as well as owner-perceived quality of life, quantitative activity measurements, cardiac biomarkers, and echocardiographic variables in cats with preclinical HCM, with and without atenolol therapy.

A total of 27 healthy cats and 32 cats with subclinical HCM were included. As compared with healthy cats, cats with subclinical HCM had significantly more arrhythmias, higher

*This study was funded by a grant from Morris Animal Foundation with additional support provided by IDEXX Laboratories.

cardiac troponin I concentrations, and higher *N*-terminal pro-B natriuretic peptide concentrations. There was no difference in overall activity scores or quality of life scores between healthy cats and cats with subclinical HCM.

Of the 32 cats with subclinical HCM, 16 were randomized and given atenolol (6.25 mg PO every 12 hours; dosage was the same regardless of body weight, BCS, or echocardiographic findings), and 16 were given a placebo. All HCM patients were reassessed at baseline and again at 6 months. Cats receiving atenolol had significantly lower heart rate and murmur grades compared with cats receiving a placebo. In cats with subclinical HCM, atenolol treatment did not significantly affect systemic blood pressure, echocardiographic variables, quality of life, or activity levels.

Atenolol has been prescribed by veterinary cardiologists to manage HCM, with the main goal of prolonging the subclinical phase of disease while maintaining a high quality of life. Atenolol use in humans with HCM remains a mainstay therapy, with evidence of improved clinical condition. In the present study, some benefits were noted in cats that had subclinical HCM and were receiving atenolol, but there was no significant improvement in all areas assessed. More significant results may occur in cats with severe subclinical HCM if an alternative survey is offered or if higher doses of atenolol are administered.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Cats are often difficult to medicate. There are some benefits to atenolol therapy in cats that have subclinical HCM, but it is important to weigh the pros and cons of treatment and prescribe medications most likely to improve quality of life and longevity. Antiplatelet therapy can be prioritized in some cases.
2. Atenolol therapy may be most useful when given based on the patient's body size and BCS and on the severity of echocardiographic findings.
3. Baseline diagnostics should be obtained prior to initiating medical therapy in cats with subclinical HCM. Recheck is needed after 6 months, and treatment should be adjusted to maximize positive effects.

References

1. Fox PR, Keene BW, Lamb K, et al. International collaborative study to assess cardiovascular risk and evaluate long-term health in cats with preclinical hypertrophic cardiomyopathy and apparently healthy cats: the REVEAL study. *J Vet Intern Med*. 2018;32(3):930-943.
2. Luis Fuentes VL, Abbott J, Chetboul V, et al. ACVIM consensus statement guidelines for the classification, diagnosis, and management of cardiomyopathies in cats. *J Vet Intern Med*. 2020;34(3):1062-1077.

Cats receiving atenolol had significantly lower heart rate and murmur grades compared with cats receiving a placebo.

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Reliable Solutions to Suit Your Hospital's Needs

Vetivex® Lactated Ringer's Solution Injection, USP
250, 500, 1000 and 5000 mL bags

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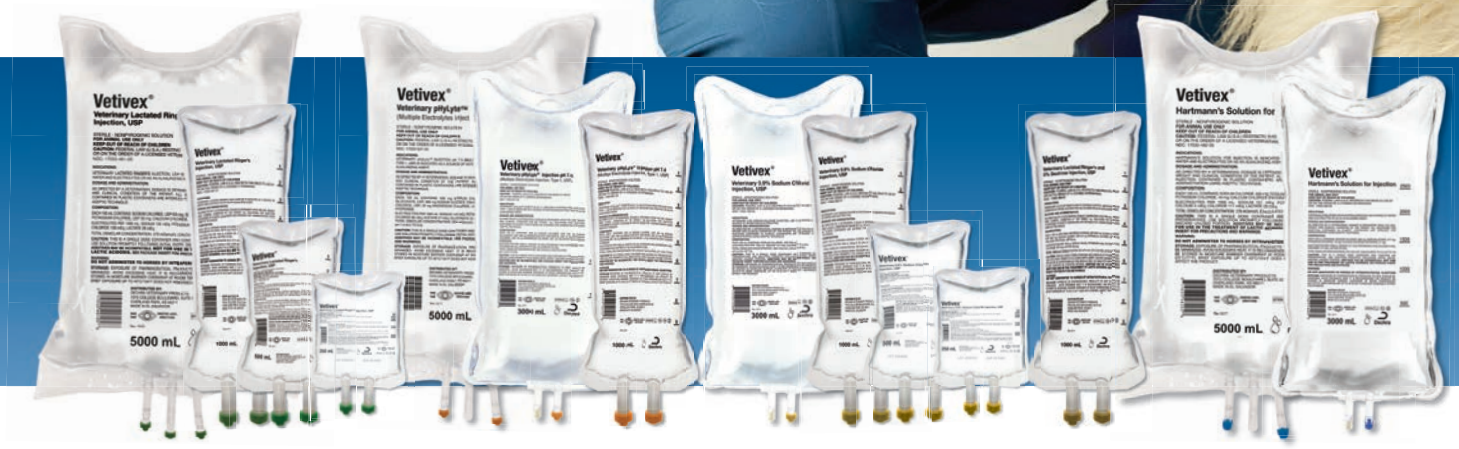

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When dogs eat something potentially poisonous or harmful, you need to act quickly. Clevor is a selective emetic with a fast onset of action and short duration of vomiting. A convenient, single-use dropper provides one injectionless treatment for a dog.

Clevor - a new way to induce emesis in dogs.

CLEVOR® is indicated for the induction of vomiting in dogs.

IMPORTANT SAFETY INFORMATION: Do not use in dogs with central nervous system depression or seizures. Do not use in cases of ingestion of sharp foreign objects, corrosive agents (acids or alkalis), volatile substances or organic solvents. CLEVOR® should not be administered in cases with corneal ulceration, ocular irritation, or ocular injury. Do not use when there is a known sensitivity to ropinirole or the inactive ingredients. **ADVERSE REACTIONS MAY INCLUDE:** Transient mild or moderate hyperemia of the eye, ocular discharge, protrusion of the 3rd eyelid and blepharospasm, transient mild lethargy and increased heart rate. Not recommended for use in breeding, pregnant or lactating dogs. CLEVOR® has not been evaluated in dogs with heart or liver impairments or dogs younger than 4.5 months or less than 4 pounds. Dopamine antagonists, neuroleptics and other medicines with antiemetic properties may reduce the effectiveness of ropinirole. CLEVOR® should be administered by a veterinary professional. Gloves and protective eyewear should be worn when administering. Not for use in humans. Keep out of reach of children.

For complete product safety information, see brief on following page or visit:
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See page 49 for product information summary.

Avoiding Pet Owner Burnout When Treating Canine Skin Disease

Katherine Doerr, DVM, DACVD
Veterinary Dermatology Center
Maitland, Florida

In the literature

Spitznagel MB, Hillier A, Gober M, Carlson MD. Treatment complexity and caregiver burden are linked in owners of dogs with allergic/atopic dermatitis. *Vet Dermatol.* 2021;32(2):192-e50.

FROM THE PAGE …

Chronic allergic dermatitis in dogs can result in significant caregiver burden for pet owners. A previously published report[1] discussed the positive correlation between caregiver burden and severity of canine skin disease.

The goal of the current study was to relate caregiver burden to both objective and subjective treatment complexity. Eighty-six participants were enrolled after completing an online survey about their dog with skin disease. An adapted 18-item Zarit Burden Interview validated for companion animal owners was used to assess caregiver burden, and a previously published measure was used to determine severity of skin disease. Complexity of treatment plans was subjectively determined using statements from the Pet Owner Adherence Scale. To decrease the influence of owner perception of difficulty, objective treatment complexity was determined by requesting the specific number of individual treatments required for management.

A majority (ie, >80%) of enrolled dogs had moderate to severe

skin disease that was positively correlated with caregiver burden. In addition, caregiver burden increased as the owner's subjective assessment of treatment complexity increased, independent of disease severity. Objective analysis of treatment complexity was also positively correlated with the degree of caregiver burden.

Assessing caregiver burden is vital for successful management of dogs with allergic dermatitis. It is important to understand that as treatment complexity increases, compliance may decrease due to caregiver burden. Burden transfer to the clinician, in which owners overburdened with caregiving transfer their stress to the clinician, may also increase if the owner does not feel they can complete the treatments recommended for their dog.[2] Although multimodal therapy is paramount in the treatment of allergic dermatitis, starting with a simple, yet effective, treatment plan can yield lower caregiver burden.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Simple, effective treatment plans should be chosen, if possible, for dogs with skin disease. Additional therapies may be provided once the patient is comfortable, but caregiver burden should be assessed at each examination.
2. Compliance may be increased by limiting the number of treatment modalities and initially focusing on the most effective therapies.
3. Simplistic treatment plans may also decrease burden transfer to clinicians, as caregiver burden would decrease, potentially resulting in fewer treatment-related follow-up questions or confusion.

References

1. Spitznagel MB, Solc M, Chapman KR, Updegraff J, Albers AL, Carlson MD. Caregiver burden in the veterinary dermatology client: comparison to healthy controls and relationship to quality of life. *Vet Dermatol*. 2019;30(1):3-e2.
2. Spitznagel MB, Ben-Porath YS, Rishniw M, Kogan LR, Carlson MD. Development and validation of a burden transfer inventory measure for predicting veterinarian stress related to client behavior. *J Am Vet Med Assoc*. 2019;254(1):133-144.

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Pain and dysphoria don't have to be part of the post-op experience.*

Controls Pain to Help Post-Op Return to Function	Single-Dose Administration	FDA-Approved
Long-Acting Local Anesthetic	UP TO 72-HOUR ANALGESIA	

Canine CCL and feline onychectomy patients can recover comfortably even after going home.**

Recovery care begins with Nocita™

Indications

For single-dose infiltration into the surgical site to provide local postoperative analgesia for cranial cruciate ligament surgery in dogs. For use as a peripheral nerve block to provide regional postoperative analgesia following onychectomy in cats.

Important Safety Information

NOCITA is for use in dogs and cats only. Do not administer concurrently with bupivacaine HCl, lidocaine or other amide local anesthetics. The safe use of NOCITA in dogs and cats with cardiac disease or with hepatic or renal impairment has not been evaluated. The safe use in dogs or cats younger than 5 months of age, that are pregnant, lactating, or intended for breeding has not been evaluated. The most common adverse reactions in dogs were discharge from incision, incisional inflammation and vomiting. The most common adverse reactions in cats were elevated body temperature and infection or chewing/licking at the surgical site. Please see accompanying brief summary for product safety information.

*In a field trial, Nocita reduced the need for post-op rescue pain treatment with opioids
**Cranial cruciate ligament

Elanco

See page 50 for product information summary.

A MODERN WAY TO LOOK AT RECOVERY CARE.

See the benefits of addressing acute surgical pain with a long-acting local anesthetic.

Maintaining a pet's longevity and quality of life can sometimes require surgical intervention. All surgeries result in some degree of tissue trauma and associated pain.[1]

While pain can be controlled in the clinic, there is a need to provide analgesia for pain relief through the critical 72-hour postoperative period, especially once patients return home, which is typically within 24 to 48 hours after surgery.

Beyond the ethical obligation to minimize pain and suffering, unmanaged pain delays healing and return to function and can lead to chronic, maladaptive pain.[1] Additionally, effective pain management creates a better client experience.

The role of local anesthetics in perioperative pain control.

> "The task force supports the International Veterinary Academy of Pain Management position that, because of their safety and significant benefit, local anesthetics should be utilized, insofar as possible, with every surgical procedure."
>
> *— American Animal Hospital Association*

Local anesthetics (LAs) are one of the most effective means of preventing transduction and transmission of pain signals,[2] in part, because LAs are the only class of drug can render complete analgesia[1].

Previous formulations LAs have some limitations, primarily their relatively short duration of action (less than eight hours).

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Indications For single-dose infiltration into the surgical site to provide local postoperative analgesia for cranial cruciate ligament surgery in dogs. For use as a peripheral nerve block to provide regional postoperative analgesia following onychectomy in cats.

Important Safety Information NOCITA is for use in dogs and cats only. Do not administer concurrently with bupivacaine HCl, lidocaine or other amide local anesthetics. The safe use of NOCITA in dogs and cats with cardiac disease or with hepatic or renal impairment has not been evaluated. The safe use in dogs or cats younger than 5 months of age, that are pregnant, lactating, or intended for breeding has not been evaluated. The most common adverse reactions in dogs were discharge from incision, incisional inflammation and vomiting. The most common adverse reactions in cats were elevated body temperature and infection or chewing/licking at the surgical site. Please see accompanying brief summary for product safety information.

*In a field trial, Nocita reduced the need for post-op rescue pain treatment with opioids.

**Cranial cruciate ligament.

[1]Epstein ME, Rodan I, Griffenhagen G, et al. 2015 AAHA/AAFP pain management guidelines for dogs and cats. J Am Anim Hosp Assoc. 2015;51:67-84.

[2]Lascelles BD, Kirkby Shaw K. An extended release local anesthetic: potential for future use in veterinary surgical patients? Vet. Med. Sci. 2016;2(4):229-38.

nocita™
(bupivacaine liposome injectable suspension)

Eyeworm Infection in a Dog

Heather D.S. Walden, MS, PhD
University of Florida

In the literature

Schwartz AB, Lejeune M, Verocai GG, Young R, Schwartz PH. Autochthonous *Thelazia callipaeda* infection in dog, New York, USA, 2020. *Emerg Infect Dis*. 2021;27(7):1923-1926.

FROM THE PAGE ...

The increased frequency of emerging parasites, especially those of zoonotic concern, in the United States can be attributed to increased global travel. Nonnative parasite species translocated to a new geographic area can infect new host species and cause severe disease.

Thelazia callipaeda (ie, oriental eye worm) is a nematode that reportedly infects dogs, cats, rabbits, wild carnivores (eg, red foxes), and humans.[1,2] *T callipaeda* requires *Phortica* spp drosophilid flies as an intermediate host in order to transmit to a new host and complete its life

The increased frequency of emerging parasites, especially those of zoonotic concern, in the United States can be attributed to increased global travel.

cycle. The flies feed on lacrimal secretions of an infected host, taking up first-stage larvae during feeding and depositing infective third-stage larvae after nematodes have developed.

This case report documented *T callipaeda* infection in an otherwise healthy 7.5-year-old Labrador retriever with no known travel history outside Dutchess County, New York. The patient was presented with a 3-week history of unilateral epiphora and blepharospasm unresponsive to treatment with a neomycin, polymyxin-B, and dexamethasone ophthalmic preparation.

Nasolacrimal duct flush using gentamicin sulfate 0.3% and dexamethasone 0.2% in saline, followed by ivermectin (100 µg/mL) in saline allowed recovery of adult worms morphologically and molecularly identified as *T callipaeda.* Systemic ivermectin treatment eliminated the infection; no further treatment was required.

This case report highlights an autochthonous infection of *T callipaeda* in the United States. *T callipaeda* is endemic in many Asian countries and has been documented in Europe since 2001.[1] Its zoonotic potential and ability to infect and use native *Phortica* spp as intermediate hosts in the United States make it a parasite of concern.[1,3]

In dogs and cats in Europe, documented ocular clinical signs of *T callipaeda* infection include conjunctival edema and hyperemia, conjunctivitis, epiphora, mucopurulent discharge, uveitis, and corneal abrasions.[4] Additional studies of thelaziasis in dogs have suggested that moxidectin or milbemycin can be effective treatments.[5]

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Travel history is not always an indicator of potential infection with novel or emerging parasites in the United States. Competent hosts for a variety of parasites can be found worldwide. It is therefore important to consider possible infection with atypical parasites.
2. Zoonotic potential should always be assumed when handling parasites unless true species identity is known. Many, but not all, parasites require an intermediate host for infection. Proper collection of parasites and safe handling of samples are important to ensure accurate diagnosis and safety of pet owners and clinic staff.
3. Controlling intermediate hosts like drosophilid flies is difficult. Owners should be made aware of how *T callipaeda* is transmitted, as knowing what to look for can help limit transmission to humans and/or other pets in the household.

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Research Note:

Glucose, pH, & Lactate Metabolic Markers: Potential Early Detection of Osteoarthritis in Dogs

Diagnosing osteoarthritis (OA) in dogs can be problematic due to the lack of early detection methods. Radiographic changes used to diagnose OA occur only in later stages of the disease. Inflammatory and degenerative biomarkers (eg, tumor necrosis factor alpha, interleukin-1 beta [IL-1 beta], tenascin-c [TN-C], matrix metalloproteinase-2 [MMP-2]) have been correlated with canine joint inflammation, and immunoassays are commercially available. Glucose, pH, and lactate metabolic biomarkers also increase in the synovial fluid of joints with OA, and tests for these biomarkers are simpler and less expensive. This pilot study of dogs with OA found that metabolic markers, pH, and glucose are significantly increased in OA-affected joints as compared with normal joints. They also found that synovial fluid lactate was significantly decreased in affected joints. Of the proinflammatory biomarkers, IL-1 beta, TN-C, and MMP-2 were significantly increased in OA-affected joints. None of the values correlated to radiographic findings, likely due to the difficulty of radiographically detecting OA in early stages of disease; correlations with MRI findings should be studied.

Source

de Bakker E, Broeckx B, Demeyere K, Stroobants V, Van Ryssen B, Meyer E. Detection of osteoarthritis in dogs by metabolic, pro-inflammatory and degenerative synovial fluid biomarkers and traditional radiographic screening: a pilot study. *Vet Immunol Immunopathol*. 2021;237:110252.

Flip the next page to see answer.

SDMA Values: Interpretation & Application

Margie Scherk, DVM, DABVP (Feline Medicine)
catsINK
Vancouver, British Columbia

In the literature

Baral RM, Freeman KP, Flatland B. Analytical quality performance goals for symmetric dimethylarginine in cats. *Vet Clin Pathol*. 2021;50:57-61.

FROM THE PAGE ...

Symmetric dimethylarginine (SDMA) is a biomarker used to assess glomerular filtration rate in the diagnosis, classification, and monitoring of chronic kidney disease. Veterinary immunoassays have been developed for regular use in commercial laboratories and point-of-care laboratory equipment but have not been evaluated independently.

This study attempted to identify intraindividual analytic performance goals (ie, imprecision, bias, total error) using both reference laboratory and in-clinic assay data and determine what internal medicine specialists considered to be acceptable analytical variability in SDMA values. Comparison revealed marked discordance between performance capability of the tests and clinician expectations for test performance; clinicians expected much less variability.

Clinicians risk attributing significance to and overinterpreting small changes in SDMA that may reflect either normal changes in the individual patient or analytical variability. An individual patient may have a normal analyte result whether healthy or sick, but the population-derived reference cutoff points may not apply to that patient. Changes (ie, trends) in an individual patient may be more meaningful. Information regarding reference change intervals that can aid in interpreting results is available (see ***Suggested Reading***).[1] In addition, breed variation is significant for SDMA, creatinine, glucose, and total protein values. Age variation has also long been recognized for numerous analytes.

This study evaluated SDMA, but biologic and analytic variations apply to all tests used in veterinary medicine.[2]

... TO YOUR PATIENTS

Key pearls to put into practice:

1. History, physical examination findings, and clinical insight may be more important than laboratory test results.
2. Trends in an individual patient may be more important than single measurements.
3. Regular screening in healthy and sick patients can generate meaningful data that can aid in making medical decisions.
4. In-clinic laboratory equipment should regularly undergo quality control.[1]

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Suggested Reading

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Research Note:
New Findings May Help Dogs with Chronic Enteropathy

This study examined biopsies from 12 dogs diagnosed with chronic inflammatory enteropathy (CIE) to quantify expression of the GI receptor for advanced glycation end products (RAGE), a pattern recognition receptor of the innate immune system. These biopsies were compared with expression from biopsies of 9 healthy dogs. Epithelial RAGE expression in the duodenum, ileum, and colon was higher in dogs with CIE, and several histologic and inflammatory lesion criteria as well as markers of inflammation (ie, serum C-reactive protein, fecal calprotectin concentration) were related to epithelial RAGE expression in these intestinal structures. These findings suggest that transmembrane RAGE expression and intracellular RAGE signaling are involved in the chronic inflammatory response of dogs with CIE. RAGE antagonization may present a novel therapeutic intervention for chronic GI inflammation.

Source

Cabrera-García AI, Protschka M, Alber G, et al. Dysregulation of gastrointestinal RAGE (receptor for advanced glycation end products) expression in dogs with chronic inflammatory enteropathy. *Vet Immunol Immunopathol*. 2021;234:110216.

COMMUNICATING WITH CLIENTS

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See question on the previous page.

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MERCK Animal Health

Novel Feline Erythrocyte Antigens

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In the literature

Binvel M, Arsenault J, Depré B, Blais MC. Identification of 5 novel feline erythrocyte antigens based on the presence of naturally occurring alloantibodies. *J Vet Intern Med*. 2021; 35(1):234-244.

FROM THE PAGE …

The feline blood group system is defined as the AB system, with cats being type A, B, or AB. Type A is the most common blood type in cats, and type B prevalence varies by breed and geographic location. Cats are born with naturally occurring alloantibodies against blood types other than their own. Severe acute hemolytic reactions can occur if a type B cat receives type A blood; type B blood given to a type A cat has shortened red cell survival time. Discovery of the feline red cell antigen, Mik, raised further questions about red cell antigens outside the classic AB system and their clinical relevance.

This study aimed to estimate the prevalence of cats with non-AB red cell antigens and to begin identifying the number of potential non-AB red cell antigens. Blood samples were collected from 11 blood donor colony cats, 24 research colony cats, and 102 client-owned healthy or sick cats; 134 surplus EDTA blood samples were also collected from healthy or sick cats. AB blood typing was performed, and 13 type B and AB cats were excluded. The remaining 258 type-A cats were subsequently evaluated for the presence of non-AB alloantibodies. Extensive crossmatching revealed 18 cats with unidentified non-AB alloantibodies. Of these, only 7 cats were available to have new blood samples drawn for more extensive crossmatching, which identified 5 potential feline erythrocyte antigens outside the AB classification system.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Cats have naturally occurring alloantibodies against the blood type they do not express. Based on the AB blood type system, administration of type A blood to a type B cat can cause an acute hemolytic transfusion reaction.
2. There may be other unidentified non-AB red cell antigens that could lead to transfusion incompatibility. This study identified the presence of 5 potential red cell antigens outside the AB classification system in a low number (7/258) of cats.
3. Blood typing prior to any transfusion in cats is recommended. Crossmatching prior to transfusion can be considered to identify non-AB incompatibilities. Cats that have previously received a blood transfusion should be crossmatched prior to transfusion.

Suggested Reading

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FELINE ACUTE GASTROENTERITIS

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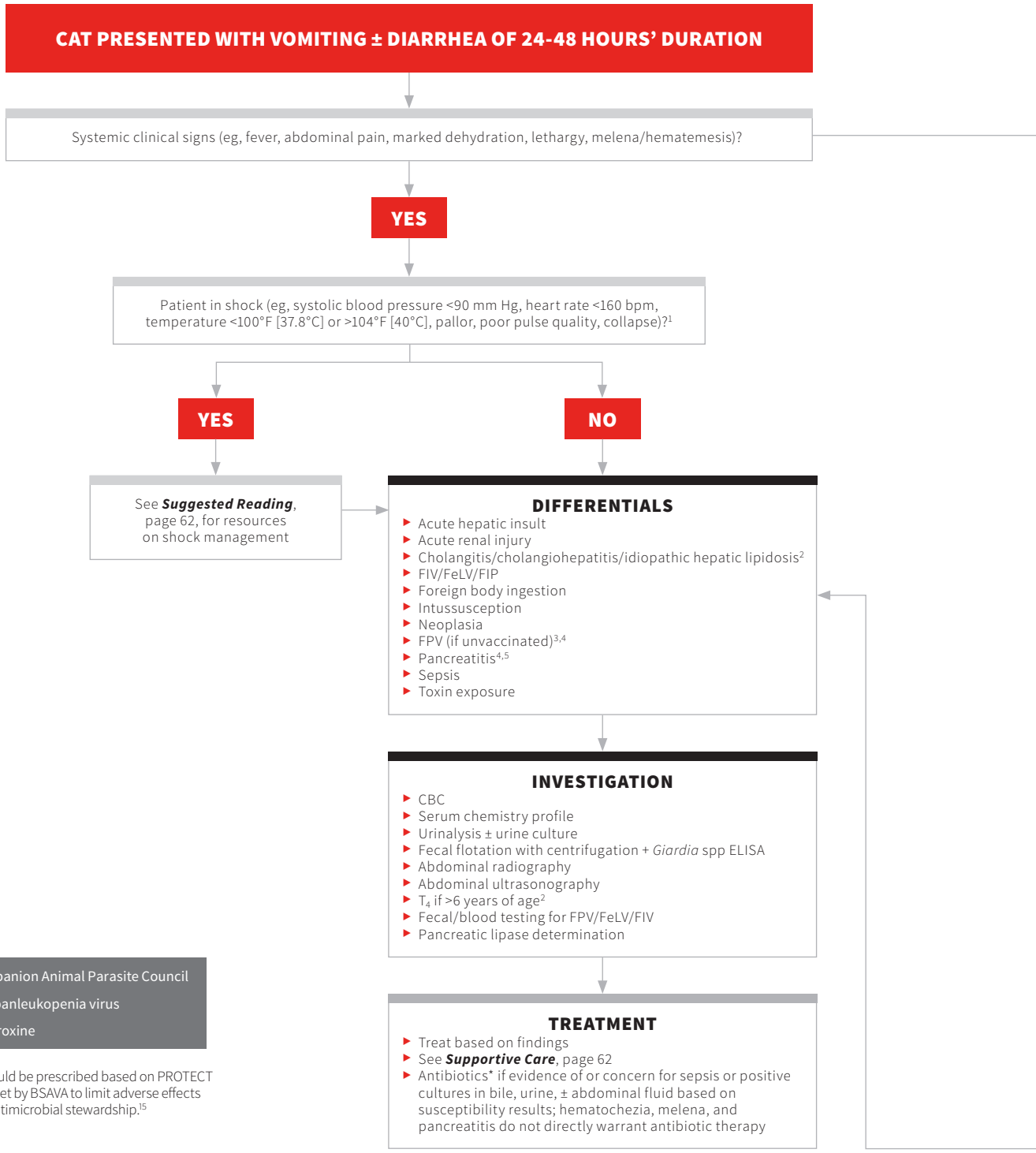
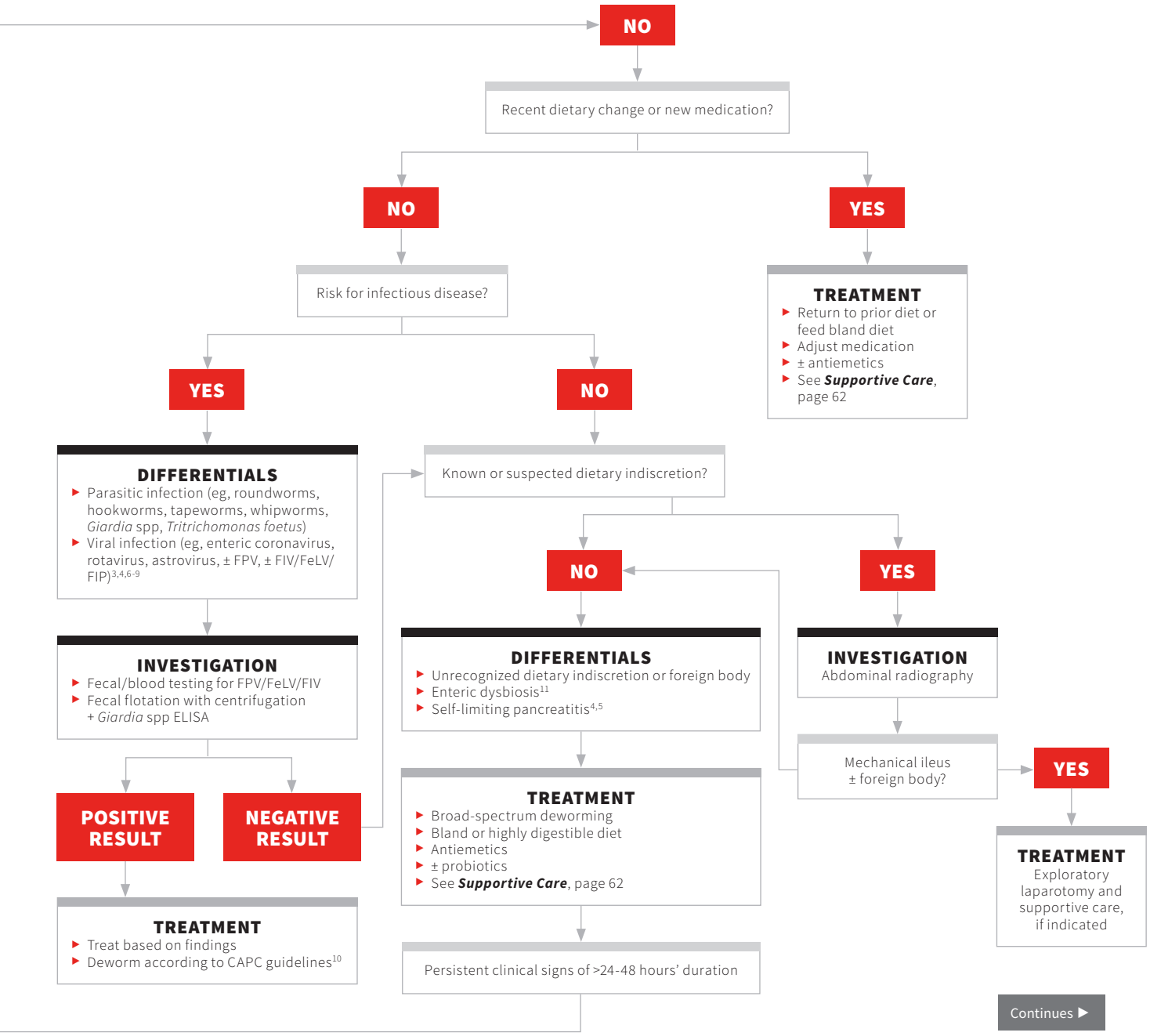


CAPC = Companion Animal Parasite Council
FPV = feline panleukopenia virus
T_4 = total thyroxine

*Antibiotics should be prescribed based on PROTECT ME guidelines set by BSAVA to limit adverse effects and support antimicrobial stewardship.[15]


NO
Recent dietary change or new medication?
NO
YES
Risk for infectious disease?
TREATMENT
Return to prior diet or feed bland diet
Adjust medication
± antiemetics
See Supportive Care, page 62
YES
NO
DIFFERENTIALS
Parasitic infection (eg, roundworms, hookworms, tapeworms, whipworms, Giardia spp, Tritrichomonas foetus)
Viral infection (eg, enteric coronavirus, rotavirus, astrovirus, ± FPV, ± FIV/FeLV/FIP)[3,4,6-9]
Known or suspected dietary indiscretion?
INVESTIGATION
Fecal/blood testing for FPV/FeLV/FIV
Fecal flotation with centrifugation + Giardia spp ELISA
NO
YES
POSITIVE RESULT
NEGATIVE RESULT
DIFFERENTIALS
Unrecognized dietary indiscretion or foreign body
Enteric dysbiosis[11]
Self-limiting pancreatitis[4,5]
INVESTIGATION
Abdominal radiography
TREATMENT
Broad-spectrum deworming
Bland or highly digestible diet
Antiemetics
± probiotics
See Supportive Care, page 62
Mechanical ileus ± foreign body?
YES
TREATMENT
Treat based on findings
Deworm according to CAPC guidelines[10]
TREATMENT
Exploratory laparotomy and supportive care, if indicated
Persistent clinical signs of >24-48 hours' duration

Continues ▶

SUPPORTIVE CARE

- Antiemetics (eg, maropitant, ondansetron)
- Analgesics (eg, buprenorphine [IV or oral transmucosal], fentanyl CRI, methadone IV)
- Nutritional support as soon as possible to maintain enterocyte health, support mucosal barrier integrity, and decrease systemic inflammation[2,12]
  - –Encourage enteral nutrition by frequently providing a variety of foods unless otherwise contraindicated. Consider warming food to increase olfactory stimulation and palatability.
  - –Remove uneaten food after 15 minutes to reduce likelihood of developing food aversion.
  - –Provide a quiet space to eat in a separate room or, if possible, place a towel over the kennel door.
  - –Consider appetite stimulants (eg, mirtazapine, capromorelin, cyproheptadine, gabapentin[12]) and antinausea medications.
  - –If hyporexia or anorexia does not improve within 48 to 72 hours, place a nasogastric or esophageal feeding tube and gradually increase caloric intake to RER over 3 to 5 days.
- Crystalloid therapy (IV or SC)
  - –Maintenance (40-60 mL/kg every 24 hours or 80 × [kg$^{3/4}$], divided by 24 hours) + correction of deficits + support for ongoing losses[13]
  - –In overweight cats, base fluid rate calculation on ideal (not actual) weight to avoid fluid overload.
  - –Consider free water supplementation in persistently hyporexic to anorexic patients or those with sodium derangements.
  - – Kittens <6 months of age have higher fluid requirements (maintenance, 60-80 mL/kg).[14]

RER = resting energy requirement

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BRAVECTO® 1-MONTH

(fluralaner) Chews for Dogs

BRIEF SUMMARY (For full Prescribing Information, see package insert)

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

Indications:
Bravecto 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.

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

WARNINGS
Human 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.

The safety of Bravecto 1-Month has not been evaluated in breeding, pregnant and lactating dogs.

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 or without blood), anorexia, pruritus, polydipsia, seizure, allergic reactions (including hives, swelling, erythema), dermatitis (including crusts, pustules, rash), tremors and ataxia.

Contact Information:
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.

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.

Rev: 03/20

Approved by FDA under NADA # 141-426

BRAVECTO®

(fluralaner) flavored chew for dogs

BRIEF SUMMARY (For full Prescribing Information, see package insert)

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

Indications:
Bravecto kills adult fleas and is indicated for the treatment and prevention of flea infestations (*Ctenocephalides felis*) and the treatment and control of tick infestations [*Ixodes scapularis* (black-legged tick), *Dermacentor variabilis* (American dog tick), and *Rhipicephalus sanguineus* (brown dog tick)] for 12 weeks in dogs and puppies 6 months of age and older, and weighing 4.4 pounds or greater.

Bravecto is also indicated for the treatment and control of *Amblyomma americanum* (lone star tick) infestations for 8 weeks in dogs and puppies 6 months of age and older, and weighing 4.4 pounds or greater.

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

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

Adverse Reactions:
In a well-controlled U.S. field study, which included 294 dogs (224 dogs were administered Bravecto every 12 weeks and 70 dogs were administered an oral active control every 4 weeks and were provided with a tick collar); there were no serious adverse reactions. All potential adverse reactions were recorded in dogs treated with Bravecto over a 182-day period and in dogs treated with the active control over an 84-day period. The most frequently reported adverse reaction in dogs in the Bravecto and active control groups was vomiting.

Percentage of Dogs with Adverse Reactions in the Field Study

Adverse Reaction (AR)	Bravecto Group: Percent of Dogs with the AR During the 182-Day Study (n=224 dogs)	Active Control Group: Percent of Dogs with the AR During the 84-Day Study (n=70 dogs)
Vomiting	7.1	14.3
Decreased Appetite	6.7	0.0
Diarrhea	4.9	2.9
Lethargy	5.4	7.1
Polydipsia	1.8	4.3
Flatulence	1.3	0.0

In a well-controlled laboratory dose confirmation study, one dog developed edema and hyperemia of the upper lips within one hour of receiving Bravecto. The edema improved progressively through the day and had resolved without medical intervention by the next morning.

Post-Approval Experience (2019):
The following adverse events are based on post-approval adverse drug experience reporting. Not all adverse events are reported to FDA/CVM. It is not always possible to reliably estimate the adverse event frequency or establish a causal relationship to product exposure using these data.

The following adverse events reported for dogs are listed in decreasing order of reporting frequency for fluralaner: Vomiting, lethargy, diarrhea (with and without blood), anorexia, pruritis, polydipsia, seizure, allergic reactions (including hives, swelling, erythema), dermatitis (including crusts, pustules, rash), tremors and ataxia.

Contact Information:
For a copy of the Safety Data Sheet (SDS) or to report suspected adverse drug events, 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 http://www.fda.gov/AnimalVeterinary/SafetyHealth.

How Supplied:
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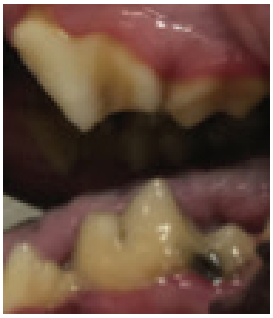

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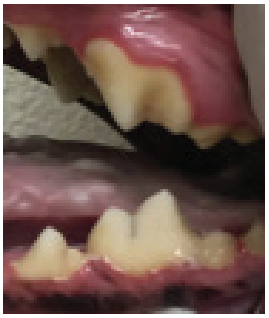

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Therapeutic Tail Amputation

Marije Risselada, DVM, PhD, DECVS, DACVS (SA)
Purdue University

Tail amputations can be broadly categorized as therapeutic (eg, neoplasia, external trauma, repeated injuries, or self-trauma) or nontherapeutic (eg, tail docking).

Tumors of the skin (eg, mast cell tumor), soft tissue (eg, sarcoma), or bone (eg, osteosarcoma) can occur along the tail. Depending on the location, adequate margins can be achieved via tail amputation (ie, caudectomy). Primary excision of skin tumors on the tail may lead to tension along the closure and can increase the risk for a tourniquet effect or dehiscence. Tail amputation should be considered for any malignant skin tumors to achieve both adequate margins and tension-free closure.

Another common indication for tail amputation is repeated self-trauma (mostly seen in dogs) caused by hitting the distal tail, sometimes forcibly, on surrounding structures. These repeated incidents can create scar tissue and more friable skin and lead to increased risk for future trauma, bleeding, and a nonhealing wound. Tail amputation should be considered in recurrent cases in which conservative (eg, bandaging) or behavioral management does not allow the wound to heal or prevent recurrence. The goal for these cases is not to amputate the entire tail but to shorten it enough to preclude recurrent self-damage.

Tail trauma in hunting dogs has been described.[1] Vehicular accidents can cause degloving wounds of the tail similar to appendicular trauma. Wounds can be sutured and closed in some cases, but if there is not enough skin to allow tension-free closure, tail amputation may be preferable.

Tail vertebrae are surrounded by closely attached dorsal (sacrocaudalis dorsalis lateralis and medialis), ventral (sacrocaudalis ventralis lateralis and medialis), and lateral (intertransversarius dorsalis caudalis

and intertransversarius ventralis caudalis) bulky muscles. The main blood supply can be found on both lateral sides of the tail (lateral caudal arteries), with smaller dorsal (dorsolateral caudal arteries) and ventral (median caudal and ventrolateral caudal arteries) arteries.

Complications of tail amputation include bleeding, dehiscence, and infection. Although infection and dehiscence are not common, they may necessitate revision of the amputation to a proximal level and require removal of more proximal coccygeal vertebrae. Bleeding in large dogs can be decreased with an intraoperative tourniquet, depending on its tightness. Temporary intermittent loosening of the tourniquet during surgery allows timely identification of vessels that can then be ligated (larger vessels) or electrocauterized. Alternatively, the tourniquet can be loosened prior to closure to check for appropriate hemostasis. A sterile, self-adhesive bandage can alternatively be placed over or adjacent to the intended incision site if there is enough proximal space. The bandage creates a tourniquet effect when applied tightly, and the incision can be extended into the bandaging. Judicious use of monopolar electrocautery when dissecting muscle off the bone and during muscle transection also decreases hemorrhage (aiding in identification of vessels) and can be used in addition to a tourniquet, especially in large-breed dogs. Individual hemostasis of vessels would still be needed.

Although infection and dehiscence are not common, they may necessitate revision of the amputation to a proximal level and require removal of more proximal coccygeal vertebrae.

Tension-free skin closure reduces the risk for postoperative dehiscence; removal of an additional vertebra can be considered if there is tension. Perioperative placement of an anal purse-string suture can reduce the risk for fecal contamination, as does placing surgery drapes to only include the tail in the surgical field; however, in higher amputations (ie, sacrococcygeal caudectomies), draping the tail base and perineum typically cannot be avoided. Placing tape in a visible place (eg, top of the patient's head) with a reminder that a purse string was placed helps in remembering to remove the purse string postoperatively.

Postoperative incontinence due to traction on the nerves is a concern with amputations at, or close to, the level of the sacrococcygeal junction. A small stump of several coccygeal vertebrae is ideally left to minimize the risk for incontinence; however, if the trauma or tumor are situated more proximally, care should be taken during dissection to avoid traction.

Although postoperative bandaging can protect the tail stump from self-trauma and keep it clean, bandages can slip easily and are often unnecessary. If a bandage is placed, care is needed to not attach the more proximal part too tightly, as a tourniquet effect is possible.

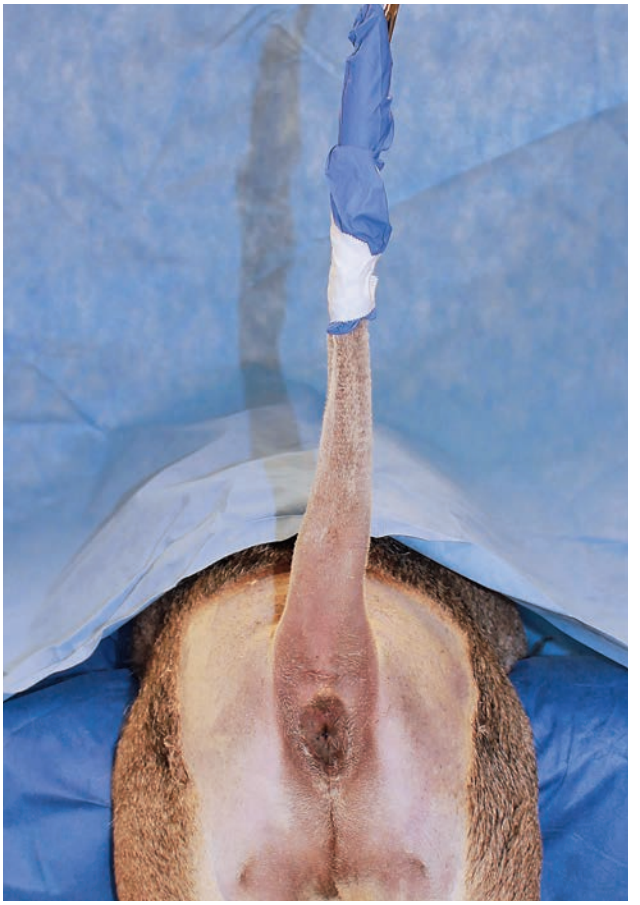
STEP-BY-STEP THERAPEUTIC TAIL AMPUTATION

WHAT YOU WILL NEED

- IV stand (or similar) to hang the tail during preparation
- Soft tissue surgical pack
- Hypodermic needle
- Electrocautery
- 4 × 4-inch gauze
- Monofilament suture (based on patient size)
  - Polydioxanone sutures (or similar) for approximation of deeper tissue
  - Absorbable monofilament sutures for subcutaneous closure
  - External sutures (eg, nylon) or buried intradermal simple interrupted sutures (monofilament) for skin closure
- Tourniquet (optional):
  - Penrose drain, IV tourniquet, or a rubber tie frequently used for endotracheal tube tie-ins
  - Sterile, self-adhesive bandage (alternatively)
- Sterile marker pen to outline the incision and flaps (optional)
- Sterile, self-adhesive bandaging if a wound or necrotic area needs to be covered (optional)
- Purse-string suture to avoid contamination in a high tail amputation (optional)
- Rongeurs to remove cartilage (optional)

STEP 1

Clip the dorsal pelvic/lumbar area, tail, and perineum. Cover the most distal portion of the tail with a glove only, a glove covered with a second layer of self-adhering bandaging, or self-adhering bandaging only, as this part of the tail will be fully removed during surgery and does not need to be fully clipped. Place an anal purse-string suture. Position the patient in ventral recumbency and at the edge of the table, with the pelvic limbs hanging freely over the edge of the table (with an appropriate amount of padding underneath), or pull the patient forward with the pelvic limbs partially supported on the table. Suspend the tail to allow a hanging limb preparation and draping technique. Depending on the impermeability of the primary bandage, place a sterile self-adhering bandage (shown in ***Step 2***, next page) or an impermeable drape followed by a sterile self-adhering bandage to cover the distal portion of the tail and prepare for coverage.



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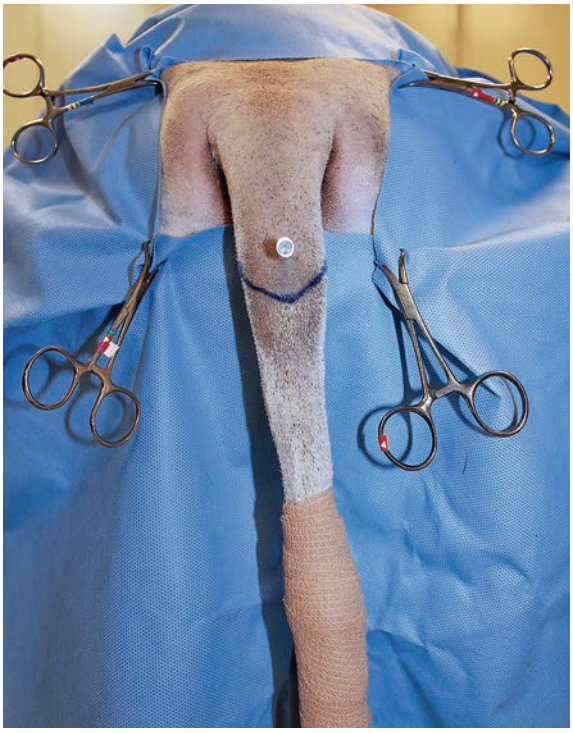
STEP 2

Choose the area of amputation and corresponding joint space. If desired, use a hypodermic needle to help identify the location of the intervertebral space. Place a tourniquet around the proximal aspect of the tail to decrease bleeding.

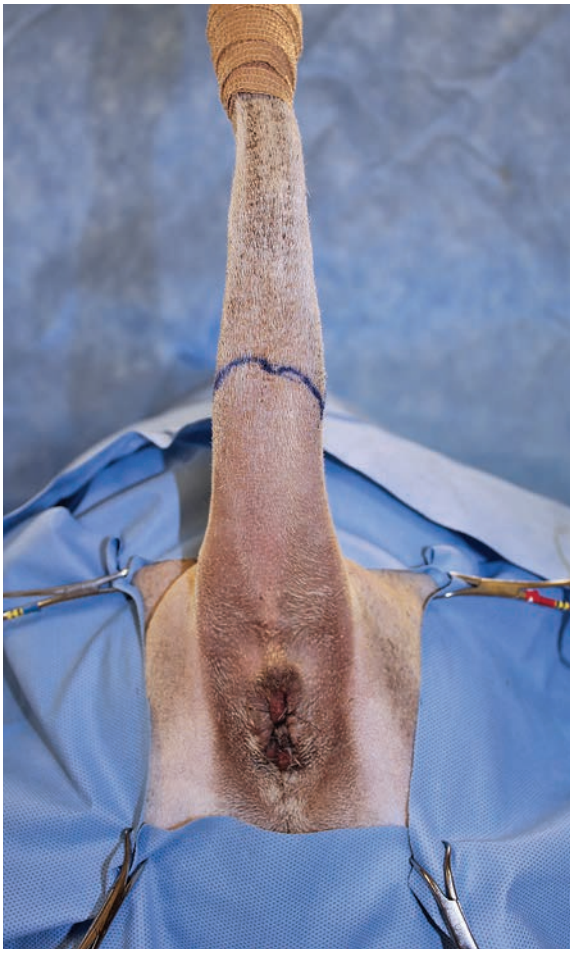
Author Insight

How long the tourniquet can be safely left in place depends on its tightness. Loosening and replacing the tourniquet every 20 to 30 minutes may be necessary.



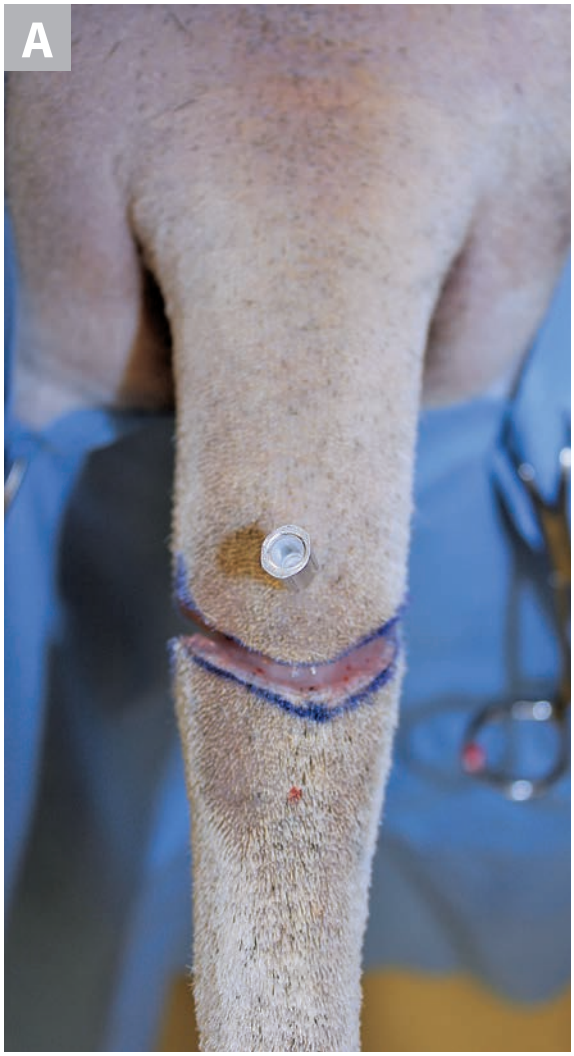
STEP 3

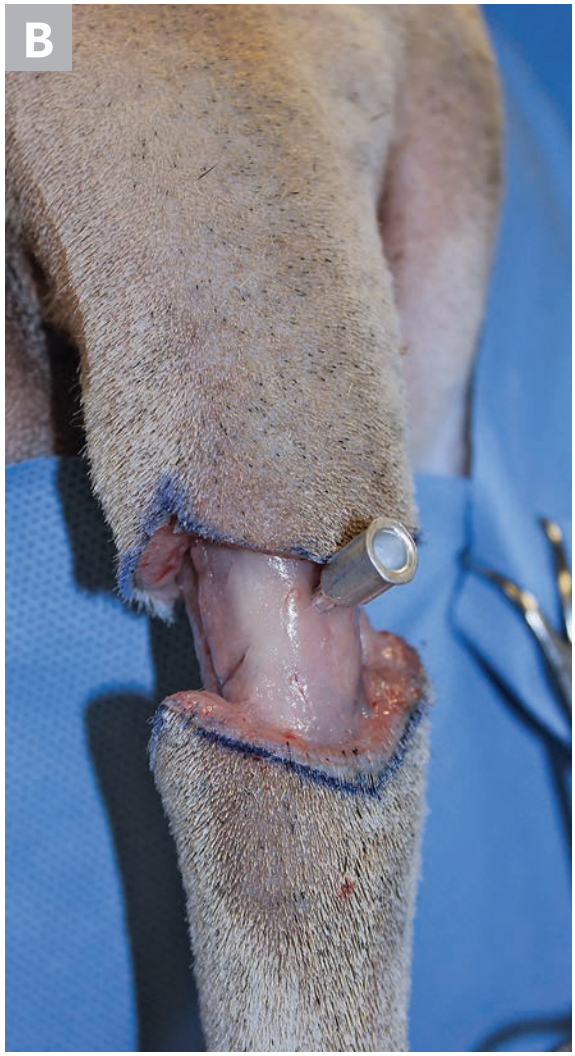
Plan to make the incision in 2 U-shaped flaps (ie, dorsal and ventral), with the tip of the U positioned toward the tip of the tail and the end of the "leg" of the U on the lateral side of the tail at the level of the planned disarticulation to allow for tension-free closure.



STEP 4

Make an incision at the preplanned site, and dissect the subcutaneous tissue to the level of the desired disarticulation site (***A***). Reinsert the hypodermic needle at the desired intervertebral space after completing the subcutaneous dissection (***B***).





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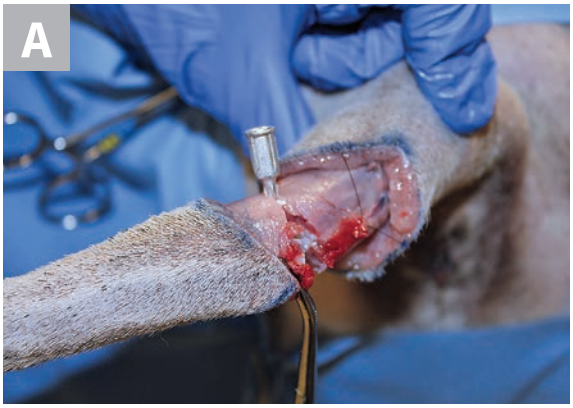
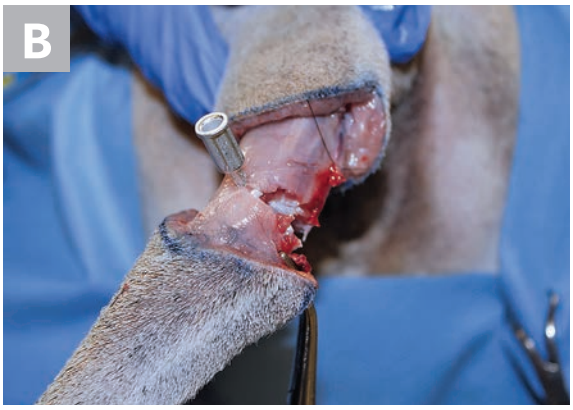
STEP 5

Sharply transect the muscles of the tail, and dissect away from the intervertebral space. Maintain hemostasis of the arteries via targeted cautery or suture ligation of the arteries.

Author Insight

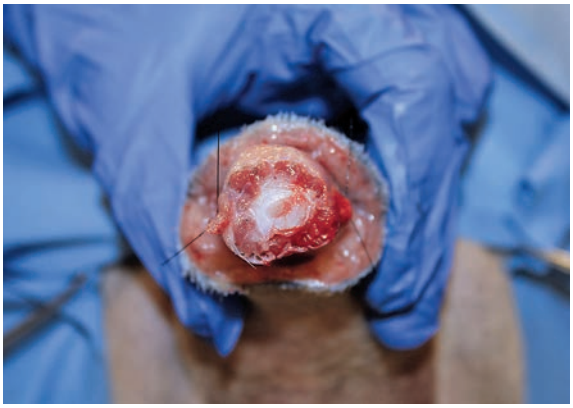
Transection can be done with monopolar electrocautery to minimize hemorrhage or with a blade (***A***). Here, a proximal ligature was placed in the vessel, and a hemostat was placed on the distal end (***B***). Suture tags were left long for illustrative purposes.

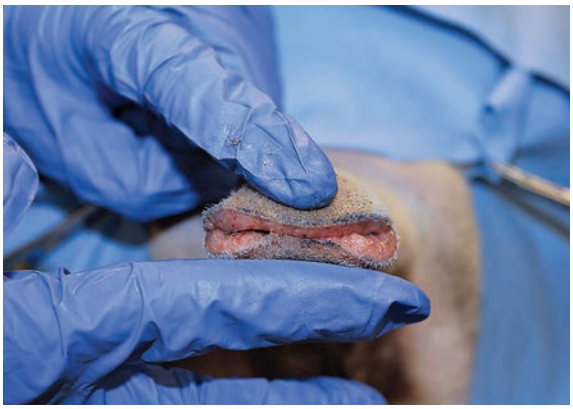




STEP 6

Locate and disarticulate the joint space with a blade or heavy scissors. Remove the remaining cartilage at the proximal vertebra with rongeurs. Release the tourniquet prior to closure to check for hemostasis. Move and manipulate the skin to assess tension on the closure line before closing the wound.



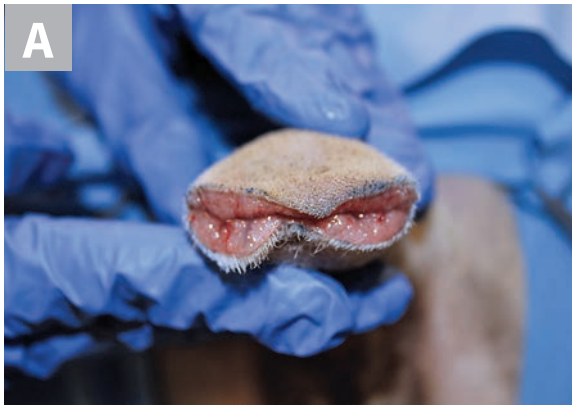


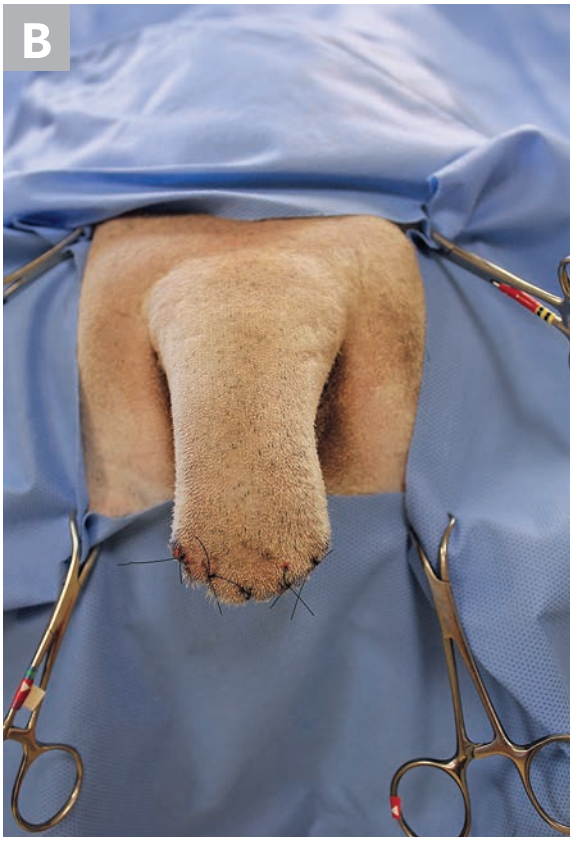
STEP 7

Start closure by approximating sutures in the deeper tissues using a simple interrupted pattern (***A***), followed by routine closure of the subcutaneous tissues and skin (***B***). Trim the flaps if excess skin is present. After the incision is fully closed, remove the purse string (either in the operating room or in the preparation or recovery area).

Author Insight

Tail amputation without a tourniquet (especially for more distal amputations or in smaller patients) requires hemostasis in individual vessels as they are transected, rather than several at once after release of the tourniquet. A tourniquet can decrease bleeding, improve visualization, and be partially tightened in large dogs.





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1. Adequan® Canine Package Insert, Rev 1/19.

Oral Ulceration in Dogs

Jan Bellows, DVM, FAVD, DAVDC, DABVP
All Pets Dental
Weston, Florida

Following are differential diagnoses, listed in order of likeliness, for dogs presented with oral ulceration.

- Mechanical trauma from malpositioned dental hard tissue (dental malocclusion)
- Mechanical trauma from foreign body
- Hyperimmune mucositis reaction to adjacent plaque
- Mucocutaneous pyoderma
- Mechanical injury or trauma (eg, chewing on an electric cord)
- Thermal injury
- Chemical injury
- Drug reaction (eg, methotrexate [shown to cause oral ulceration in humans])
- Breed predisposition (eg, Cavalier King Charles spaniel)
- Viral infection (canine distemper virus)
- Erythema multiforme
- Malignancy (eg, amelanotic melanoma, squamous cell carcinoma, fibrosarcoma, epitheliotropic lymphoma, melanoma, osteosarcoma)
- Uremia
- Eosinophilic granuloma
- Lupus erythematosus (discoid, mucocutaneous)
- Pemphigus vulgaris or pemphigus foliaceus
- Bullous pemphigoid or mucous membrane pemphigoid
- Candidiasis
- *Leptospira* spp infection
- Chemotherapy or radiation therapy

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January/February 2022

clinicalnotes™

Wintertime Worries: Why Parasites Are Still a Problem

Lindsay A. Starkey, DVM, PhD, DACVM (Parasitology)

KEY POINTS

- Many pet owners still believe that parasites do not pose a threat during the cooler seasons of the year; however, the risk is rarely absent, with activity for some parasites even increasing during the cooler months.
- Pet owners should be educated on the risks that exist to their pets throughout the different seasons and that the best way to prevent parasite-related problems is to use safe and effective year-round prevention strategies.
- Consistent, cohesive communication amongst the veterinary team and pet owners is key to the implementation and continuation of a new or updated parasite control strategy.
- Even though not all parasites may pose the same risk during all months of the year in all locations, year-round implementation of a parasite prevention program, including the use of broad-spectrum parasite preventive products, is still recommended.
- The veterinary team should also work to find the product(s) that best fit the lifestyle of the pet and preferences of the owner to ensure compliance.

Although many veterinary professionals recommend year-round use of broad-spectrum parasiticides for all patients to protect both animal and human health,[1-3] pushback still exists among clients. One key factor behind some of this pushback centers around the perceived "seasonality of parasites," the idea that parasites do not pose a threat during the cooler seasons of the year. Some parasites may tend to have decreased activity in colder weather, but nevertheless, the risk is rarely, if ever, absent. In fact, activity for some parasites may even increase during the cooler months.[4-6]

Seasonality of Parasites

Ectoparasites

It would seem to make sense that ectoparasites such as fleas, ticks, and mosquitoes would become less active or disappear in harsh winter weather; however, more data continue to describe that the risk for ectoparasites is not absent in the winter months.[4,5,7]

Many tick species can survive in colder temperatures, and some even thrive in temperatures near freezing.[7] In a survey, veterinarians across the United States collected ticks from pets entering their clinic.[4] Ticks were recovered from dogs and cats every month of the year. Of the ticks submitted from October through March, ≈61% collected from dogs and 72% collected from cats were *Ixodes scapularis*.[4] The second most common tick collected from dogs during those winter months was *Rhipicephalus sanguineus*, at ≈19% of the total ticks.[4]

Similar data regarding fleas exist. In one collaborative global flea-monitoring study, veterinarians collected flea eggs from infested pets entering their practice year-round.[5] The months with the fewest flea eggs collected and submitted were January through March, with peak months running August through October.[5]

Internal Parasites

When infecting pets, internal parasites are being housed at ≈101.5°F (38.6°C), with plenty of surrounding nutrients to support their existence. Furthermore, parasites with life stages that are hardy in adverse climatic conditions (eg, roundworms, whipworms, tapeworms) are primed for transmission year-round.

For internal parasites, stages within animals that do not receive treatment are fully

protected against the outside world, although their offspring (typically eggs) may enter an environment that could be incompatible with life, especially in the winter. However, the eggs of some parasites are incredibly resilient and can withstand freezing temperatures and other climate adversities.[8-10] In addition, some internal parasites utilize intermediate or paratenic hosts for transmission, through which the immature parasite stages may survive for extended periods while safely contained within that host. Using the data available through the Companion Animal Parasite Council, a recent study detailed the seasonality of fecal-based diagnoses for select internal parasites of dogs.[6] Year after year, detection of both roundworm and whipworm infections peaked during the cooler months as compared with hookworms, which were identified more frequently in the warmer months. Survivability of environmental stages, seasonal use of preventive products, and canine breeding season were hypothesized as contributing to the seasonal nature of internal parasite detection.[6]

"Off-Season" Strategies

How can compliance with recommendations for year-round parasite prevention and protocols, including the use of broad-spectrum products, be increased? As with so many preventive care challenges, the answer lies in improving client education and communication.

More information regarding the threat of parasitism in the "off season" is available now than ever before. Through utilization of the published literature, interactive websites with county-level data, and one's own clinical experiences and findings, pet owners can be educated on the risks that exist to their pets during the different times of year and that the best way to prevent parasite-related problems is to stay ahead of them by using safe and effective year-round prevention strategies. These can include in- or on-pet approaches (eg, broad-spectrum preventive products), as well as environmental strategies such as fecal stewardship, limiting roaming and scavenging behaviors, and vector mitigation in and around the home.

Communication is also key to the implementation and continuation of a new or updated strategy regarding parasite control. The entire veterinary team must be on-board so that clients receive a cohesive and consistent message on year-round parasite prevention and its importance. The team must also continue to communicate the importance after the visit, whether that be with directed, timely reminders for re-dosing or monthly social media updates highlighting local parasite data. These follow-up conversations can serve as opportunities for encouragement and positive reinforcement with clients.

Lastly, but most importantly, parasite prevention should make it easy for the pet owner to succeed. That means finding the products that best fit the lifestyle of the pet and preferences of the pet owner. Would using something long-lasting that only needs to be administered every few months increase the owner's ability to comply with recommendations? Does the owner want to give a "treat," or would they prefer to apply something topically? Are there skin or food allergies to consider? Offering too many product choices can make it harder for pet owners to make a decision; limiting product recommendations to a few options allows for consistent messaging and inventory control but still permits owners to choose preventives that best suit their needs. It is imperative that the veterinary team actively include the client in the decision-making process, combining the owner's knowledge of their capabilities and their pet with the team's knowledge of risks and products that will result in the most comprehensive and effective strategy for parasite prevention.

Conclusion

The data that continue to be gathered and published highlight year-round parasite risk for pets, regardless of lifestyle or geography. Even though not all parasites may pose the same risk during all months of the year in all locations, year-round implementation of a parasite prevention program, including the use of broad-spectrum parasite preventive products, is still recommended. Compliant use of the right product or combination of products by pet owners will be beneficial for controlling and preventing parasitic diseases in pets.

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MERCK Animal Health

FROM CLINICIAN'S BRIEF ON SOCIAL MEDIA

WE ASKED ...

During radiography, do you sedate patients or use restraint with staff wearing personal protective equipment?

"Unless it is an orthopedic or surgery patient, we only use sedation if gentle restraint is not possible. Most pet owners are nervous about sedation, and it is not worth the additional cost and time if the patient is cooperative."—*Tiffany B*

"Sedated patients need to stay in the clinic for monitoring, which requires additional paperwork; therefore, we only sedate painful or aggressive patients."—*Courtney M*

"We use sedation only, except in an extreme emergency. Nothing outweighs the patient's health!"—*Justine B*

"I sedate every patient, even if staff must be in the room, so we can get a good quality radiograph on the first try and minimize exposure."—*Louis L*

"We sedate patients for orthopedic radiography, but we usually use restraint for soft tissue radiography."—*Magy P*

What is the highest packed cell volume you have seen in a patient?

"Upper 80s in a patient with polycythemia vera. We would drain her blood every 3 months."—*Briana R*

"88% in a 16-year-old Chihuahua with assumed polycythemia vera. Blood work 2 months prior was 79%. It lived another 6 months after that packed cell volume reading but was unable to be medicated."—*Danielle S*

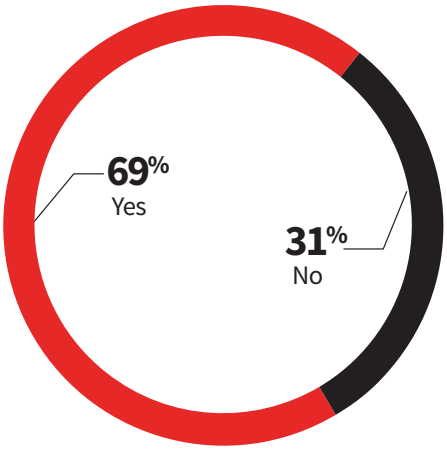
"89% in a senior oncology patient" —*Lia M*

"92.6% in a greyhound with exertional rhabdomyolysis"—*Georgina H*

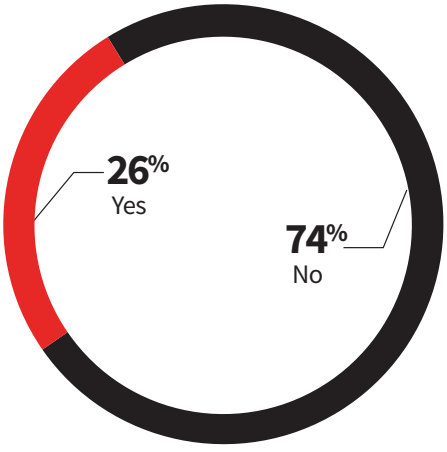
"93% in a dog with hemorrhagic gastroenteritis"—*Ali B*

"We have a dog that comes in for phlebotomy every couple of weeks. His packed cell volume is in the 80s." —*Melinda K*

Do you feel like the pandemic has led to less socialized puppies and kittens?



Do you have an isolation ward with a dedicated exterior entrance/exit?



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TAKING ON TOUGH QUESTIONS

AMERICAN HEARTWORM SOCIETY™ EST. 1974

FAQs ABOUT HEARTWORM DIAGNOSIS, PREVENTION AND MANAGEMENT

Q Dear AHS: I know the AHS recommends year-round heartworm prevention for pets. However, I practice in the Upper Midwest where we have very cold winters. How can I justify giving heartworm prevention when there isn't a mosquito in sight? – *Dr. M.*

CHRIS DUKE, DVM
BIENVILLE ANIMAL MEDICAL CENTER
OCEAN SPRINGS, MISSISSIPPI
President, AHS

THE SHORT ANSWER

It is more difficult to predict when you'll see either the first OR the last mosquito of the year, and that makes "seasonal" prevention challenging. Improved compliance and the ability to control additional parasites also help justify year-round prevention.

Dear Dr. M.,

This is a logical question heard from both practitioners and pet owners. Heartworms are spread by mosquitoes, so why would you recommend year-round heartworm prevention if you live in an area with cold, snowy winters? Here are three important points to consider:

1. Urban "heat islands" can extend the heartworm transmission season. The length of the heartworm transmission season is dependent on having levels of heat and humidity that can support a viable mosquito population and incubation of heartworm larvae to the infective stage in the mosquito. While climatic data suggest there are time periods when the temperatures are too cold to support heartworm transmission, these data fail to account for the presence of microenvironments called **urban heat islands**.

Census data tell us that >82 percent of the U.S. population live in cities and urban areas. The urban heat island effect occurs when daytime heat is retained in buildings and parking lots, creating protected spaces where mosquito vectors can thrive well past the months historically referred to as heartworm "season." With weather patterns being hard to predict, maintaining pets on preventives eliminates guesswork and ensures pets won't inadvertently be exposed.

2. Broad-spectrum heartworm preventives protect pets against multiple parasites. Depending on the product your clients are using, heartworm preventives may **protect their pets from intestinal parasites as well as external parasites** such as fleas and ticks. Studies have shown that the prevalence of roundworms and whipworms peaks during the winter months. Meanwhile, fleas live indoors as well as outdoors, so the need to protect pets doesn't disappear when the temperature drops. Some tick species, such as *Ixodes scapularis*, actually prefer cooler conditions to balmier ones and can survive near-freezing temperatures. Arbitrarily discontinuing the pet's preventive because the summer has passed can put pets at risk for other parasitic diseases.

3. Avoiding on-again, off-again preventive use ensures pets are protected when they need it. Stopping and starting heartworm preventives can be penny-wise and pound-foolish. The cost savings incurred by discontinuing preventive administration during cold-weather months are eclipsed by the cost of treatment, which typically run $1,000 or more. Meanwhile, the impact of heartworm disease on a pet's health can be life altering and life-long.

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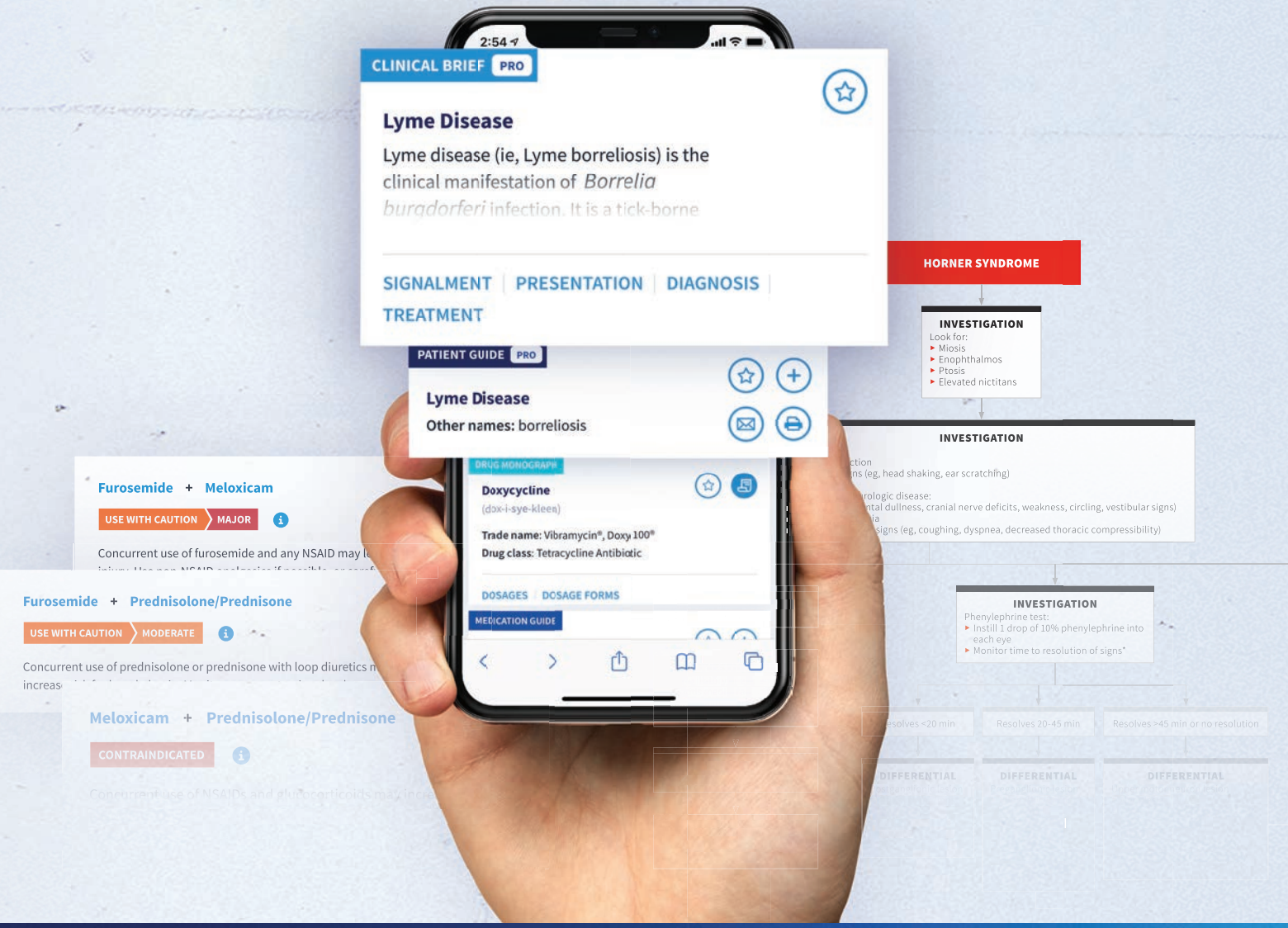

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QUIZ CORNER

QUIZ YOURSELF

on this issue's features

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1 **PATHOGEN PROFILE** **PAGE 11**

Which of the following statements regarding severe acute respiratory syndrome coronavirus 2 in animals is *true*?

A. Dogs and cats may act as mechanical vectors (fomites) to humans through hair coat contamination.
B. Dogs are highly susceptible to infection and frequently develop serious clinical illness.
C. An inactivated vaccine is licensed for use in dogs and cats in the United States.
D. There is a high seroprevalence rate in cats with owners diagnosed with coronavirus disease.

2 **TOP 5** **PAGE 17**

Which of the following statements regarding analgesic pain control for surgical procedures is *false*?

A. Alpha-2 agonists provide effective analgesia but only light sedation.
B. NSAIDs alone are not optimal for managing most surgical pain.
C. Administrating NSAIDs postoperatively can prevent potential negative impacts on renal function during anesthesia-induced hypotension.
D. Ketamine can be administered as a perioperative infusion alone or in combination with an opioid infusion (eg, fentanyl CRI).

3 **A MATTER OF OPINION** **PAGE 26**

Early gonadectomy in dogs may increase the risk for all the following except _____.

A. Joint disease
B. Mammary tumor development
C. Urinary incontinence
D. Nonreproductive cancers

4 **PROCEDURES PRO** **PAGE 69**

Where is the main blood supply to the tail?

A. The dorsal aspect of the tail
B. The ventral aspect of the tail
C. Both lateral aspects of the tail
D. None of the above

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

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