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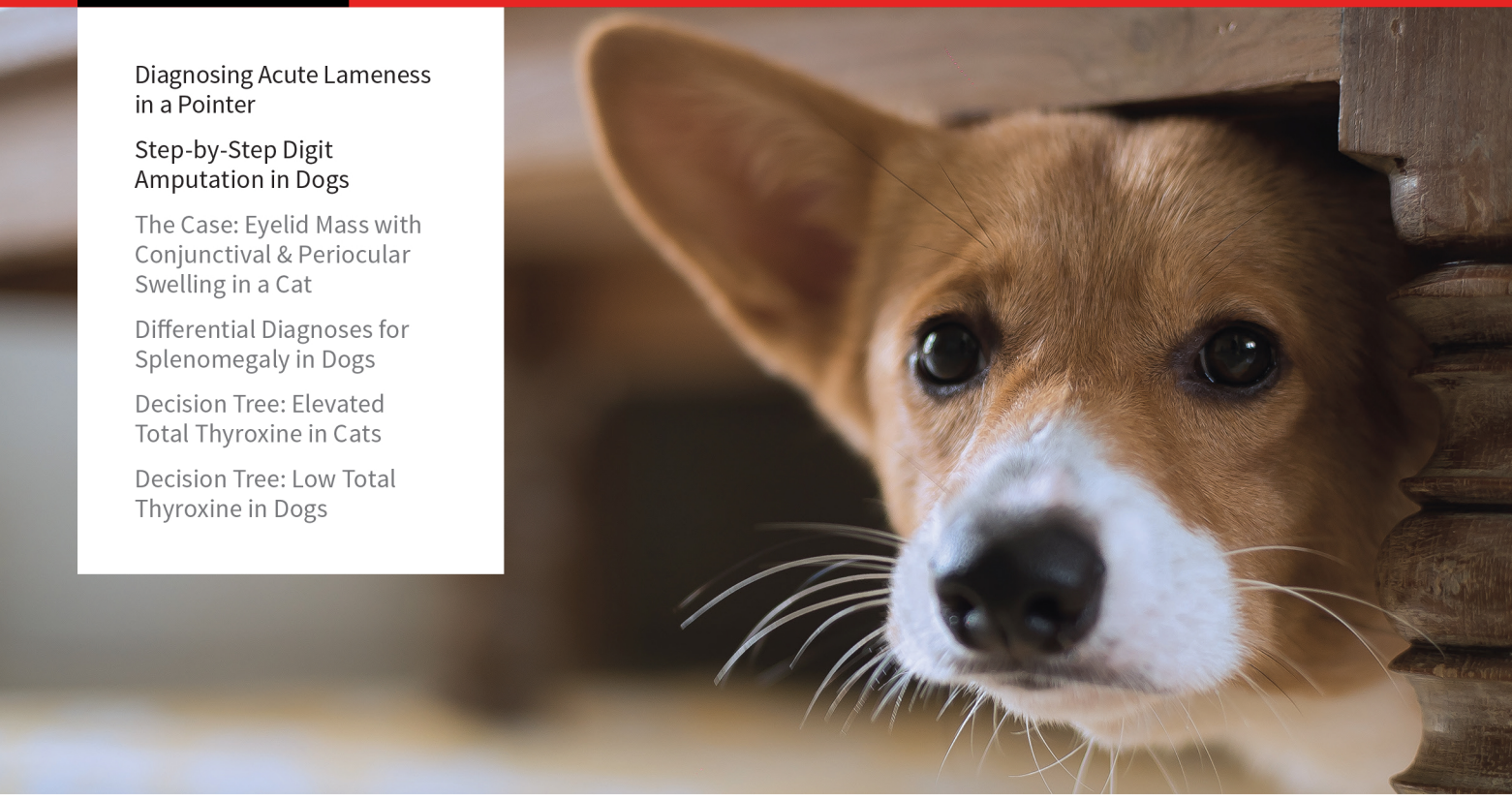
TOP 5 SIGNS OF PATIENT STRESS & EXCITEMENT ON CLINICAL PATHOLOGY

IN THIS ISSUE



Volume 20 Number 3

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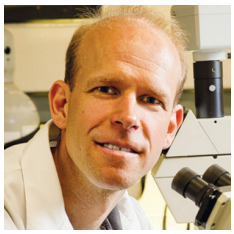

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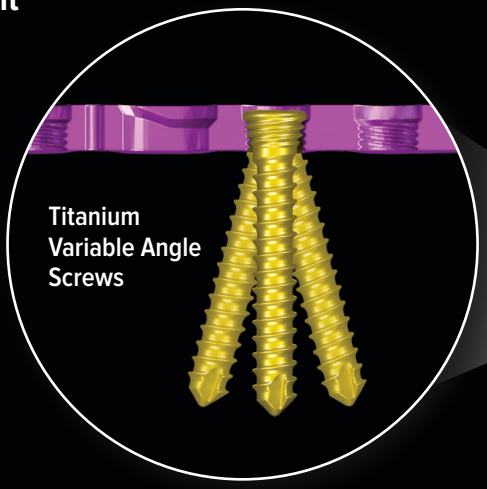

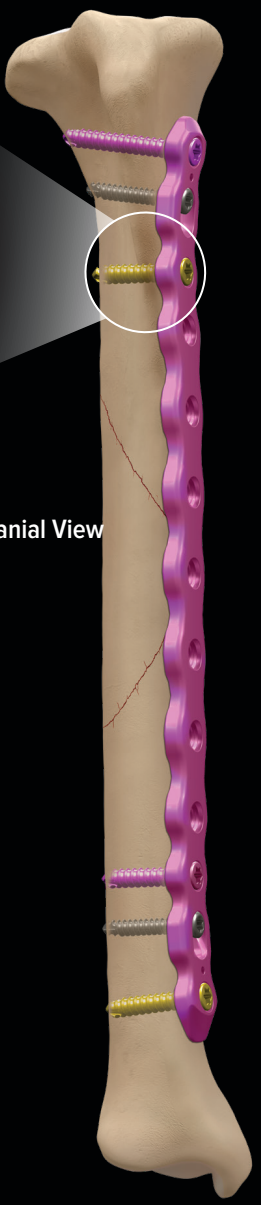

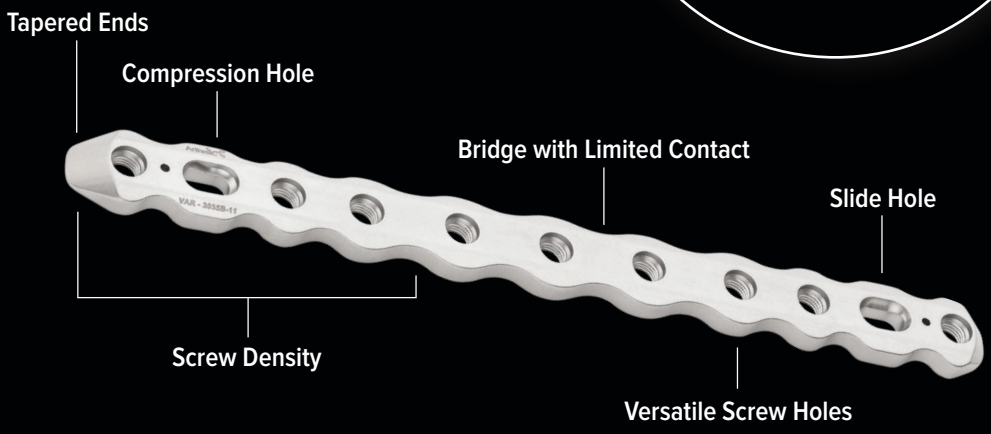

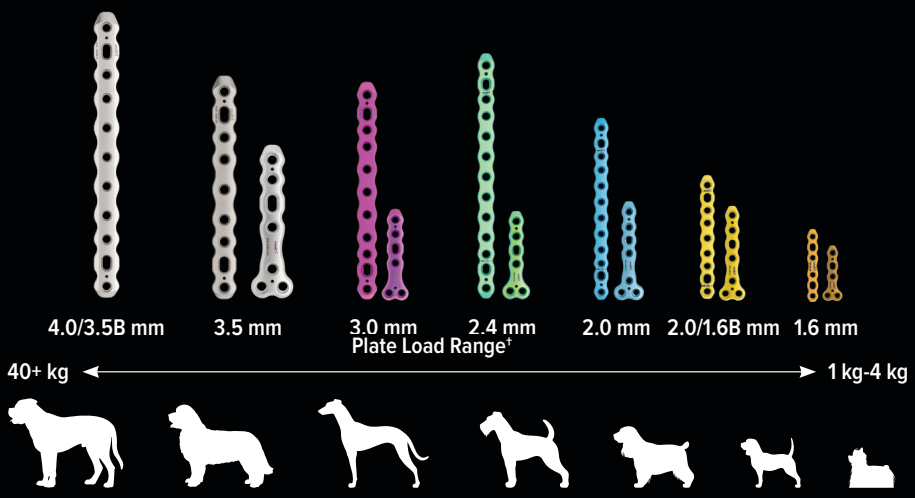

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OUR AUTHORS

JUDITH BERTRAN, DVM, MS, DACVS (SA), is an assistant professor of surgical oncology at University of Florida. Dr. Bertran earned her DVM from Autonomous University of Barcelona in Spain. She also completed an internship in small animal medicine and surgery at Washington State University, an internship in small animal surgery at Fitzpatrick Referrals in Godalming, England, and a residency in small animal surgery and a surgical oncology fellowship at The Ohio State University, where she also earned her MS. Her research interests are in metastatic cancer to the lymph nodes, lymph node mapping, and molecular profiles of metastatic lymph nodes.

PROCEDURES PRO PAGE 65

SARAH BOSCH, DVM, is pursuing a clinical pathology residency at University of Florida. She earned her DVM from Cummings School of Veterinary Medicine at Tufts University and completed a diagnostic medicine internship at Kansas State University.

CASE IN POINT PAGE 55

KRISTYN D. BROADDUS, DVM, MS, DACVS, is a small animal surgeon and owner of Veterinary Specialists of Hanover in Mechanicsville, Virginia. Dr. Broaddus earned her DVM from Michigan State University. She completed a small animal rotating internship and small animal surgery residency and earned her MS at Auburn University. Her interests are in soft tissue surgery, orthopedics, and teaching and speaking at veterinary continuing education events.

HISTORY & PHYSICAL EXAMINATION PAGE 12

ELIJAH ERNST, DVM, is a resident in small animal internal medicine at North Carolina State University, where he also completed a rotating medicine and surgery internship. He earned his DVM from The Ohio State University.

DIFFERENTIAL DIAGNOSIS PAGE 61

KARYN HARRELL, DVM, DACVIM (SAIM), is an assistant professor at North Carolina State University, where she also serves as intern director of small animal rotating internships and established the radioactive iodine clinic. Her clinical interests include hematology and immunology, especially immune-mediated hemolytic anemia and idiopathic thrombocytopenia, and teaching clinical medicine.

DIFFERENTIAL DIAGNOSIS PAGE 61

HEATHER KVITKO-WHITE, DVM, DACVIM (SAIM), is a small animal internal medicine specialist, founder and president of KW Veterinary Consulting in Kansas City, Missouri, and a national speaker who promotes a creative and common-sense approach to caring for patients without sacrificing quality. She earned her DVM from The Ohio State University, completed a small animal rotating internship at Purdue University, and completed an internal medicine residency at Texas A&M University. Her interests are in teaching pragmatic veterinary medicine, mentoring veterinary students and house officers, and developing continuing education content at all industry levels.

DIAGNOSTIC/MANAGEMENT TREE PAGE 18

PATTY LATHAN, VMD, MS, DACVIM (SAIM), is an associate professor of small animal internal medicine at Mississippi State University, where she also completed an internship. Dr. Lathan completed a small animal internal medicine residency at Purdue University. Her clinical interests are in adrenal function testing, diabetes mellitus, and stress hyperglycemia.

DIAGNOSTIC/MANAGEMENT TREE PAGE 20

KA YUNG LEE, DVM, is a small animal rotating intern at Tuskegee University. Dr. Lee earned her DVM at Kyungpook National University in Daegu, South Korea, and participated in VSTEP at Ontario Veterinary College in Guelph, Ontario, Canada. Her clinical interests are in soft tissue surgery, surgical oncology, and international veterinary medicine.

PROCEDURES PRO PAGE 65

Continues on page 5

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See page 5 for product information summary.

JESSICA MEEKINS, DVM, MS, DACVO, is an associate professor of ophthalmology at Kansas State University. Dr. Meekins earned her DVM from The Ohio State University, completed a rotating internship at a private specialty hospital in Albuquerque, New Mexico, and was accepted into the ophthalmology residency training program at Purdue University. Her clinical and research interests are in management of viral surface ocular diseases in cats.

CASE IN POINT PAGE 55

SUSAN NELSON, DVM, is a clinical professor at Kansas State University, where she also earned her DVM. Dr. Nelson also works in conjunction with mental health therapists in the instruction of communication skills. Her interests are in wellness, preventive medicine, and palliative care options for patients unable to receive advanced treatment.

CASE IN POINT PAGE 55

LISA M. POHLMAN, DVM, MS, DACVP, is an associate professor of clinical pathology at Kansas State University. She earned her DVM from University of Guelph and her MS from Auburn University, where she also completed a residency. Dr. Pohlman serves as the president and medical director of the Riley County Humane Society in Manhattan, Kansas, and is an active teacher and mentor of veterinary interns, residents, and graduate students. Her research interests include improvement of clinical pathology laboratory methods and identification and characterization of disease in domestic species.

CASE IN POINT PAGE 55

R. DARREN WOOD, DVM, DVSc, DACVP (Clinical Pathology), is an associate professor of clinical pathology at University of Guelph in Guelph, Ontario, Canada, where he also earned his DVSc. Dr. Wood earned his DVM from University of Prince Edward Island in Charlottetown, Prince Edward Island, Canada, and served as president of the American Society for Veterinary Clinical Pathology. His interests include hemostasis and molecular biomarkers of cancer in dogs.

TOP 5 PAGE 51

FROM CLINICIAN'S BRIEF ON SOCIAL MEDIA

WE ASKED ...

Would you rather repeat veterinary school or high school?

57% Veterinary school

43% High school

"I enjoyed both until my senior year of veterinary school. I had great friends in high school, which made all the difference."—*Amy C*

"Neither; both were challenging in their own ways."—*Heather R*

"High school was the best time of my life. I was carefree and had zero responsibilities. I would go back in a heartbeat."—*Deanne M*

"Veterinary school, without a doubt! Those were the best years of my life, and I spent them with the best friends I have ever had."—*Cindy G*

Would you be in favor of state or federal regulations that limit or ban noncompete clauses in veterinary medicine?

74% Yes

26% No

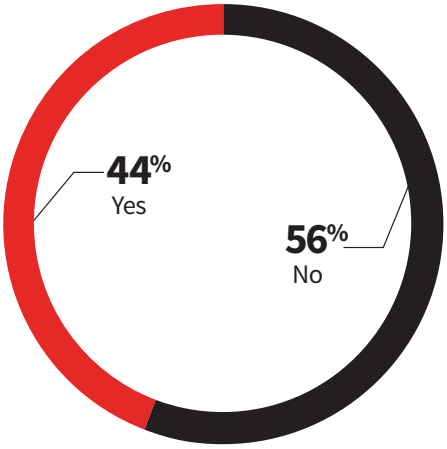
"I do not accept positions with non-compete clauses."—*Anthony T*

"Regulations should only apply to individuals selling or starting practices, not associates moving from one clinic to another."—*Kim F*

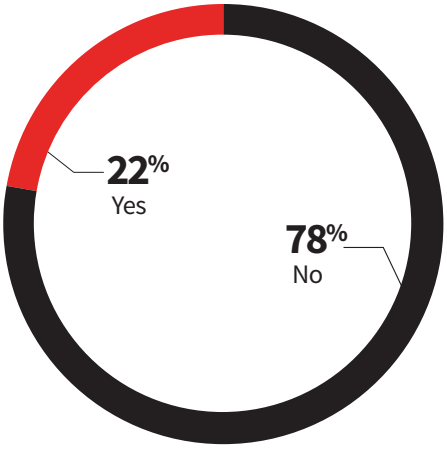
"Limits maybe, but not a ban." —*Kate S*

"As a former owner and someone now job searching as an associate, I am in favor of limited time and radius noncompete clauses. It is not fair for an owner to invest in an associate who then opens a clinic next door, but it is also not fair that an associate who is treated poorly must move to get a new job."—*Danielle C*

Do you routinely fast patients when treating acute pancreatitis?



Do you administer an anticholinergic to combat bradycardia in dogs that have received dexmedetomidine as a premedication?



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Reference: 1. Data on file, Study No. D870R-US-21-045, 2021, Zoetis Inc.

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IN THIS ISSUE

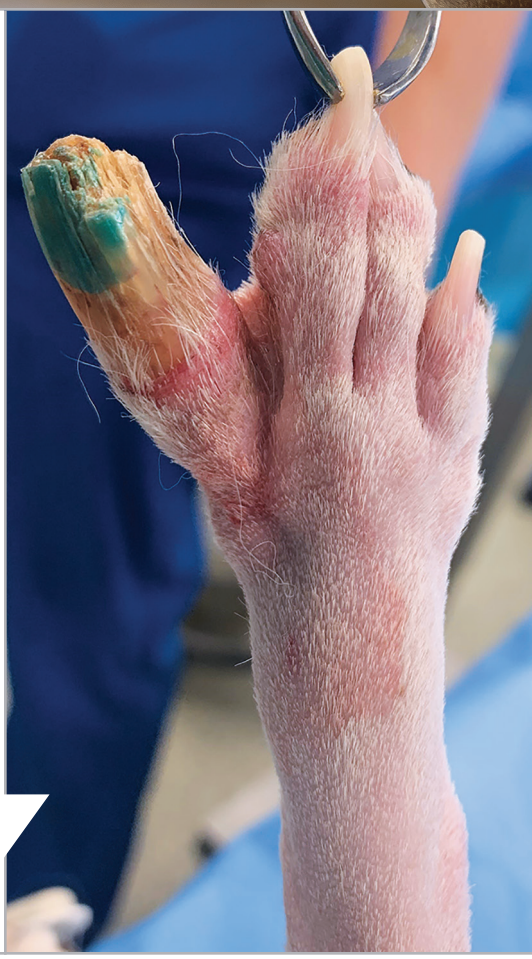
ON THE COVER

TOP 5

Top 5 Signs of Patient Stress & Excitement on Clinical Pathology

R. Darren Wood, DVM, DVSc, DACVP (Clinical Pathology)

PG 51



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References: 1. LaFleur RL, Dant JC, Tubbs AL, et al. Prevention of leptospiremia and leptospiruria following vaccination with a DAPPv + 4-way *Leptospira* combination vaccine. Presented at: Proceedings of the ISCAID Symposium; October 16–19, 2016; Bristol, UK. **2.** LaFleur RL, Dant JC, Wasmoen TL. Prevention of disease and mortality in vaccinated dogs following experimental challenge with virulent *Leptospira*. *J Vet Int Med*. 2011;25:747.

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Demodicosis & Secondary Bacterial Folliculitis in a Dog

Christina Monika Gentry, DVM, DACVD

brief.vet/bacterial_folliculitis

PODCAST

Feline Orthopedic Examination with Dr. Gordon-Evans

Wanda J. Gordon-Evans, DVM, PhD, DACVS, DACVSMR, explains why evaluating for musculoskeletal pain in cats is challenging but important.

brief.vet/orthopedic_examination

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HISTORY & PHYSICAL EXAMINATION

ACUTE LAMENESS IN A POINTER

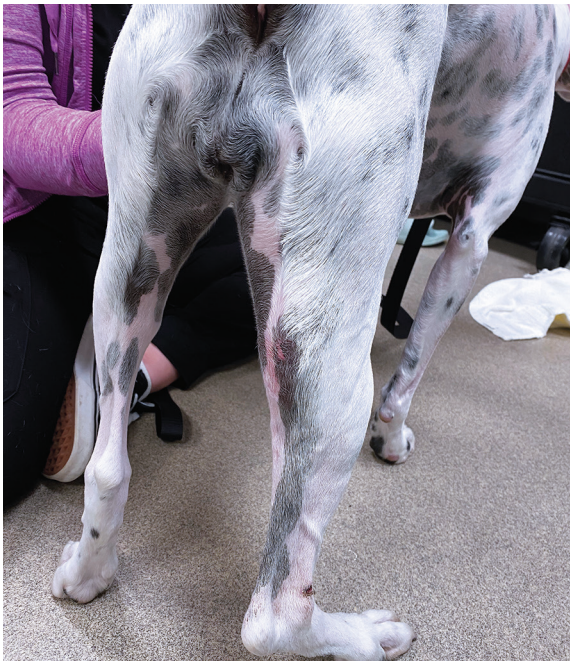
Kristyn D. Broaddus, DVM, MS, DACVS
Veterinary Specialists of Hanover
Mechanicsville, Virginia

Mable, a 3-year-old spayed pointer, is presented with acute right pelvic limb lameness (right pelvic limb is non-weight–bearing) of 2-days' duration. She has no history of previous lameness. Her owner reports she had been standing on top of her doghouse (≈4.5 ft off the ground) on the day she was injured.

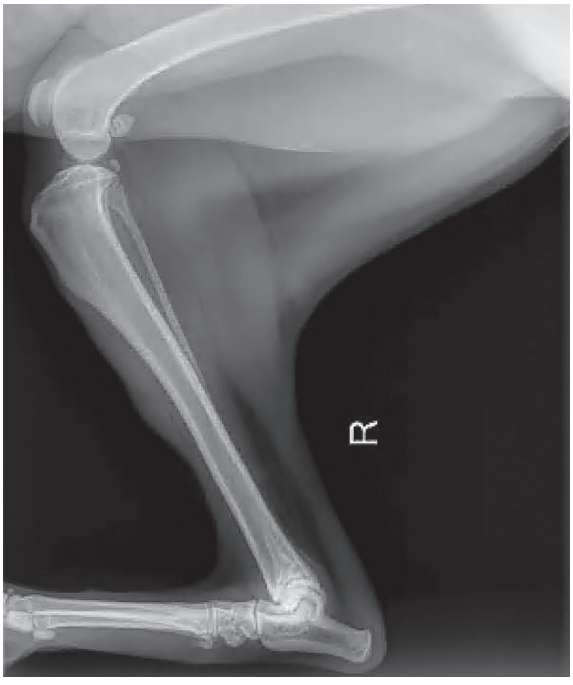
▲ **FIGURE 1** Lateral view in which increased flexion of the tarsus independent of the stifle can be seen. The stifle is extended to compensate for loss of functional limb length.

▲ **FIGURE 2** A small skin laceration over the distal aspect of the lateral tibia is visible.

Her owner reports she had been standing on top of her doghouse (≈4.5 ft off the ground) on the day she was injured.



▲ **FIGURE 3** Caudal view in which the right pelvic limb has a dropped hock and there is a faintly bruised region over the gastrocnemius muscle bellies, where swelling is appreciated



▲ **FIGURE 4** Lateral radiograph of the affected right pelvic limb. No fractures or luxations are noted.

History

Mable has congenital deafness but is otherwise healthy. Her BCS is 4/9. She was spayed at 6 months of age without complication. She receives routine flea, tick, and heartworm preventives. One other dog also lives in the household; both dogs are fed a commercially prepared raw diet. Mable's owner reports she is a high-energy dog that performs in agility competitions and has traveled throughout the southeastern coastal part of the United States.

Physical Examination

On physical examination, Mable is tachycardic (180 bpm) and panting. Her temperature is 103.1ºF (39.5ºC). When she occasionally places the affected limb on the ground, she has a plantigrade stance. Mable is sedated due to her high stress level.

Pain is isolated to the hock region, and hyperflexion of the tarsus independent of the stifle is easily appreciated (***Figure 1***). During manual flexion of the tarsus, a crab claw appearance of the paw is noted. Diameter of the right Achilles tendon (ie, calcaneal tendon) is reduced by 25% relative to the left side. A firm knot is palpated deep in the gastrocnemius muscle bellies, a faint bruise is noted over the swelling on the caudal aspect of the thigh, and a 2-cm laceration is seen over the lateral aspect of the distal tibia (***Figures 2*** and ***3***). Radiographs of the right pelvic limb do not indicate fractures or luxations (***Figure 4***).

How would you diagnose and treat this patient?

QUESTION 1

What is the most likely cause of this patient's mild temperature elevation?

A. Excitement and stress
B. Tick-borne disease
C. Inflammation from laceration on laterodistal hock
D. Septic tarsal joint from consuming a raw diet

QUESTION 2

Which of the following imaging modalities would be most cost-effective for further initial evaluation of this patient's injury?

A. Radiography
B. Ultrasonography
C. CT
D. MRI

QUESTION 3

Gastrocnemius, superficial digital flexor tendon, biceps femoris, gracillus, and semitendinosus define the _____ tendon.

A. Supraspinatus
B. Suspensory
C. Achilles
D. Iliopsoas

QUESTION 4

What is the standard course of treatment to maximize possible full tarsal function return in a patient with acute, complete rupture of the Achilles tendon?

A. Ehmer sling for 6 weeks
B. Partial tarsal arthrodesis
C. Surgical repair of the Achilles tendon with 6 to 12 weeks of external coaptation via splint, cast, custom orthotic, or external fixator
D. Injection of stem cells to the swollen region with cage rest for 4 weeks

QUESTION 5

True or false? External coaptation with a custom orthotic or splint is a nonsurgical option in a patient with a chronic, partial tear.

A. True
B. False

QUESTION 6

What is the most relevant cause of the plantigrade/dropped hock stance in this patient?

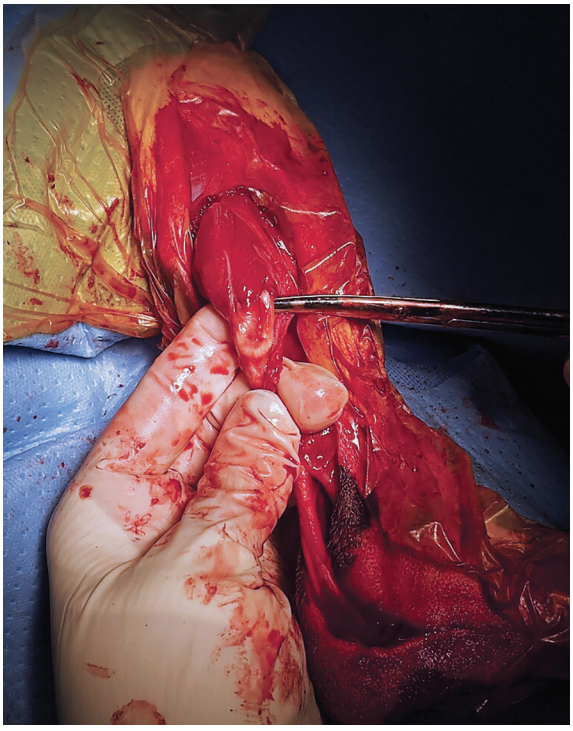
A. Metatarsal fracture II-V
B. Central tarsal bone fracture
C. Achilles tendon rupture
D. Degenerative myelopathy

TURN THE PAGE TO SEE THE RESULTS

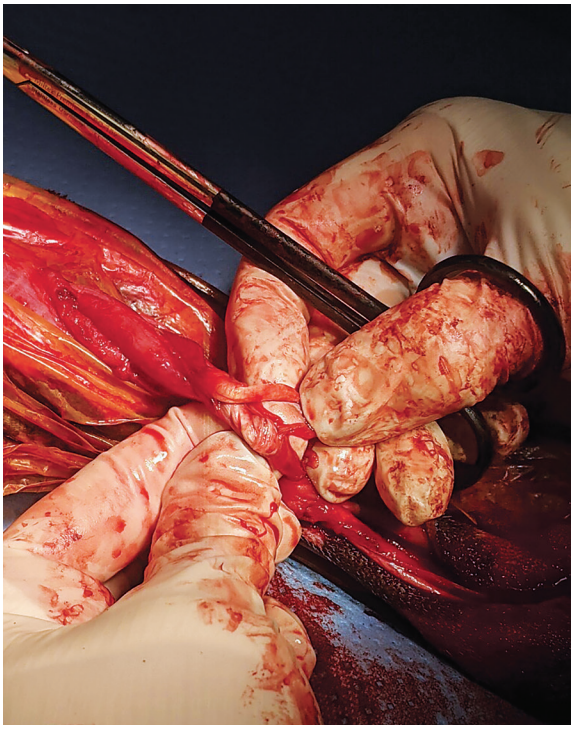
Treatment & Outcome

Surgery was performed to repair the full Achilles tendon rupture. The primary repair involved suturing the tendon ends to the calcaneus bone using bone tunnels and a 3-loop pulley with 0 polypropylene. Polypropylene mesh was used as additional reinforcement to reconstruct the Achilles tendon and its components (***Figures 5*** and ***6***).

External coaptation was provided via a cast that was transitioned to a caudal splint after 4 weeks. At 8 weeks, the splint was transitioned to a soft bandage. All bandages (ie, cast, splint, soft) were changed weekly. At 10 weeks, all external support was removed, and Mable's activity was restricted for an additional 4 weeks. At her 16-week follow-up, Mable had a normal gait and stance.



▲ **FIGURE 5** Intraoperative view of the gastrocnemius tendons (2) that are torn and retracted into the muscle bellies



▲ **FIGURE 6** Intraoperative view of the lacerated gastrocnemius tendons being dissected out so they can be reattached to the calcaneus bone

Suggested Reading

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Lamb CR, Duvernois A. Ultrasonographic anatomy of the normal canine calcaneal tendon. *Vet Radiol Ultrasound*. 2005;46(4):326-330.

Lin M, Glass EN, Kent N. Utility of MRI for evaluation of calcanean tendon rupture in a dog: case report. *Front Vet Sci*. 2020;7:602.

Meutsege FJ. The classification of canine Achilles tendon lesions. *Vet Comp Orthop Traumatol*. 1993;6(1):53-55.

Answers

1:A, 2:B, 3:C, 4:C, 5:A, 6:C

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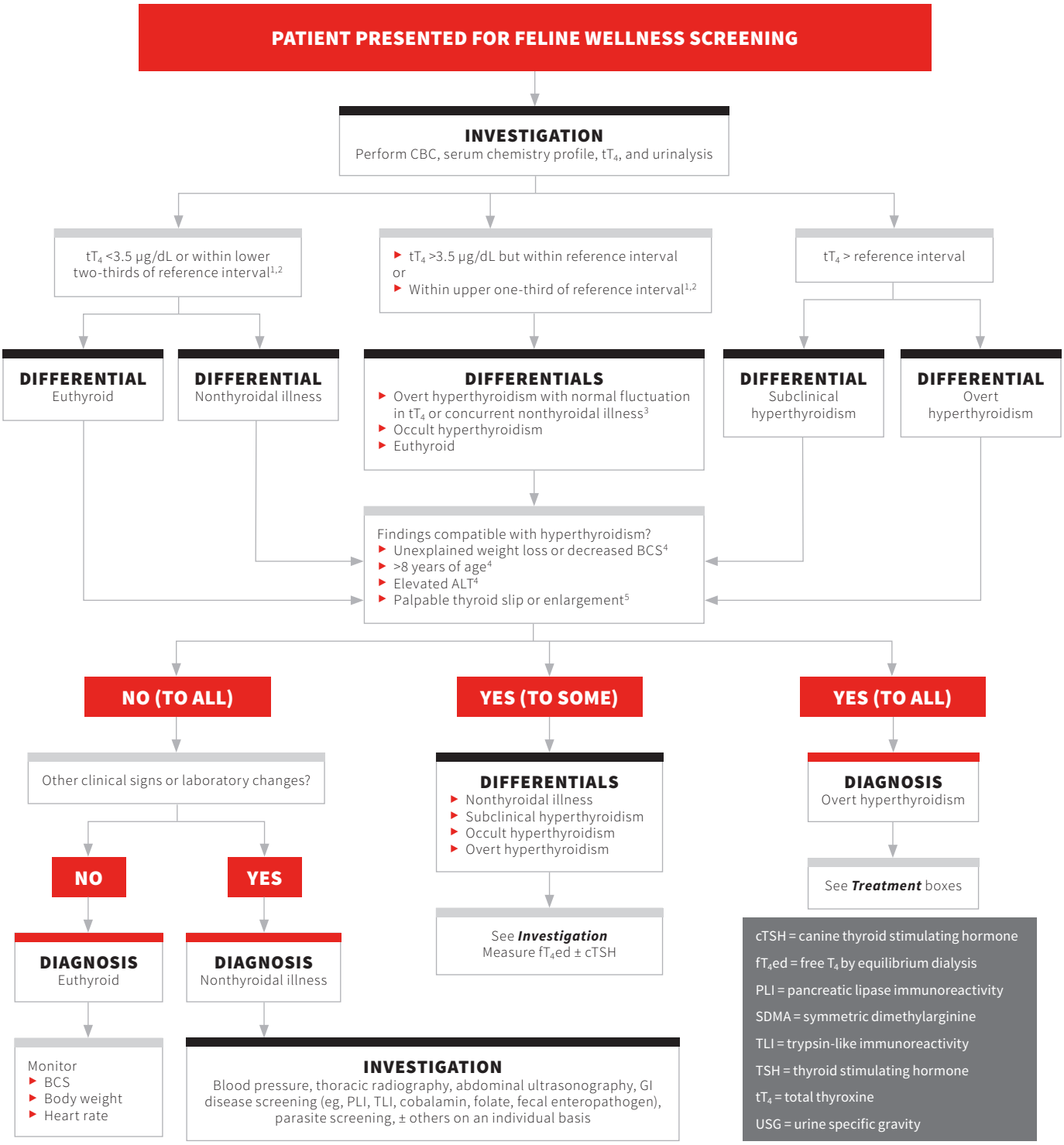
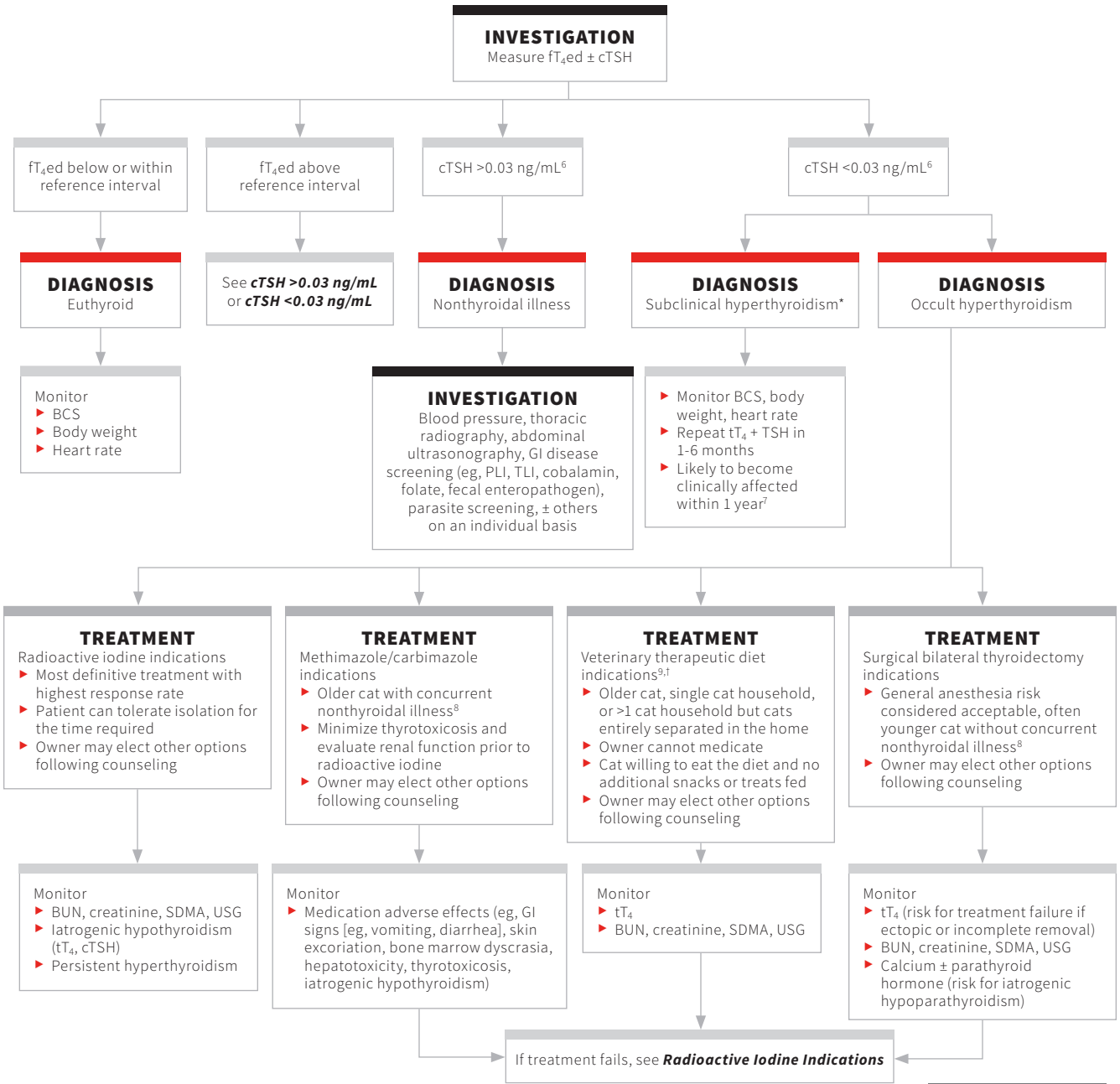
Heather Kvitko-White, DVM, DACVIM (SAIM)
KW Veterinary Consulting
Kansas City, Missouri



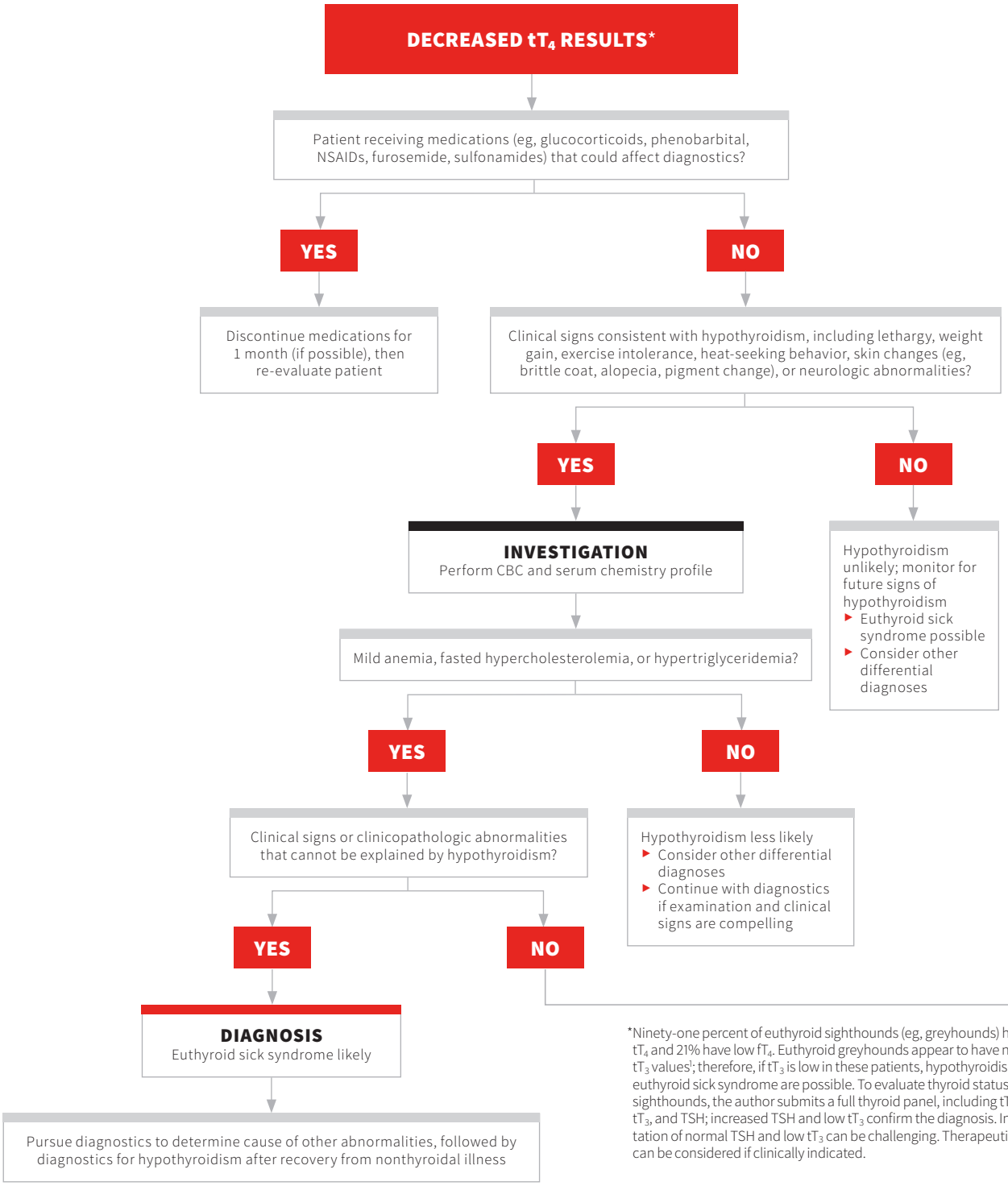


*Cats diagnosed with subclinical hyperthyroidism usually develop occult hyperthyroidism within one year.[7]
†Treatment failure in 1 out of 10 patients

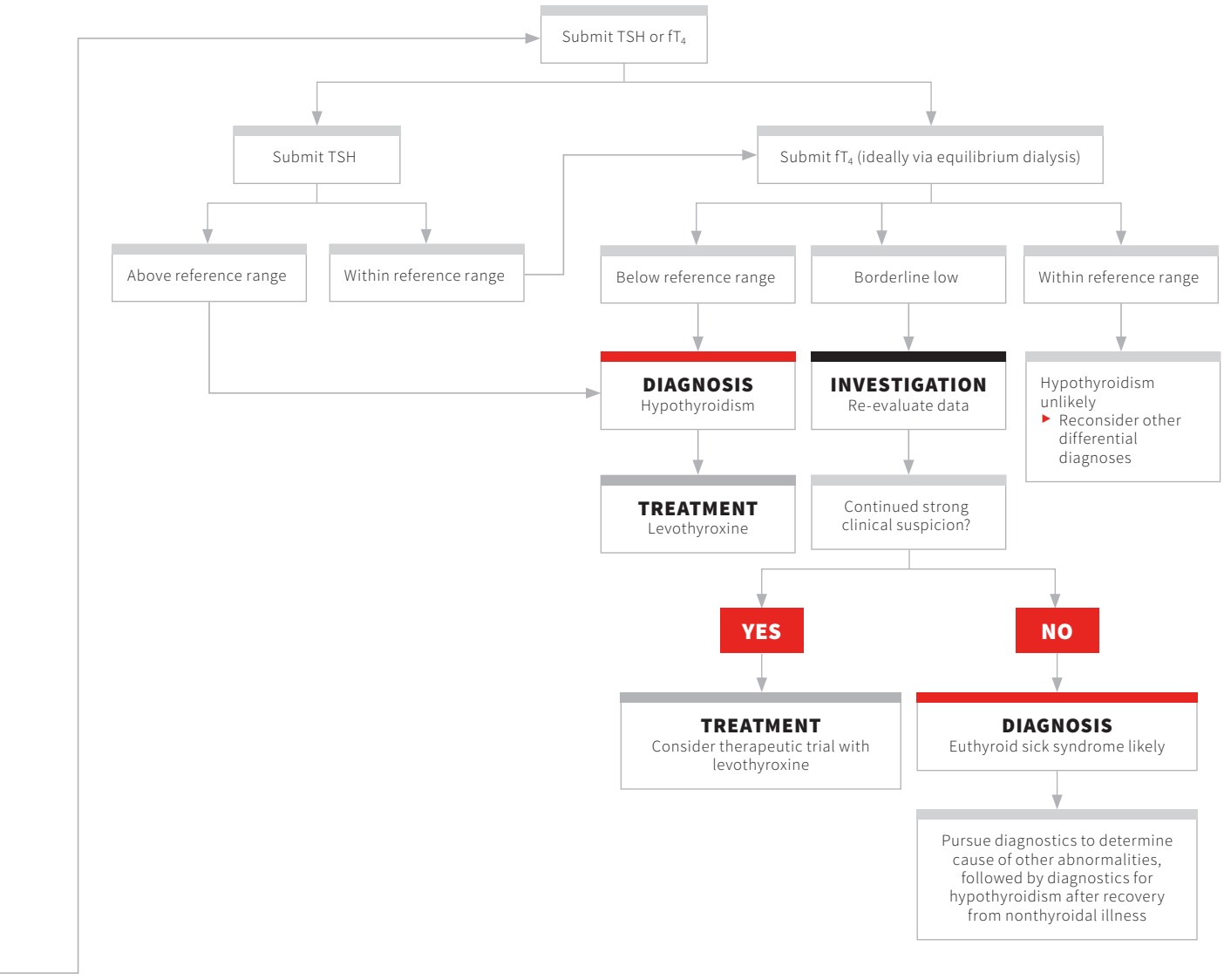
References on page 60.

LOW TOTAL THYROXINE IN DOGS

Patty Lathan, VMD, MS, DACVIM (SAIM)
Mississippi State University



*Ninety-one percent of euthyroid sighthounds (eg, greyhounds) have low tT_4 and 21% have low fT_4. Euthyroid greyhounds appear to have normal tT_3 values[1]; therefore, if tT_3 is low in these patients, hypothyroidism or euthyroid sick syndrome are possible. To evaluate thyroid status in sighthounds, the author submits a full thyroid panel, including tT_4, fT_4, tT_3, and TSH; increased TSH and low tT_3 confirm the diagnosis. Interpretation of normal TSH and low tT_3 can be challenging. Therapeutic trial can be considered if clinically indicated.



fT_4 = free thyroxine
TSH = thyroid stimulating hormone
tT_3 = total triiodothyronine
tT_4 = total thyroxine

Reference

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FROM PAGE TO PATIENT

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

Identifying and Managing High-Risk Cats: How Early Intervention Helps Avert Clinical Diabetes

Chen Gilor, DVM, PhD, DACVIM (SAIM)
Associate Professor, Small Animal Internal Medicine
Department of Small Animal Clinical Sciences
College of Veterinary Medicine
University of Florida

Q Your research has focused on identifying strategies to delay or prevent the need for insulin therapy in pets. Why do you feel this approach is so important?

A I want to do right by my patients, and disease prevention is better for them than any treatment strategy. Insulin therapy can be dangerous, complicated and expensive. Not only are there risks for the diabetic patient, including hypoglycemia and diabetic ketoacidosis, but insulin administration and monitoring of pets with insulin-dependent diabetes can be quite burdensome for the pet owner.

Q The terms "prediabetes" and "subclinical diabetes" are used to describe cats at risk of clinical diabetes. What do these terms mean?

A Prediabetes and subclinical diabetes are not well defined in veterinary medicine. Although risk criteria for prediabetes have been suggested, they have not yet been tested in a prospective, longitudinal study. The diagnosis of subclinical diabetes is applied to patients with glucose and/or glycated protein (fructosamine, A1C) measurements that are consistent with diabetes but not yet displaying clinical signs of overt diabetes or insulin dependence.[1]

It's fair to say that cats probably follow a similar course to humans with Type 2 diabetes, in that during the prediabetic and subclinical phases, it's still possible to change course. Weight management is important: Although most obese cats will not develop diabetes, we know that these cats are at increased risk of developing diabetes because of the association of obesity with insulin resistance.

Practitioners can be proactive with patients they believe to be at risk. The three pieces to the feline diabetes puzzle are: (1) **preserve beta cell function and avert its further loss;** (2) **decrease insulin resistance; and** (3) **decrease carbohydrate consumption** (see Figure 1).

Q What steps can practitioners take to identify and manage cats at risk?

A **Regularly monitor cats for changes in blood glucose and other parameters.** A caveat to this is that stress can cause temporary elevation of blood glucose, causing practitioners to sometimes dismiss high glucose readings. Fructosamine levels can be measured, although if a cat has an average blood glucose of around 160, a fructosamine test may not be sensitive enough to determine if that patient has diabetes. A more sensitive parameter to measure might be A1C levels. When I see high blood glucose readings—especially with an obese cat—I typically run a hemoglobin A1C test.

Facilitate weight loss. In addition to nutritional management, there are safe, effective drugs that are useful. I emphasize to clients that if the intervention can prevent the cat from developing diabetes, it's worth it.

Recommend a therapeutic diet. If the cat is not already on a **low-carbohydrate diet,** such as one of the canned Purina® Pro Plan® Veterinary Diets DM Dietetic Management® Feline Formulas, they should start. Diets such as these have high protein content to help maintain lean body mass, which is key as the cat loses weight.

Preserve beta cell function and avert its further loss. This is currently the most challenging step. Aggressive management of hyperglycemia and hyperlipidemia might help reduce beta cell glucolipotoxicity. Drugs in the GLP-1 receptor agonist family likely help in beta cell preservation and have been studied in cats, with similar effects noted in people and other models of diabetes.[2]

Weight loss and preserving beta cell function are also key to achieving remission in a diabetic cat. Veterinarians often ask me for my recommendations on the best insulin or diet for a particular patient with diabetes and how to achieve remission. However, I believe that successful management of patients with diabetes—as well as diabetes prevention—isn't really about these kinds of isolated choices. It's about understanding all of the options available and determining the right combination for the individual owner and patient with whom you're working.

Preventing clinical diabetes in at-risk cats.

- Preserving beta cell function in the pancreas and preventing beta cell loss helps ensure the production of insulin.

- Increasing insulin sensitivity decreases the amount of insulin needed to keep the cat in a non-diabetic state.
- Decreasing dietary carbohydrate reduces the cat's insulin needs.

Figure 1.

1 *European Society of Veterinary Endocrinology, Project ALIVE, Subclinical diabetes mellitus in dogs and cats. https://www.esve.org/alive/search.aspx (Accessed Jan. 26, 2022)*

2 *Gilor C, Rudinsky AJ, Hall MJ. New Approaches to Feline Diabetes Mellitus: Glucagon-like peptide-1 analogs. J Feline Med Surg. 2016 Sep;18(9):733-43.*

Veterinary/Client Commitment Key to Managing Diabetic Cats

Jocelyn Mott, DVM, DACVIM (SAIM)
Diabetes Fellow
University of Florida

Successful management of cats with diabetes requires close supervision, regular monitoring, dedication and excellent teamwork by the cat's owner and veterinarian. A therapeutic and dietary protocol should be tailored to fit both the medical needs of the individual cat and the abilities, wishes and lifestyle of the owner. Many owners who initially are hesitant about insulin therapy become more comfortable and committed with time and experience. Some owners want to do everything possible and, in those cats, tight glycemic control with the goal of remission would be appropriate. Clients should be informed that most diabetic cats need lifelong insulin therapy and monitoring.

Here are my recommendations:

1. Encourage observation. Improvement or worsening of signs can be an indication that a cat's insulin requirements may be changing. Owners should monitor for improvement in signs such as decreased water consumption, decreased urine production, and changes in appetite, weight and activity levels.

Signs of worsening glycemic control can include decreased appetite or anorexia, lethargy, and/or dramatic weight loss or weight gain. Owners can report these signs to their veterinarians to inform decisions about insulin adjustments.

Clients should be educated to watch for signs of hypoglycemia, such as disorientation, ataxia or seizures—and, if these occur, to inform their veterinarian immediately. Owners should also keep Karo syrup or dextrose paste on hand to administer as they seek immediate veterinary care.

2. Emphasize appropriate nutrition. For diabetic cats, I typically recommend therapeutic low-carbohydrate diets such as Purina® Pro Plan® Veterinary Diets DM Dietetic Management® Feline Formulas. If a cat won't eat a therapeutic diabetic low-carbohydrate diet, I may recommend a change to a lower carbohydrate canned diet than he or she was eating when the diabetes developed.

For an overweight diabetic cat, I'll first recommend a therapeutic diabetic low-carbohydrate diet that is also indicated for weight loss. However, if the cat does not lose weight on that diet, I may recommend a therapeutic weight management diet, then switch to a therapeutic diabetic diet after weight loss has been achieved.

3. Discuss at-home glucose monitoring. Diabetic cats need regular monitoring of glucose levels to maintain good glycemic control and maintain the correct insulin dose. Continuous blood glucose monitoring devices are a great way to monitor cats at home and can make hospital visits less frequent. If clients want to do home blood glucose curves, I advise they use a glucometer designed specifically for pets. However, clients should only adjust insulin doses based on their veterinarian's directions. If home monitoring is not an option for the owner, then blood glucose curves and/or fructosamine levels should be performed regularly with their veterinarian.

4. Schedule regular check-ups. Ongoing veterinary appointments are needed to monitor patients with feline diabetes and to catch any developing comorbidities—such as pancreatitis, urinary tract infections, hyperadrenocorticism, renal disease, dental disease or obesity—early. Even if owners are monitoring the cat's blood glucose levels or using continuous glucose monitoring at home and the cat appears well controlled, I still like to examine and reassess the cat about every three months.

5. Communicate between clinic visits. Regular reinforcement via phone calls and/or emails from their veterinary team can help ensure that clients follow their cat's treatment and monitoring protocols. If a technician on staff shows interest in managing cats with diabetes, he or she can be a valuable resource.

Ensuring that clients feel confident in their ability to care for their diabetic pet is essential. While reaching this point can take time, the process can be rewarding for all concerned.

Diabetes and Diet:

Answering FAQs About Feline Diabetes Management

Emily Cross, DVM, DABVP (Canine/Feline)
Director of Publications and Education,
Purina Institute
Nestlé Purina PetCare

Here are some common queries from veterinarians about feeding cats with diabetes.

What is the optimal feeding frequency for diabetic cats?

Administering insulin with a morning and evening meal is commonly recommended for feline patients—if the client is willing and the timing works for patient and owner. However, if an owner feeds their cat *ad libitum* or the cat is picky and needs fresh food offered more frequently during the day, I don't dictate a cat only be fed when insulin is administered. One study showed cats do not have the same postprandial hyperglycemia seen in canine and human diabetics.[1]

Why is it important to maintain cats with diabetes on a therapeutic diet after they've achieved remission?

Fortunately, diet is something we can control in our patients with diabetes. However, it is essential that clients view their cat's therapeutic diet as a lifelong form of therapy.

A client may think that if his or her cat is in diabetic remission, the problem is fixed and the cat can resume eating the previously fed over-the-counter (OTC) diet. A cat in remission might appear normal, but the therapeutic high-protein/low-carbohydrate diet must continue to be fed because an increase in digestible carbohydrate could lead to dysregulated blood glucose and a need to reinstitute exogenous insulin.

Some clients will ask if they can use a high protein/low carbohydrate OTC canned diet. While this strategy is possible, the client should understand that such diets are designed for healthy cats, not cats with the specific requirements of a diabetic. In addition, if the diet is reformulated and the type or amount of carbohydrate is changed, that could be an issue for a cat with diabetes. To manage conditions, therapeutic diets should be used under the guidance of a veterinarian.

Can diabetic cats lose weight on a high-calorie dry diet formulated for management of cats with diabetes?

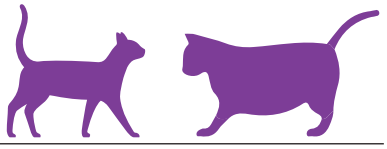
If a diabetic patient is obese or overweight, then weight loss is a priority and canned food may offer a benefit. I recommend owners try a wet therapeutic diet such as Purina® Pro Plan® Veterinary Diets DM Dietetic Management® canned Feline Formula, which is high in protein, moderate in fat and low in carbohydrate. Moisture can help dilute calories, increasing the volume of food consumed per kilocalorie. Even cats that are used to eating dry food can often be transitioned to all canned if done over time.

However, if an obese diabetic cat strongly prefers dry food, I may recommend a calorie-restricted dry diet like Purina® Pro Plan® Veterinary Diets OM Overweight Management® Feline Formula, which is higher in carbohydrate compared to DM canned or dry, and use insulin to maintain diabetic control. Ultimately the cat may be able to transition to lower-carbohydrate DM dry once weight-loss goals have been reached. However, client education is a must in such cases, given that the volume of DM fed will be significantly less than that of OM.

1 *Martin GJ, Rand JS. Food intake and blood glucose in normal and diabetic cats fed* ad libitum. *J Feline Med Surg. 1999;1(4):241-251. doi:10.1053/jfms.1999.0052.*

Feline Diabetes by the Numbers

Overweight cats have **4.6x** greater risk of diabetes than cats in ideal body condition.



Approximately **1 in 5** obese cats >8 years of age are prediabetic.

Best odds of diabetes remission occur if glycemic control is achieved within **6 months** of diagnosis.

25% to 30% of cats in remission will relapse and require that insulin be restarted.

Source: Gottlieb S, Rand J. Managing feline diabetes: current perspectives. Vet Med (Auckl) 2018;9:33-42. Published 2018 Jun 19. doi:10.2147/VMRR.S125619.

Key Takeaways

- Practitioners can reduce risk and decrease insulin resistance in cats by recommending low-carbohydrate diets and weight loss for obese cats.
- A diet change—either to a therapeutic low-carbohydrate diet or to a therapeutic weight-loss diet for overweight cats—is an essential step for managing patients with diabetes.
- Clients should view a therapeutic diet as a lifelong form of therapy for their diabetic cats, even if the cats are in remission.

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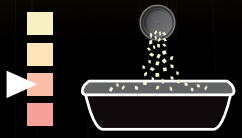

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Neutrophil-to-Lymphocyte Ratio in Canine Inflammatory Bowel Disease

Jonjo Reece, DVM
Mary Anna Labato, DVM, DACVIM (SAIM)
Cummings School of Veterinary Medicine at Tufts University

During inflammatory states, the neutrophil count may increase, whereas the lymphocyte count may decrease.[3]

In the literature

Benvenuti E, Pierini A, Gori E, Lucarelli C, Lubas G, Marchetti V. Neutrophil-to-lymphocyte ratio (NLR) in canine inflammatory bowel disease (IBD). *Vet Sci*. 2020;7(3):141.

FROM THE PAGE …

Canine inflammatory bowel disease (IBD) is characterized by idiopathic intestinal inflammation and lack of response to diet and antibiotic treatments.[1] Histopathology of the intestinal tract and response to immunosuppressive therapy are required for definitive diagnosis. Factors associated with negative outcomes for dogs with IBD include the chronic canine enteropathy clinical activity index (CCECAI), a high endoscopic score in the duodenum, hypocobalaminemia (<200 ng/L), and hypoalbuminemia (<20 g/L).[2]

Predictive markers are still needed to classify IBD-affected dogs into risk groups. One such prospective marker is the neutrophil:lymphocyte ratio (NLR). During inflammatory states, the neutrophil count may increase, whereas the lymphocyte count may decrease.[3] NLR is an accessible parameter that can easily be calculated as a ratio between absolute neutrophils and lymphocytes using a WBC count differential.[3] In studies of human patients with IBD, NLR appeared to be higher in patients with active disease.[4]

This retrospective study evaluated the clinical and prognostic significance of NLR in dogs with IBD. NLR of healthy control dogs (n = 150) was compared with dogs with IBD (n = 41). The correlation between NLR and several variables, including CCECAI and endoscopic histology scores, was investigated. After one month of treatment with immunosuppressive therapy, differences in NLR between responders and nonresponders were assessed.

Results revealed that dogs with IBD had higher median NLRs than the control dogs (4.78 vs 3), although most dogs with IBD had neutrophil and lymphocyte counts within reference intervals. There was a moderate positive correlation between NLR and CCECAI at the time of admission, which supports the potential use of NLR as a marker of clinical disease severity in canine IBD. NLR seemed to be negatively correlated with total protein, albumin, and cholesterol levels. NLR was higher in dogs diagnosed with protein-losing enteropathy, potentially due to loss of lymphocytes through ruptured lacteals.[4] The only significant histologic parameter associated with NLR was the presence of lacteal dilation. In the study population, NLR did not differ significantly between endoscopic or histologic score groups. After one month of immunosuppressive therapy, the median NLR was significantly higher in nonresponders than responders (12.23 vs 4.58).

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Because of its poor sensitivity and specificity, increased NLR should not be used as the sole diagnostic criteria for canine IBD or lymphangiectasia. Although NLR can be used to further support suspicion of these disorders, histologic diagnosis is still required.
2. NLR has potential use as a marker of disease severity in canine IBD as well as for clinical monitoring of therapeutic response in cases of chronic enteropathies. NLR can be easily calculated by dividing the absolute neutrophil count by the absolute lymphocyte count using the results of routine blood work.
3. NLR can be impacted by stress and chronic disease states. The extent of impact has not been examined, and further studies are needed.

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1. Dandrieux JRS. Inflammatory bowel disease versus chronic enteropathy in dogs: are they one and the same? *J Small Anim Pract*. 2016;57(11):589-599.
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Research Note: **Chronic Enteropathy in French Bulldogs & Miniature Dachshunds**

Chronic enteropathy (CE) in dogs is categorized into subtypes according to responsiveness to food trials, antibiotics, or steroids/immunosuppressants. CE unresponsive to any of these treatments is classified as *nonresponsive enteropathy*. Differentiating subtypes can be difficult due to clinical and histologic similarities. The major histocompatibility complex (MHC) class II genotype in humans and the canine MHC (ie, dog leukocyte antigen [DLA]) genotype have been associated with several immune-mediated conditions.

This study examined the potential for determining susceptibility to refractory CE through identification of risk and protective genotypes in French bulldogs and miniature dachshunds. No statistical difference was noted between dachshunds and controls. In French bulldogs, several significant associations were found between DLA class II genotypes and refractory CE. These findings support an immunogenetic component of CE in French bulldogs. Further studies involving larger sample sizes and different breeds may aid in early diagnosis, treatment, and prevention of CE through epigenetic approaches and breeding.

Source

Nakazawa M, Miyamae J, Okano M, et al. Dog leukocyte antigen (DLA) class II genotypes associated with chronic enteropathy in French bulldogs and miniature dachshunds. *Vet Immunol Immunopathol*. 2021;237:110271.

Congenital Ocular Malformations

Shelby Reinstein, DVM, MS, DACVO
VETgirl
Bucks County, Pennsylvania

These malformations result from abnormal embryonic development, which may occur spontaneously or due to gestational teratogens, including both genetic and nongenetic factors.

In the literature

Saraiva IQ, Delgado E. Congenital ocular malformations in dogs and cats: 123 cases. *Vet Ophthalmol*. 2020;23(6):964-978.

FROM THE PAGE ...

Congenital ocular malformations are rare in dogs and cats and include abnormalities present at birth, after the eye opens, or at ≈6 to 8 weeks of age. These malformations result from abnormal embryonic development, which may occur spontaneously or due to gestational teratogens, including both genetic and nongenetic factors. Some congenital ocular disorders have been identified as heritable within a breed (eg, collie eye anomaly) and form the basis for breeding recommendations by veterinary ophthalmologists. In humans, congenital ocular malformations are a leading cause of childhood blindness, and veterinary models are often used to investigate disease mechanisms and treatment options.

This study sought to identify the prevalence and epidemiology of congenital ocular malformations in dogs and cats presented to a veterinary teaching hospital in Portugal. A prospective and retrospective evaluation of medical records included data on age, breed, sex, medical history, reason for presentation, clinical findings, vision impairment, and treatment options.

Of the 32,974 dogs and 13,977 cats evaluated, 103 (0.3%) dogs and 20 (0.1%) cats were diagnosed with a congenital malformation in one or both eyes. The most commonly identified ocular malformations in both dogs and cats were congenital cataracts, microphthalmia, and persistent pupillary membranes. Among dogs with ocular dermoids, French bulldogs were significantly overrepresented (75% of cases). No sex predisposition was identified for any congenital ocular malformation.

Surgery was performed on 25 dogs to address congenital ocular malformations. The most common procedures were ocular dermoid removal (12 dogs) and cataract phacoemulsifica-

tion with intraocular lens implantation (9 dogs). Four cats underwent surgery (3 for microphthalmos and/or entropion and one for enucleation due to congenital glaucoma).

This study highlighted the rarity of congenital ocular malformations in dogs and cats and provided insight into these conditions. It is important to be aware of the most common congenital eye conditions, as treatment options may be available. Additional exploration of the possible hereditary nature of ocular dermoids in French bulldogs is warranted.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Congenital ocular malformations are rare in dogs and cats. The most frequently diagnosed conditions are congenital cataracts, microphthalmia, and persistent pupillary membranes. Congenital cataracts and microphthalmia may affect vision, and referral to a veterinary ophthalmologist for surgical evaluation is recommended.

2. Persistent pupillary membranes vary in appearance and are named based on the structures with which they associate (ie, iris-to-iris, iris-to-lens, iris-to-cornea). In addition, persistent pupillary membranes may simply appear as a cluster of pigment on the anterior lens capsule without overt pigment strands; this type of persistent pupillary membrane is common in dogs, especially cocker spaniels. The most common type of persistent pupillary membrane in cats is iris-to-cornea, and a corneal opacity is usually present at the endothelial attachment point.

3. French bulldogs appear to be predisposed to ocular dermoids. Clinically, dermoids are typically located on the eyelids, conjunctiva, or limbus of the cornea. The most common complication is corneal irritation, and surgery to remove the dermoid is often recommended.

Suggested Reading

Badanes Z, Ledbetter EC. Ocular dermoids in dogs: a retrospective study. *Vet Ophthalmol*. 2019;22(6):760-766.

Cook CS. Ocular embryology and congenital malformations. In: Gelatt KN, Gilger BC, Kern TJ, eds. *Veterinary Ophthalmology*. 5th ed. John Wiley & Sons; 2013:3-38.

Glaze MB. Congenital and hereditary ocular abnormalities in cats. *Clin Tech Small Anim Pract*. 2005;20(2):74-82.

Research Note: **Detecting Ionized Hypocalcemia**

Serum total calcium (tCa) exists in 3 fractions: protein-bound (primarily albumin), ionized (iCa), and complexed. iCa is the most clinically relevant fraction of tCa for evaluating calcium homeostasis; however, methods for measuring iCa in clinical practice are not always readily available. Although formulas to adjust tCa to correct for serum protein concentration have been evaluated, these formulas are not designed for and do not predict iCa in the general population. These formulas were hypothesized to be predictive of iCa in patients with hypoalbuminemia but not hyperphosphatemia, which can affect the complexed fraction of calcium.

A retrospective review of 262 dogs with serum albumin concentration ≤2.5 g/L and serum phosphorus concentration ≤5 mg/dL calculated adjusted calcium concentration (aCa) using the formula:

$$aCa = tCa\ (mg/dL) - \text{serum albumin concentration}\ (g/dL) + 3.5\ (g/dL)$$

Results demonstrated that low aCa was useful for accurate detection of ionized hypocalcemia in this population of dogs.

Source

De Witte F, Klag A, Chapman P. Adjusted calcium concentration as a predictor of ionized hypocalcemia in hypoalbuminemic dogs. *J Vet Intern Med*. 2021;35(5):2249-2255.

Screening Dogs for Hip Dysplasia

Heather L. Troyer, DVM, DABVP, CVA, CVPP
Oradell Animal Hospital
Paramus, New Jersey

Hip joint laxity can lead to abnormal acetabular contact with the femoral head, which can exacerbate the disease.

In the literature

Haney PS, Lazarowski L, Wang X, et al. Effectiveness of PennHIP and Orthopedic Foundation for Animals measurements of hip joint quality for breeding selection to reduce hip dysplasia in a population of purpose-bred detection dogs. *J Am Vet Med Assoc*. 2020;257(3):299-304.

FROM THE PAGE ...

Although hip dysplasia is a malformation of the hip joint, the consequent degenerative joint disease (DJD) is largely caused by the dynamic and abnormal articulation of the femoral head within the acetabulum. Hip joint laxity can lead to abnormal acetabular contact with the femoral head, which can exacerbate the disease. DJD is the primary reason for medical intervention in older dogs, as pain and decreased range of motion typically impact daily activities, particularly exercise and mobility, posturing to urinate and defecate, overall engagement, and advanced exercises (eg, agility, detection/law enforcement work, guide dog work).

This study details the PennHIP scoring system for detecting congenital hip dysplasia and suggests that quantifying hip laxity is a key factor in improving hip joint quality scores. PennHIP evaluations are performed by PennHIP specialists to measure passive hip joint laxity of the pelvis under compression or distraction, which changes the femoral head displacement from the center of the acetabulum. The measured distance is then divided by the radius of the femoral head, resulting in a unitless measure of joint laxity (ie, the distraction index [DI]), which is more accurately predictive of DJD risk than subjective methods (eg, the Orthopedic Foundation for Animals [OFA] system—a 7-point scoring system that describes nondysplastic hips as excellent, good, or fair and dysplastic hips as mild, moderate, or severe).[1,2] The PennHIP index is most useful in patients <24 months of age and in females not in estrus, as hormonal changes have been shown to directly correlate with hip laxity.[3]

… TO YOUR PATIENTS

Key pearls to put into practice:

1. DJD is the most common reason military working dogs >5 years of age are discharged.[4] Attention to multimodal pain management, including joint restorative therapies, is important in these patients.

2. When screening for hip dysplasia, it is key to obtain quality radiographs taken with the patient under sedation. The positive predictive value of standard OFA positioning may be enhanced by the addition of DI values to OFA hip joint scores.

3. Limitations exist when screening young dogs for hip dysplasia. Environmental factors, estrus, breed, body weight, frame size, history of strenuous activity, and poor muscle mass can contribute to joint laxity. It is thus important to educate pet owners about the specific needs of their dog when deciding whether radiography is warranted to evaluate hip integrity.

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4. Evans RI, Herbold JR, Bradshaw BS, Moore GE. Causes for discharge of military working dogs from service: 268 cases (2000-2004). *J Am Vet Med Assoc*. 2007;231(8):1215-1220.

Suggested Reading

Antech imaging services. The key to reducing canine hip dysplasia. AIS website. Accessed January 2021. https://antechimagingservices.com/antechweb/pdf/AIS_PennHIP_Brochure_2015.pdf

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See page 29 for product information summary.

Effect of Dietary Starch Sources on Canine Lipidemia

Camille Torres-Henderson, DVM, DABVP (Canine/Feline)
Colorado State University

In the literature

Teixeira FA, Machado DP, Jeremias JT, Queiroz MR, Pontieri CFF, Brunetto MA. Starch sources influence lipidaemia of diabetic dogs. *BMC Vet Res*. 2020;16(1):2.

Pea protein has been found to reduce triglyceride and cholesterol levels in some species.[4-8]

FROM THE PAGE ...

Hyperlipidemia is a disturbance of lipid metabolism that results in increased serum lipids (ie, triglycerides, cholesterol, or both). Hyperlipidemia in a fasted state is abnormal and indicates accelerated synthesis or reduced degradation of lipoproteins. Hyperlipidemia due to a lipid disorder is primary (ie, a defect of lipoprotein metabolism) or secondary (ie, characterized by increased lipoproteins, decreased lipoprotein catabolism, or both).

This randomized, crossover, double-blinded study evaluated the effects of 3 high-starch diets (ie, dietary peas/barley, peas/barley/rice, corn) in 12 dogs with stable diabetes and a history of hyperlipidemia. Dogs were fed a basal diet (9% fat on a dry-matter basis) for 60 days, then randomized to be fed each of the test diets for 60 days. The test diets had similar percentages of crude protein, fat, fiber, and ash but differed in sources of starch (ie, peas and barley vs corn). At the end of the test period, plasma triglyceride and cholesterol curves were measured over 10 hours.

Mean plasma triglyceride levels were significantly lower after the pea and barley diet trial as compared with the basal diet trial at fasting and 8 hours postprandial and as compared with the corn diet trial 4 hours postprandial. Mean, minimum, and maximum plasma cholesterol levels were significantly lower after the pea and barley diet as compared with the corn diet at all time points except during fasting; there were no differences as compared with the basal diet.

Feeding a lower-fat diet is considered critical for hyperlipidemia management. The results of this study suggest that dietary ingredients may also play an important role. Although dogs fed the pea and barley diet had lower cholesterol at several time points as compared with dogs fed the

corn diet, hypercholesterolemia in dogs is believed to be less clinically important than hypertriglyceridemia. In addition, a complete dietary analysis of the diets was not specified, making it challenging to interpret the results. Barley contains beta-glucans (ie, polysaccharides found in the bran of cereal grains that have several reported health benefits in humans[1,2]) and has been evaluated in humans for its cholesterol- and lipid-lowering effects.[3] Pea protein has been found to reduce triglyceride and cholesterol levels in some species.[4-8] Although the mechanism is not fully understood, the benefit of pea protein may be due to increased hepatic activity of low-density lipoproteins, resulting in increased clearance of low-density lipoprotein cholesterol, decreased synthesis of fatty acids, and increased excretion of bile acids in feces.[4-7]

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Hyperlipidemia in a fasted dog or cat is abnormal and should be managed.
2. Dietary and drug interventions can decrease the morbidity associated with hyperlipidemia.
3. Dietary ingredients, fiber, and several nutrients (eg, beta-glucans), in addition to reduced dietary fat, may play an important role in management of patients with hyperlipidemia.

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06AD-OSU21014-0421

See page 32 for product information summary.

A Comparison of Nalbuphine, Butorphanol, & Morphine in Dogs

Andrew K. Claude, DVM, DACVAA
Michigan State University

As compared with morphine, neither butorphanol nor nalbuphine have been shown to reduce the minimum alveolar concentration of inhalant anesthetics.[6]

In the literature

Gomes VH, Barbosa D, Motta AS, Corrêa CG, Moreno DJ, da Silva MF. Evaluation of nalbuphine, butorphanol and morphine in dogs during ovariohysterectomy and on early postoperative pain. *Vet Anaesth Analg*. 2020;47(6):803-809.

FROM THE PAGE ...

Although other analgesic drugs have increased in popularity, opioids continue to be extensively used for pre-, intra-, and postoperative analgesic periods in veterinary medicine.[1] Opioid analgesic drugs are classified according to the opioid receptor(s) at which they exert agonistic action.[2] Mu-opioid analgesic drugs include morphine, hydromorphone, methadone, and fentanyl; buprenorphine is classified as a partial mu agonist. Mixed agonist/antagonist drugs include butorphanol and nalbuphine; these are kappa agonists and predominately mu antagonists.

Morphine and butorphanol are commonly used in veterinary practice, but nalbuphine (a non-controlled, human opioid drug[3]) is not. Butorphanol and nalbuphine have similar pharmacologic and adverse effects in dogs and cats. However, there is conflicting evidence as to whether nalbuphine has equal or greater sedative and analgesic effects as compared with butorphanol or morphine, and extensive analgesic studies involving nalbuphine in veterinary medicine are lacking.[4] Butorphanol as an analgesic in small animals is less effective than mu agonists, partial mu agonists, and NSAIDs, primarily because of its short duration of action and ability to control only mild to moderate degrees of pain.[5] As compared with morphine, neither butorphanol nor nalbuphine have been shown to reduce the minimum alveolar concentration of inhalant anesthetics.[6] In addition, butorphanol should be used judiciously in patients with the multidrug sensitivity gene (*MDR1* gene, also known as *ABCB1* gene).[7]

Continues ▶

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[1] Cline MG, Burns KM, Coe JB, et al. 2021 AAHA nutrition and weight management guidelines for dogs and cats. *J Am Anim Hosp Assoc.* 2021;57(4):153-178. doi: 10.5326/JAAHA-MS-7232.

This study compared the analgesic effects of intra- and postoperative nalbuphine (either 0.5 mg/kg or 1 mg/kg), butorphanol, and morphine administered with acepromazine for premedication in dogs undergoing ovariohysterectomy. The authors believed that morphine would provide the most effective analgesia as compared with nalbuphine and butorphanol and that nalbuphine would provide a dose-dependent degree of analgesia. The number of rescue doses of propofol needed to maintain an adequate level of anesthesia was used to assess intraoperative analgesia. The dynamic and interactive visual analog scale and the modified Glasgow composite measure pain scale were used to assess postoperative pain. No difference in the degree of analgesia was observed among the 3 opioids, and the effects of a higher and lower dose of nalbuphine were similar. All 3 opioids, when combined with acepromazine, provided insufficient analgesia for all dogs during the surgical procedure. In addition, none of the 4 premedication protocols provided acceptable analgesia within the first 6 hours postoperatively. The authors speculated that the morphine dose (0.2 mg/kg IV) may have been insufficient to provide adequate analgesia; however, the butorphanol and nalbuphine doses were comparable with those in other studies.

Increasing the dose of nalbuphine or butorphanol may not provide increased analgesia because of their ceiling effects.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. This study did not fully illustrate the antinociceptive advantages of morphine, butorphanol, and nalbuphine. However, opioid drugs are valuable analgesics for surgical procedures and should be administered pre-emptively to help control surgical nociception.
2. Increasing the dose of nalbuphine or butorphanol may not provide increased analgesia because of their ceiling effects. Increasing the dose of morphine (0.4-0.5 mg/kg) can increase analgesia but may also increase adverse effects. Mu-agonist opioids (eg, morphine, hydromorphone) or partial mu-agonist opioids (eg, buprenorphine) may provide better analgesia for surgical patients as compared with butorphanol or nalbuphine.
3. Administering maropitant prior to mu-agonist opioid drugs can decrease the incidence of vomiting in dogs and may provide additional analgesia.[8,9]
4. Butorphanol and nalbuphine are kappa agonists and mu antagonists; therefore, either can be used as a nonemergent, mu-opioid–reversing drug.

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Potential Tool for Prognosticating in Canine Mammary Gland Tumors

Cheryl Balkman, DVM, MS, DACVIM (Internal Medicine, Oncology)
Cornell University

In the literature

Ariyarathna H, Thomson NA, Aberdein D, Perrott MR, Munday JS. Increased programmed death ligand (PD-L1) and cytotoxic T-lymphocyte antigen-4 (CTLA-4) expression is associated with metastasis and poor prognosis in malignant canine mammary gland tumors. *Vet Immunol Immunopathol*. 2020;230:110142.

FROM THE PAGE ...

Immunosurveillance helps identify infected or abnormal cells. Signaling molecules, collectively referred to as *immune checkpoint molecules*, on T lymphocytes help regulate immunosurveillance and can be either activating or inhibitory. Inhibitory immune checkpoint molecules, which suppress T-lymphocyte activation, are aberrantly expressed in many human cancers. Suppression may allow tumors to evade the host immune surveillance, allowing more aggressive clinical behavior.

Two inhibitory immune checkpoint molecules often expressed in human tumors are programmed death ligand-1 (PD-L1) and cytotoxic T-lymphocyte associated protein-4 (CTLA-4)[1,2]; these molecules are associated with more aggressive behavior and worse prognosis, and measuring their expression on tumors may help provide a more accurate prognosis.[3,4] A variety of canine tumors express PD-L1 and CTLA-4, which have been shown to be prognostic in canine high-grade B-cell lymphoma.[5] PDL-1 is detected more frequently in malignant than benign mammary gland tumors,[6,7] but association with prognosis has not been reported.

This study investigated the immunostaining and gene expression of PDL-1 and CTLA-4 in 41 histologically malignant and 12 benign canine mammary gland tumors with known outcomes. The goal was to determine whether PDL-1 and CTLA-4 immunostaining and gene expression are correlated with biological behavior and clinical outcome. Metastasized malignant mammary gland tumors had significantly higher immunostaining scores and gene expression for both PDL-1 and CTLA-4 than nonmetastasized malignant tumors.

On multivariate analysis, PDL-1 and tumor grade were independent prognostic indicators of survival; CTLA-4, tumor size, and tumor emboli were not independent prognostic indicators of survival.

… TO YOUR PATIENTS

Key pearls to put into practice:

1 Canine malignant mammary gland tumors are a heterogeneous group of tumors with biological behavior that can be difficult to predict.

2 Different prognostic factors, including histologic subtype, tumor grade, and stage, have been evaluated, but additional factors likely play a role in the aggressive behavior of a tumor.

3 Results of this study show PDL-1 and CTLA-4 immunostaining of mammary gland tumors may allow better prognostication in dogs and could lead to development of future therapeutics.

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Canadas A, França M, Pereira C, et al. Canine mammary tumors: comparison of classification and grading methods in a survival study. *Vet Pathol*. 2019;56(2):208-219.

Matos AJ, Baptista CS, Gärtner MF, Rutteman GR. Prognostic studies of canine and feline mammary tumours: the need for standardized procedures. *Vet J*. 2012;193(1):24-31.

Rasotto R, Berlato D, Goldschmidt MH, Zappulli V. Prognostic significance of canine mammary tumor histologic subtypes: an observational cohort study of 229 cases. *Vet Pathol*. 2017;54(4):571-578.

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Screening Liver & Kidney Values Prior to NSAIDs

Faith I. Buckley, DVM, DACVIM (SAIM)
Mobile Veterinary Specialists (MOVES)
Londonderry, New Hampshire

In the literature

Chalifoux NV, Kaiman G, Drobatz KJ, Thawley VJ. Evaluation of renal and hepatic blood value screening before non-steroidal anti-inflammatory drug administration in dogs. *J Small Anim Pract.* 2021;62(1):12-18.

FROM THE PAGE ...

NSAIDs are commonly prescribed in veterinary medicine, but there are concerns regarding safety profiles of these drugs.[1-3] Reported adverse effects include anorexia; lethargy; vomiting; gastric irritation, ulceration, and perforation; renal insufficiency; and idiosyncratic hepatotoxicity.

Dogs with elevated hepatic blood values were less likely to have an NSAID administered, although this was not the case for an elevated renal parameter in isolation.

Continues ▶

In this retrospective study, medical records of 81 dogs with laboratory evaluations conducted in advance of NSAID therapy were reviewed. Of these, 56% had an elevation in at least one renal (ie, BUN, creatinine) or hepatic (ie, ALP, ALT, AST) value; these values are often reflective of renal perfusion, hepatocellular injury, and cholestasis.

Dogs with elevated hepatic blood values were less likely to have an NSAID administered, although this was not the case for an elevated renal parameter in isolation. This variation in administration may be due to the relatively low number of dogs with an elevated renal parameter, as opposed to a lack of concern for renal elevation. Results also suggested that dogs <8 years of age were less likely to have an elevated renal or hepatic blood value, questioning screening utility in young, healthy, euvolemic patients. Other associations pertaining to patient history, physical examination, or onset of illness were not significant.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Patients with compromised circulating volume (eg, dehydration, hypotension, GI losses, ascites, congestive heart failure) are at increased risk for adverse effects secondary to NSAID administration.
2. Although risk factors for idiosyncratic, life-threatening hepatotoxicity are unknown, there is concern that NSAID administration may exacerbate pre-existing underlying hepatitis.[4]
3. Regardless of physical examination and serum chemistry profile findings, pet owners should be informed of the possible adverse effects prior to an NSAID being administered and guided to seek medical care if adverse effects occur.

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Research Note: **Transmittable Blood-Borne Disease from Canine Blood Donors**

This registry-based retrospective study examined 6,150 units of blood from 1,914 active canine blood donors in order to estimate and predict positivity of transmittable blood-borne pathogens. Of the 1,779 units tested for antibodies, 10 (0.56%) were positive for antibodies against *Anaplasma phagocytophilum* and *A platys*, and none had antibodies against *Ehrlichia canis* or *E ewingii*. After excluding the antibody-positive units, 1.1% of 6,140 units were found to be PCR-positive for *A phagocytophilum*, *Bartonella* spp, *Brucella canis*, *Candidatus Mycoplasma haematoparvum*, *Mycoplasma haemocanis*, or a combination thereof. Units from the first blood collection were more likely to test PCR-positive for pathogens than were units from subsequent collections. The prevalence of transmittable pathogens is low but represents a risk to transfusion recipients, highlighting the importance of screening blood donors, especially those donating for the first time.

Source

Nury C, Blais M-C, Arsenault J. Risk of transmittable blood-borne pathogens in blood units from blood donor dogs in Canada. *J Vet Intern Med*. 2021;35(3):1316-1324.

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Greetings, Departures, & Canine Separation Anxiety

Katherine A. Houpt, VMD, PhD
Cornell University

In the literature

Teixeira AR, Hall NJ. Effect of greeting and departure interactions on the development of increased separation-related behaviors in newly adopted adult dogs. *J Vet Behav*. 2021;41:22-32.

FROM THE PAGE ...

Separation anxiety is common in dogs, especially those adopted as adults. This study assessed whether high-arousal departures and greetings can lead to or be associated with separation anxiety. Many veterinary behaviorists suggest minimizing greetings and departures as part of a treatment plan for dogs with separation anxiety, as excessive greeting has been previously reported as a risk factor for separation anxiety.[1] The first half of this study compared the behavior of shelter dogs after a high-arousal situation (ie, being played with, petted, and spoken to) versus a low-arousal situation (ie, receiving a calm and brief greeting, receiving a short petting interaction, then being ignored) before being left alone in an unfamiliar room. Heart rate, activity, and vocalizations were measured across 10 trial sessions. Initially, the heart

This study assessed whether high-arousal departures and greetings can lead to or be associated with separation anxiety.

rate and activity were higher in dogs after a high-arousal situation, but values decreased across sessions. Of note, these dogs were in a relatively barren room (not a home) and had no prior relationship with the human who interacted with them; thus, this may not be a particularly good measure of separation anxiety.

The second half of this study involved a more clinically applicable experiment in which a questionnaire for dog owners was posted on multiple dog-related Facebook groups, including a group focused on separation anxiety. Owners were asked how they originally greeted and departed from their dog, whether this had changed over time, and, if changed, how they now greet and depart from their dog. Responses from owners of dogs with (n = 978) and without (n = 1,012) separation anxiety were compared. Owners of dogs with separation anxiety reported engaging in low-arousal greetings and departures both when they initially acquired the dog and presently. Owners scored their dogs for separation-anxiety–related behaviors (eg, barking, destructiveness); these scores were not correlated with the intensity of greetings or departures. The authors concluded that high-arousal greetings and departures were not risk factors for separation anxiety; however, further research—including video-recorded observation of newly adopted dogs when owners leave and return—is warranted.

… TO YOUR PATIENTS

Key pearls to put into practice:

1. Separation anxiety may be more prevalent in dogs adopted after the sensitive period for socialization (7-16 weeks); owners of these dogs should be instructed to begin leaving their dog alone for short periods to habituate them to being alone.

2. Based on the results of this study, intensity of departures and greetings may not be correlated with separation anxiety, and it may not be necessary to advise owners to ignore their dog when leaving and returning home; however, further research is needed.

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Parthasarathy V, Crowell-Davis SL. Relationship between attachment to owners and separation anxiety in pet dogs (*Canis lupus familiaris*). *J Vet Behav*. 2006;1(3):109-120.

Takeuchi Y, Houpt KA, Scarlett JM. Evaluation of treatments for separation anxiety in dogs. *J Am Vet Med Assoc*. 2000;217(3):342-345.

Research Note: **Efficacy of a Nonnucleoside Inhibitor Against FIP Virus**

Prevention and treatment options for FIP, a virulent pathotype of feline enteric coronavirus, are limited. Feline recombinant interferon omega is the most commonly available antiviral treatment, but its efficacy against FIP virus has not been well-demonstrated. ERDRP-0519 (ERDRP), a nonnucleoside inhibitor that targets RNA polymerase, is effective against in vitro and in vivo morbilliviruses. This study examined the in vitro efficacy of ERDRP against FIP virus. Results demonstrated significant inhibition of FIP virus replication in a dose-dependent manner, confirming ERDRP is highly effective against a coronavirus in vitro. Further study is needed to assess suitability of ERDRP in treatment of FIP virus in vivo.

Source

Camero M, Lanave G, Catella C, et al. ERDRP-0519 inhibits feline coronavirus in vitro. *BMC Vet Res*. 2022;18(1):55.

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TOM NELSON, DVM
Medical Director,
Animal Medical Centers
of N.E. Alabama

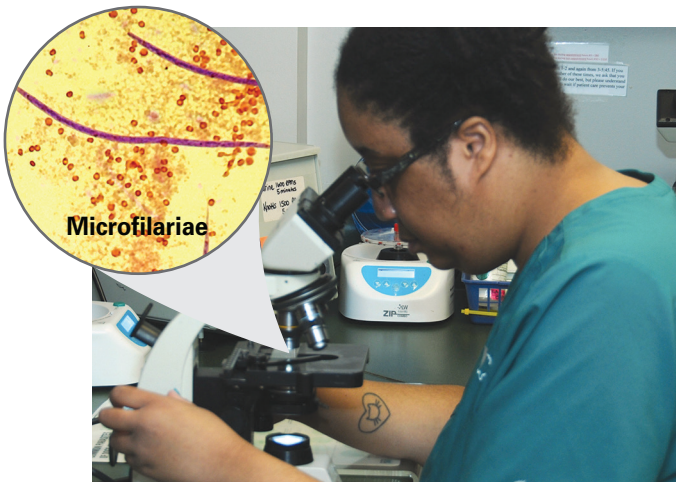
THE SHORT ANSWER

If the dog was treated with the full AHS protocol and is on heartworm prevention, there is little cause for concern.

As part of its heartworm treatment protocol, the AHS recommends that dogs that have undergone melarsomine treatment for heartworms be rechecked for microfilaria (MF) 30 days after their last injection, which is Day 120 following diagnosis. If you're seeing MF on Day 120, consider these questions:

Which heartworm preventive did you give during the pretreatment phase? The AHS protocol recommends administering an "appropriate heartworm preventive" on Days 1 and 30 as part of the pretreatment protocol that also includes doxycycline and either ivermectin or moxidectin. These macrocyclic lactones coupled with doxycycline suppress embryogenesis, weaken adult heartworms, and have adulticidal activity.

Did you give the full dose of doxycycline? Doxycycline is administered to eliminate the *Wolbachia* bacteria prior to giving melarsomine. *Wolbachia* are necessary for embryogenesis and giving 4 weeks of doxycycline at 10 mg/kg B.I.D. should result in amicrofilaremia for at least 12 months. If you dose doxycycline properly, any residual MF won't develop into adult worms; however, if you gave doxycycline at a lower dose (e.g., 5 mg/kg) or shorter time period, the *Wolbachia* could recrudesce and embryogenesis may have not been completely suppressed.



Was the full dose of melarsomine given? Melarsomine is an adulticide, but it does not kill microfilaria—nor is it absolutely 100% effective. However, if you give melarsomine as part of a 3-dose protocol, you will kill 98% of the worms, including 100% of male worms. Even if a female worm survived, it cannot produce microfilariae without a male worm. Giving the full recommended dose of melarsomine is essential as underdosing will affect efficacy! A bottle of melarsomine treats a 44-pound dog, so if the dog weighs 50 pounds, you will have to open a second vial. While melarsomine is a costly medication that must be used within 24 hours once opened, practitioners should avoid the temptation to underdose patients.

Could it be a case of macrocyclic lactone-resistant heartworms? While heartworm resistance isn't common, you should monitor for potentially resistant isolates in your practice area. When you do the Knott test, count the MF, then administer topical moxidectin which is the only FDA-approved microfilaricide. A week later, you can do another Knott test and once again do a count. If the number has dropped by half, chances are the heartworms weren't resistant. If the number hasn't dropped, you may be looking at a resistant isolate. While the presence of macrocylic lactone-resistant isolates in your area is of concern, the good news is they are not resistant to melarsomine.

The most important factor with MF in a heartworm-positive dog is to prevent future heartworm transmission. If you follow the AHS treatment protocol diligently, any remaining MF will not pose a threat.

Surgical Site Infection Following Extracapsular Cranial Cruciate Ligament Repair

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In the literature

Cox T, Maddox TW, Pettitt R, Wustefeld-Janssens B, Innes J, Comerford E. Investigation of variables associated with surgical site infection following the management of canine cranial cruciate ligament rupture with a lateral fabellotibial suture. *Vet Comp Orthop Traumatol*. 2020;33(6):409-416.

FROM THE PAGE ...

Surgical site infection (SSI) is an important cause of morbidity in dogs. Previous studies based on older guidelines from the Centers for Disease Control and Prevention have reported SSI rates of <5% for the lateral fabellar nylon suture technique, a procedure used for cranial cruciate ligament (CCL) repair.[1,2]

This study examined SSI rates and contributing variables for lateral suture surgery of the stifle joint in dogs; 150 surgical procedures in 130 dogs were evaluated, and the SSI rate was found to be 17.3%. Of these, infected joints were found in 73.1% of dogs; 53% of affected dogs required implant removal. All infections were *Staphylococcus* spp, with only 10.5% of isolates being methicillin resistant. Although all dogs received perioperative beta-lactam antibiotics, only 13.3% received a postoperative antibiotic course. Postoperative antibiotics have been associated with reduced SSI in some CCL studies.[3,4]

Variables significantly associated with SSI included increased body weight and use of propofol instead of alfaxalone as an anesthetic induction agent. For each 2.2-lb (1-kg) increase in body weight, the SSI rate increased 4%. Use of propofol was associated with a 3.6-fold increase.

... TO YOUR PATIENTS

Key pearls to put into practice:

1. Heavier dogs have a higher risk for postoperative infection of the stifle joint after lateral fabellotibial nylon suture technique for CCL rupture.
2. Dogs receiving alfaxalone as an anesthetic induction agent for lateral fabellotibial nylon suture repair may have lower risk for SSI than when propofol is used.
3. If SSI occurs after extracapsular suture repair for CCL rupture, the lateral suture may need to be removed in ≈50% of cases.

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Top 5 Signs of Patient Stress & Excitement on Clinical Pathology

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Evaluation of laboratory data for indicators of underlying disease is a mainstay of veterinary diagnostics. In addition to disease mechanisms, routine physiologic responses can also impact measured variables. A common example of an interpretive consideration is patient stress and/or excitement due to illness or unfamiliarity with the veterinary clinic.

TOP 5 SIGNS OF PATIENT STRESS & EXCITEMENT ON CLINICAL PATHOLOGY

1. Stress Leukogram
2. Physiologic Leukocytosis
3. Erythrocytosis
4. Hyperglycemia
5. Increased Corticosteroid-Induced ALP Activity

Following are the author's top 5 signs of patient stress and excitement on clinical pathology.

1 Stress Leukogram

A stress leukogram is a common set of leukocyte responses caused by the release of endogenous corticosteroids that result from stress-related disease and hospitalization. Possible changes include segmented neutrophilia, lymphopenia, monocytosis, and eosinopenia, but all abnormalities are not always present,[1] and it is unusual for alterations to vary >2 to 3 times the reference values.[2] Lymphopenia is most common, and segmented neutrophilia is usually present.[3] Monocytosis and eosinopenia are possible in dogs; however, they are more variable and frequently not present in cats.

Neutrophilia is caused by decreased adherence to the vascular endothelium from receptor downregulation, which inhibits margination of cells and therefore increases the proportion of cells in the circulating pool inside blood vessels.[4] Prolonged circulation time may

cause neutrophils to appear hypersegmented,[5] and increased release of neutrophils from bone marrow is possible.[4] The segmented neutrophil count can double in dogs and triple in cats due to a larger number of cells in the marginating pool.[6] Neither a left shift to band neutrophils or toxic changes are expected due to lack of inflammatory response.

Instead of entering circulation, lymphocytes become redistributed to and retained in lymphocytic tissue (eg, lymph nodes).[6] It is suspected that monocytes increase in concentration due to mechanisms similar to those of neutrophils (eg, decreased margination), although this has not been definitively proven. Eosinopenia can be difficult to detect because eosinophils are rare and only a few may be present in circulation at baseline.

The stress leukogram is transient, and cell dynamics return to normal when increased stress is resolved.[3] The changes observed in a stress leukogram can also occur with consistently increased cortisol concentrations in patients with hyperadrenocorticism. Stressed patients with underlying illness may have a co-occurring inflammatory leukogram as suggested by the presence of a left shift and neutrophil toxicity; these do not occur with a stress response alone.

The stress leukogram is transient, and cell dynamics return to normal when increased stress is resolved.[3]

2 Physiologic Leukocytosis

Leukocytosis can be caused by fear, exercise, or excitement; is mediated by increased catecholamine concentrations (eg, epinephrine, norepinephrine); and should be considered a transient physiologic response. Catecholamine hormones can cause cells from the marginating pool to shift to the circulating pool in the vasculature.[5,7] This effect may double the total WBC concentration within minutes but is temporary, and, at least in horses, cell counts return to baseline values after 30 minutes.[8] In addition, splenic contraction induced by catecholamine hormones can expel leukocytes into the peripheral circulation.

Leukocytosis is usually characterized by segmented neutrophilia without a left shift. Lymphocytosis may be present, especially in kittens and young cats. The effect in cats is often considered a prominent lymphocytosis, which can be up to twice the upper reference value.[5,6]

3 Erythrocytosis

Transient erythrocytosis occurs when catecholamines from excitement or stress cause splenic contraction, resulting in expulsion of stored erythrocytes into circulation.[9] Transient erythrocytosis is most common in young horses, less frequent in dogs, and unusual in cats—possibly because the feline spleen is nonsinusoidal—but can occur under experimental conditions.[5,10] RBC concentration (ie, hematocrit) only slightly increases in most small animals, and the effect may not be appreciated because values may remain within reference intervals. In a study, the hematocrit of racing greyhounds increased immediately postrace, presumably due to catecholamine-induced splenic contraction, although decreased plasma volume may have also been a contributing factor.[11]

4 Hyperglycemia

Transient stress hyperglycemia, or physiologic hyperglycemia, is particularly common in cats and is most likely due to catecholamine release in acute cases, resulting in glycogenolysis and suppression of insulin release.[12] An increase in glucose and lactate concentrations has been correlated with epinephrine and norepinephrine, but not cortisol, concentrations.[12]

Stress hyperglycemia should be differentiated from diabetes mellitus, but this can be challenging, especially in cats, as blood glucose can become increased with stress alone. Diabetes mellitus is unlikely if repeat sampling for hyperglycemia is negative. In patients with chronic stress, endogenous corticosteroids may be more likely to cause hyperglycemia.[13] Catecholamines and corticosteroids can be contributing factors for transient hyperglycemia in hospitalized patients.

Measuring fructosamine concentration can also help discern stress-related hyperglycemia from diabetes mellitus.[14] In dogs, infusion of a combination of glucagon, epinephrine, and cortisol (ie, stress hormones) more effectively induced hyperglycemia than individual hormones.[15] Glucosuria may occur with stress-related hyperglycemia, particularly in cats, if the renal threshold is exceeded.

5 Increased Corticosteroid-Induced ALP Activity

Chronic stress in dogs can cause long-term increase of endogenous corticosteroids, which may result in increases in serum ALP activity. Increased activity is initially due to an increase in the liver ALP isoenzyme; corticosteroid-induced ALP (C-ALP) activity begins to increase after 7 days.[16] Evidence indicates that hepatocytes upregulate a gene that generates C-ALP when exposed to corticosteroids.[17] Cats do not have C-ALP.

Enzymatic activity may remain increased for several weeks after stress has resolved due to the prolonged half-life of the hormones. C-ALP activity can be used to screen for hyperadrenocorticism, but screening can be challenging in stressed patients. Although C-ALP can be measured specifically, only total ALP activity is typically reported. It is thus important to consider the impact of stress when investigating liver disease.[18]

Conclusion

Patient stress and excitement may interfere with routine laboratory data interpretation. It is important to consider these factors so the most accurate conclusions are drawn and the patient is managed appropriately.

References on next page ▶

Stress hyperglycemia should be differentiated from diabetes mellitus, but this can be challenging, especially in cats, as blood glucose can become increased with stress alone.

C-ALP = corticosteroid-induced ALP

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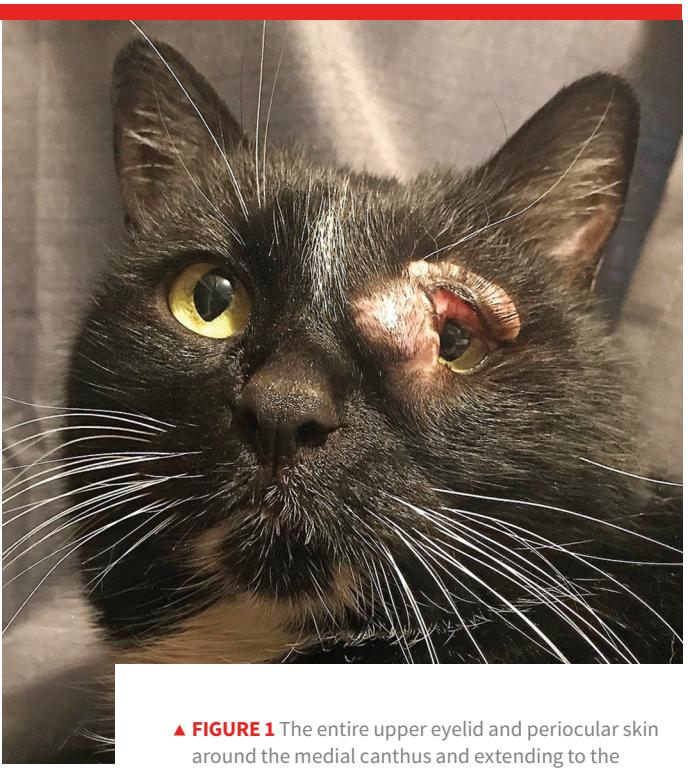
LOOK FOR THESE ARTICLES IN FUTURE ISSUES

- Metatarsal Draining Tract in a German Shepherd Dog
- Incisional Biopsy of Oral Tumors
- Acute Gastroenteritis in Dogs
- Top 5 Ocular Consequences of Systemic Hypertension
- Chronic Diarrhea in a Dog
- Incisional Biopsy of Subcutaneous Tumors

Eyelid Mass with Conjunctival & Periocular Swelling in a Cat

Sarah Bosch, DVM
Susan Nelson, DVM
Jessica Meekins, DVM, MS, DACVO
Lisa M. Pohlman, DVM, MS, DACVP
Kansas State University



▲ **FIGURE 1** The entire upper eyelid and periocular skin around the medial canthus and extending to the medial lower eyelid associated with the left eye are moderately to severely and diffusely thickened and alopecic. *Image courtesy of Guinevere Rava (veterinary student and Belinda's foster caretaker)*

Clinical History & Signalment

Belinda, a 9-lb (4-kg), 5-year-old spayed domestic shorthair cat, was returned to an animal shelter approximately one year after adoption with a recurring mass on the upper left eyelid (***Figure 1***). The conjunctiva and periocular tissue around the left eye were thickened and inflamed; periocular alopecia was also present. Belinda had been acting normally at home, and the surrendering owner had no other concerns.

An incisional biopsy of the mass had been performed one year prior, and a cutaneous mast cell tumor (MCT) was diagnosed; at the time, histopathology showed the mast cells extended to the surgical margins, which is expected with incisional biopsy, and no mitotic figures were seen.

Physical Examination

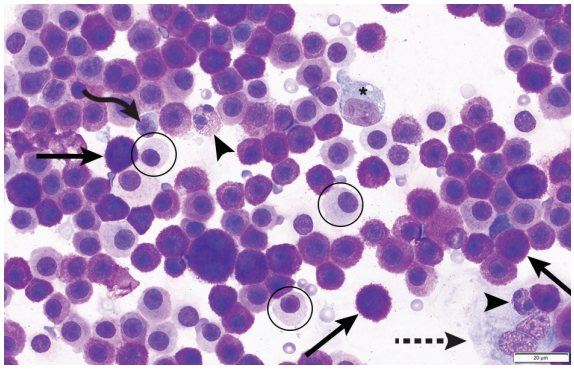
On physical examination, Belinda was bright, alert, and responsive. Her vital parameters were within normal limits. The entire upper left eyelid and periocular skin around the medial canthus and extending to the medial lower eyelid exhibited moderate to severe diffuse thickening and alopecia. The left mandibular lymph node was mildly enlarged. The remainder of the physical examination was within normal limits.

Diagnostics

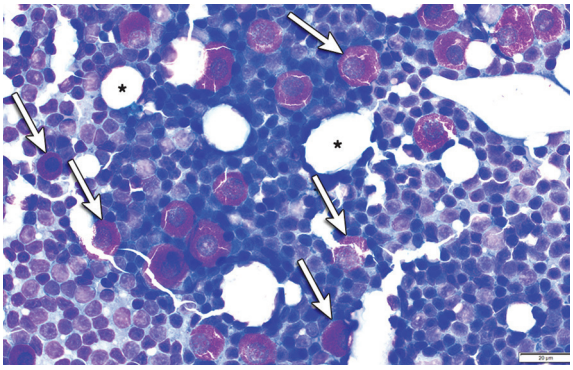
There were no significant abnormalities on CBC and serum chemistry profile. Premedication with diphenhydramine (2 mg/kg IM) was administered prior to fine-needle aspiration of the mass and mandibular lymph node. Cytology of the mass was highly cellular and composed predominantly of variably granulated mast cells (***Figure 2***, next page). There was mild to moderate anisocytosis and mild anisokaryosis. Binucleated cells were frequent.

MCT = mast cell tumor

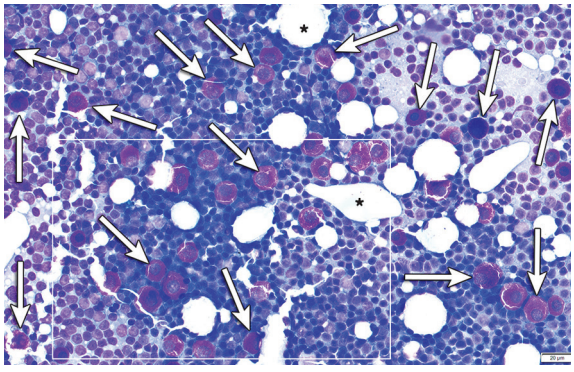
Left mandibular lymph node aspirate showed frequent, well-granulated mast cells distributed individually and in groups among a population of lymphocytes, including predominantly small lymphocytes with fewer medium and large lymphocytes and scattered plasma cells (***Figures 3*** and ***4***). Given the cytologic findings from the mass and lymph node, abdominal ultrasonography was performed. No abnormalities were seen on ultrasound, but a fine-needle aspirate of the spleen revealed an increased concentration of mast cells scattered individually and in small groups among normal splenic lymphoid and hematopoietic tissue (***Figure 5***).



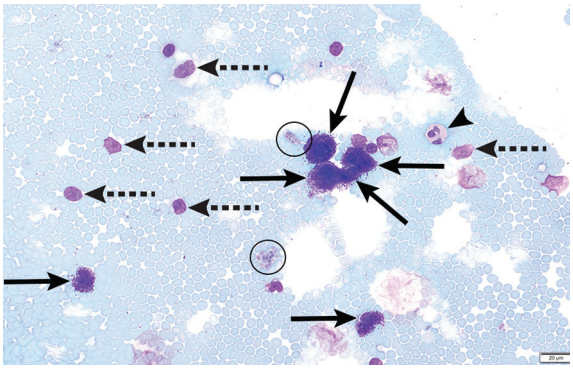
▲ **FIGURE 2** Fine-needle aspirate of the subcutaneous, periorbital mass showing a sample composed predominantly of variably granulated mast cells. Well-granulated (***solid arrows***) and poorly granulated (***circles***) mast cells can be seen. Eosinophils (***arrowheads***), macrophages (***asterisk***), and occasional lymphocytes (***curved arrow***) and spindle cells (***dashed arrow***) consistent with reactive fibroblasts are also present. No mitotic figures were identified. *Modified Wright's stain, 1,000× magnification*



▲ **FIGURE 4** Fine-needle aspirate of the left mandibular lymph node showing abundant lymphocytes (consistent with a lymph node aspirate) with frequent, well-granulated mast cells (***arrows***). Large, round-to-oval clear spaces (***asterisks***) represent lipid droplets removed from the smear upon staining. *Modified Wright's stain, 1000× magnification*



▲ **FIGURE 3** Fine-needle aspirate of the left mandibular lymph node showing abundant, predominantly small lymphocytes with frequent, well-granulated mast cells (***arrows***; not all mast cells are indicated). Large, round to oval clear spaces (***asterisks***) represent lipid droplets removed from the smear upon staining. Boxed area is shown in ***Figure 4***. *Modified Wright's stain, 600× magnification*



▲ **FIGURE 5** Splenic aspirate showing well-granulated mast cells (***solid arrows***) that exhibit mild anisocytosis. RBCs; frequent unidentifiable ruptured cells (***dashed arrows***), often referred to as *smudge cells* because only smudged nuclear material remains; platelet clumps (***circles***); and an eosinophil (***arrowhead***) can also be seen. *Modified Wright's stain, 1,000× magnification*

MCT = mast cell tumor

DIAGNOSIS:
FELINE CUTANEOUS MAST CELL TUMOR WITH REGIONAL LYMPH NODE & SPLENIC METASTASIS

Treatment

Surgery was not pursued because of the presence of metastatic disease. Belinda was placed in palliative care in a permanent foster home. She was prescribed diphenhydramine (12.5 mg PO every 12 hours), famotidine (10 mg PO every 24 hours), and prednisolone (7.5 mg PO every 24 hours). Periodic attempts were made to decrease the prednisolone dose; however, increased swelling, erythema, and pruritus with self-injury were consistently noted, and the initial prescribed dose (7.5 mg PO every 24 hours) was determined to be the appropriate maintenance dose.

Prognosis & Outcome

Belinda continued to do well for 15 months, at which time she was returned for evaluation of moderate, focal, cranial abdominal pain with apparent nausea and vomiting. She weighed 9.72 lb (4.41 kg). CBC and serum chemistry profile were unremarkable, and imaging was considered but declined. Maropitant (4.4 mg SC every 24 hours for 3 days), lactated Ringer's solution (100 mL SC), and buprenorphine (0.044 mg via buccal oral transmucosal route every 8 hours for 3 days) were administered. Famotidine, prednisolone, and diphenhydramine were continued at the previously determined doses. One month later, Belinda was again stable and maintaining a good quality of life.

Discussion

Cutaneous MCTs are the second most common skin neoplasm in cats. Although most feline cutaneous MCTs are benign, ≈10% are aggressive regardless of histologic type.[1] MCTs most frequently arise on the head and neck, followed by the trunk and limbs. There can be a solitary lesion, clusters of lesions, or widespread distribution of lesions ranging from papules and plaques to discrete nodules in the skin or subcutis. Cats may exhibit pruritus, erythema, or edema of the affected area.[1]

The mean age for development of MCTs is ≈10 years,[1] but periorbital MCTs are more common in younger cats.[2] There is no sex predisposition. Siamese cats may be more predisposed, especially when young, but MCTs in these patients often regress spontaneously within 24 months.[3]

MCTs generally exfoliate readily via fine-needle aspiration techniques. Mast cells are large round cells with a centralized purple nucleus often obscured by numerous dark purple granules that fill the abundant cytoplasm. The granules, especially in feline MCTs, can stain poorly with quick stains commonly used in many clinics, making in-clinic diagnosis challenging.[1,4]

Histologically, feline MCTs are divided into mastocytic (more common) and atypical (less common; previously classified as *histiocytic*) forms. The mastocytic form is further subdivided into well-differentiated and pleomorphic forms.[1] A well-differentiated MCT is typically composed of morphologically normal-appearing mast cells that have minimal anisocytosis and anisokaryosis.[1] Mitotic figures can be present but are uncommon. Small lymphocyte clusters can also be present.

Continues ▶

TREATMENT AT A GLANCE

- Pretreatment with diphenhydramine is recommended prior to MCT aspiration or surgery.[9]
- Surgical removal is the treatment of choice for a solitary cutaneous MCT. Tumor recurrence is low regardless of whether complete surgical excision is obtained.[2,3]
- Histopathology should be performed to determine MI, which is the most significant prognostic indicator for feline cutaneous MCTs.[1]
- Diphenhydramine, famotidine, and prednisolone can be used as medical therapy for feline cutaneous MCTs.[9]
- Consultation with a veterinary medical oncologist to discuss other chemotherapeutic options as necessary is recommended.[8,9]

TAKE-HOME MESSAGES

- Cutaneous MCTs are the second most common skin neoplasm in cats[1] and are generally seen in older cats; however, periorbital MCTs are more common in younger cats.[2]
- Young Siamese cats may be more prone to developing cutaneous MCTs, which can spontaneously regress.[3]
- Feline cutaneous MCTs are usually benign, regardless of histologic type, and recurrence at the site is low regardless of complete surgical excision, although new tumors can occur. Uncommonly, cutaneous MCTs can be aggressive or associated with visceral (splenic or intestinal) disease.[1-3]
- Mast cells exfoliate well with aspiration; however, the granules may stain poorly with quick stains, especially in cats. Cytologic diagnosis should be confirmed by a clinical pathologist.[1,4]
- MI is the most important prognostic indicator in feline cutaneous MCTs; high MI (>5 per 10 HPFs) is associated with a poorer prognosis.[1]
- Clinical staging should ideally include CBC, serum chemistry profile, urinalysis, lymph node aspiration, abdominal ultrasonography with splenic aspiration, thoracic radiography, and possibly bone marrow aspiration.[1]
- Up to 10% of cats with a single cutaneous MCT can have circulating mast cells, making CBC with blood smear review the minimum necessary diagnostic recommendation prior to surgery.[1]

The most important prognostic factor for feline cutaneous MCTs is mitotic index (MI).

HPF = high-power field
MCT = mast cell tumor
MI = mitotic index

Spindle cell infiltrates can be seen in MCT aspirates but are less common in feline tumors as compared with canine tumors.[1] Mast cells in pleomorphic tumors exhibit more variability (including anisocytosis and anisokaryosis) and eosinophilic infiltrates.[1] The cytology of atypical MCTs more closely resembles histiocytes, as opposed to mast cells, and can also contain lymphocytic and eosinophilic infiltrates.[1] The cytologic features seen in pleomorphic and atypical MCTs do not correlate with malignant behavior.[1]

The most important prognostic factor for feline cutaneous MCTs is mitotic index (MI). Low MI (ie, <1 per 10 high-power fields [HPFs]) is associated with a better prognosis. High MI (ie, >5 per 10 HPFs) is associated with a poorer prognosis. Other factors associated with poor prognosis include multiple (>5) simultaneous cutaneous tumors, spread to local lymph nodes, low or moderate cytoplasmic granularity, and a high Ki67 index.[1]

The treatment of choice for a solitary cutaneous MCT is surgical removal. Studies demonstrate that tumor recurrence is low regardless of whether complete surgical excision is obtained.[2,3] Multiple de novo cutaneous MCTs occur in a significant number of cats, and pet owners should be advised of this possibility.[1] Additional clinical staging should be considered for all cats with cutaneous MCTs, but cats with any factors for poor prognosis (eg, high mitotic tumor index, >5 simultaneous cutaneous tumors, others as mentioned previously) and cats with visceral MCTs should be fully staged with an evaluation that includes CBC, serum chemistry profile, urinalysis, lymph node aspiration, abdominal ultrasonography with splenic aspiration, thoracic radiography, and possibly bone marrow aspiration. Mastocytemia is more common in cats with MCTs as compared with dogs, and ≈10% of cats with a single cutaneous MCT have mastocytemia.[1]

Medical treatment for feline cutaneous MCTs may include diphenhydramine (2-4 mg/kg PO every 12 hours), famotidine (1 mg/kg PO every 12 hours), and prednisolone (1-2 mg/kg PO every 24 hours to start).[5-7,8] Other potential treatment options may include chemotherapy (eg, lomustine), small molecule inhibitors (eg, imatinib mesylate [tyrosine kinase inhibitor]), and radiation therapy. These therapies may increase survival in some cats; consultation with a veterinary medical oncologist is therefore strongly recommended.[8-10]

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Splenomegaly in Dogs

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Following are differential diagnoses for dogs presented with splenomegaly.*

- Infiltrative disease
  - Neoplasia
    - –Hemangiosarcoma (may be focal enlargement or mass as opposed to diffuse splenomegaly)
    - –Lymphoma
    - –Mast cell tumor
    - –Plasma cell neoplasia
    - –Histiocytic sarcoma (diffuse or focal enlargement)
    - –Other sarcomas (eg, leiomyosarcoma, fibrosarcoma; often focal enlargement)
    - –Leukemia
  - Amyloidosis
- Infectious disease
  - Bacterial
    - –Brucellosis
    - –Rickettsial (ie, ehrlichiosis, anaplasmosis)
    - –Salmonellosis
    - –Tularemia
  - Viral
    - –Infectious canine hepatitis
  - Fungal
    - –Histoplasmosis
  - Protozoal
    - –Babesiosis
    - –Hepatozoonosis
- Reactive/hyperplastic changes (often cause focal enlargement)
  - Lymphoid hyperplasia
  - Nodular hyperplasia
    - –Splenic
    - –Complex
    - –Lymphoid
  - Extramedullary hematopoiesis (eg, bone marrow failure [myelofibrosis, myelophthisis, toxicity, immune-mediated disease, radiation], tissue inflammation or injury, hypoxia, hemolytic anemia, splenic hematoma, splenic thrombosis, lymphoid hyperplasia)
  - Hematoma
- Congestion
  - Anesthesia/sedation
  - Right-sided congestive heart failure
  - Portal hypertension
  - Splenic vein thrombosis
  - Splenic torsion

*Splenomegaly refers to diffuse enlargement unless otherwise noted.

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BRIEF SUMMARY (for full prescribing information, see package insert)

DESCRIPTION: Laverdia-CA1 (verdinexor tablets) is a selective inhibitor of nuclear export (SINE) that blocks chromosome region maintenance 1 (CRM1).

INDICATION: Laverdia-CA1 is indicated for the treatment of lymphoma in dogs.

CONTRAINDICATIONS:
Do not use in dogs that are pregnant, lactating or intended for breeding. Laverdia-CA1 is a possible teratogen and can affect female and male fertility.

WARNINGS: NOT FOR USE IN HUMANS. KEEP THIS AND ALL MEDICATIONS OUT OF THE REACH OF CHILDREN. CHILDREN SHOULD NOT COME INTO CONTACT WITH LAVERDIA-CA1. Children should not come in contact with the feces, urine, vomit, or saliva of treated dogs.

Pregnant women, women who may become pregnant, and nursing women should not handle or administer Laverdia-CA1 or come in contact with the feces, urine, vomit, or saliva from Laverdia-CA1-treated dogs.

Laverdia-CA1 may cause birth defects and can affect female fertility based on animal studies.

Wear protective disposable chemotherapy resistant gloves when handling Laverdia-CA1 to avoid exposure to drug.

Wear protective disposable chemotherapy resistant gloves to prevent direct contact with moistened, broken, or crushed Laverdia-CA1 tablets and prevent direct contact with feces, urine, vomit, and saliva during treatment and for **3 days** after the dog has received the last treatment. Place all waste material in a plastic bag and seal before general disposal. Wash hands immediately and thoroughly with soap and water if contact occurs with the feces, urine, vomit, or saliva from Laverdia-CA1 treated dogs.

Any items that come in contact with feces, urine, vomit, or saliva should not be washed with other laundry during treatment and for **3 days** after the last treatment with Laverdia-CA1.

Wear protective disposable chemotherapy resistant gloves when handling the dog's toys, food bowl, and water bowl. Wash food and water bowls separately from other items during treatment and for **3 days** after the dog has received the last treatment.

If Laverdia-CA1 is accidentally ingested, or if there is significant contact with feces, urine, vomit or saliva of dogs during treatment or within **3 days** after the last treatment without proper precautions, seek medical advice immediately. It is important to show the treating physician a copy of the package insert, label, or client information sheet.

Special instructions for handling and administering the product
It is recommended that Laverdia-CA1 by administered under the supervision of, or in consultation with, a veterinarian experienced in the use of cancer therapeutic agents.

Do not store near food, in or near a food preparation area, or with medications intended for use in humans.

Skin contact
In case of contact with the skin, wash the affected area immediately and thoroughly with soap and water.

Accidental eye exposure
Rinse the eyes with large amounts of tap water (use eyewash station if present) for 10 minutes while holding back the eyelid.

Remove contact lenses.

Seek medical advice immediately and show the package insert or label to the physician.

Accidental oral exposure or ingestion
Seek medical advice immediately and show the package insert or label to the physician.

Animal Safety Warnings

Laverdia-CA1 can cause severe anorexia. Patients should be carefully monitored for inappetence, vomiting, diarrhea and dehydration, and supportive care should be provided as clinically indicated. Keep Laverdia-CA1 in a secure location out of reach of dogs, cats, and other animals to prevent accidental ingestion or overdose.

PRECAUTIONS: Safe use of Laverdia-CA1 has not been evaluated in dogs with concurrent serious infections; concurrent renal, cardiovascular, or hepatic disease; in dogs with diabetes mellitus; in dogs with clinically relevant hypercalcemia; in dogs with concurrent malignancy or dogs younger than 7 months of age.

Laverdia-CA1 can cause hematologic and serum chemistry abnormalities. Dogs should be frequently monitored for evidence of hematologic and serum chemistry abnormalities when initiating and maintaining treatment with Laverdia-CA1 (see ADVERSE REACTIONS).

The safety and effectiveness of Laverdia-CA1 has not been evaluated in conjunction with other chemotherapeutic agents or other treatment modalities for lymphoma.

ADVERSE REACTIONS: The most common adverse events reported during the course of a US field study supporting reasonable expectation of effectiveness were lethargy, fever, weakness, generalized pain, anorexia, vomiting, diarrhea, polyuria, polydipsia, hematuria, proteinuria, elevated liver enzymes, bilirubinuria, cough/dyspnea, weight loss, blood cell abnormalities, subcutaneous edema, and pyoderma. Less common adverse reactions seen were protein losing nephropathy, urinary incontinence, hepatomegaly, elevated bilirubin, icterus, heart murmur, arrhythmia, heart block, blood protein abnormalities, prolonged prothrombin time, seizure, tremor, disorientation, corneal opacity, skin bruising, redness, loss of hair, nasal discharge, epistaxis, lymphadenitis and platelet abnormalities.

To report suspected adverse events, for technical assistance or to obtain a copy of the SDS, contact Dechra Veterinary Products at 1-833-264-8483. 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.

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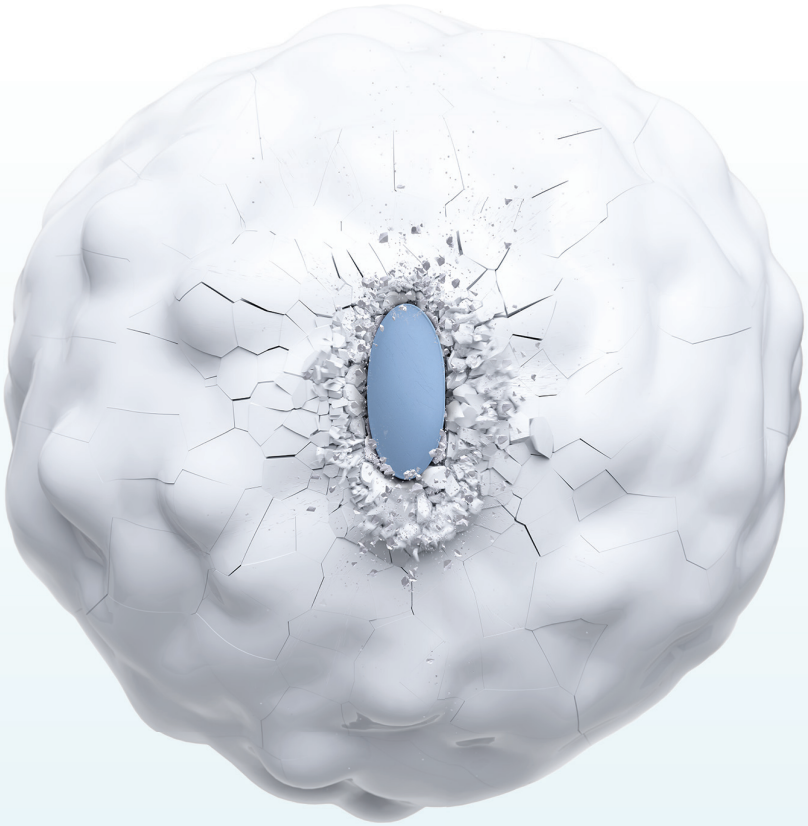

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For product label, including complete safety information, visit go.dechra-us.com/laverdia-pi, or scan the QR code below.

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See page 62 for product information summary.

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Digit Amputation in Dogs

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University of Florida

Digit amputation is indicated in dogs with digital or subungual neoplasms, degloving/shearing wounds of the foot, chronic sprains or luxations, phalangeal or intra-articular fractures, chronic osteomyelitis, severe osteoarthritis, or chronic severe dermal diseases (eg, chronic severe acral lick dermatitis), as well as in dogs requiring distal foot skin reconstruction via phalangeal fillet techniques.[1]

Amputation is generally performed at the metacarpophalangeal or metatarsophalangeal joints, especially in patients with neoplasms or osteomyelitis. More distal amputations are reserved for patients with traumatic or degenerative diseases that only affect the distal phalanges. Amputation of the second or fifth digit does not affect limb function; however, amputation of the third or fourth digits, which are weight-bearing, may affect function or result in mechanical lameness.[2]

The surgical principles of proximal and distal interphalangeal joint amputation and metacarpophalangeal and metatarsophalangeal joint amputation are similar.[1,2] The digital pad is preserved in proximal and distal interphalangeal joint amputation but is removed in metacarpophalangeal and metatarsophalangeal joint amputation, most frequently performed for digit amputation.[1,2] If the location is distal (second or third phalanx) and the condition is benign, amputation at the interphalangeal joints can be performed.

Malignant lesions usually require soft tissue and bone margins (wide surgical excision) for cancer-free excision at the surgical margin. Distal malignant lesions are thus usually excised at the metacarpophalangeal or metatarsophalangeal joints. Ring block or regional analgesia can be performed using longer-lasting anesthetics (eg, bupivacaine, liposome-encapsulated bupivacaine).

STEP-BY-STEP DIGIT AMPUTATION

WHAT YOU WILL NEED

- #15 scalpel blade
- Rongeur
- Electrocautery tool (recommended)
- Metzenbaum scissors
- Monofilament nonabsorbable suture (4-0 or 3-0)
- Monofilament absorbable suture (4-0 or 3-0)
- Needle holder
- Bandage materials
- Esmarch tourniquet
  –Adherent wrap
  –Scissors

METACARPOPHALANGEAL & METATARSOPHALANGEAL JOINT AMPUTATION

STEP 1

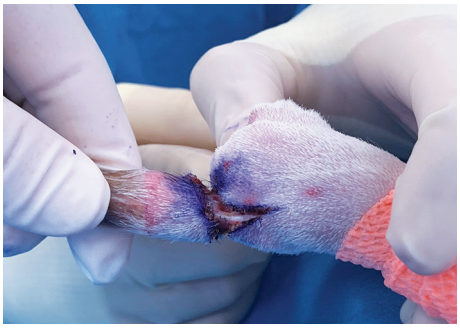
To exsanguinate the limb, tightly apply an Esmarch bandage from the most distal aspect of the toes to 2 to 3 cm proximal to the carpus or the tarsus. Tightly secure the bandage at the proximal aspect of the limb to prevent blood from flowing into the limb during surgery. Cut the bandage from distal to proximal to expose the surgical site (up to the carpus or tarsus), leaving the most proximal aspect of the tourniquet intact. Be careful not to cut the skin.

Author Insight

Applying an Esmarch bandage prevents the limb from bleeding and removes blood from the limb. There are many advantages of a bloodless surgery, but it may be difficult to identify when large vessels are punctured, and ligation may be required. In addition, use of an Esmarch bandage can result in regional ischemia; the surgeon should work quickly and be conscious of surgical time to minimize ischemic morbidity of the distal aspect of the extremity. A tourniquet should not be used longer than 1 to 2 hours and should be removed as soon as possible.[3]

STEP 2

Beginning on the dorsal aspect of the affected digit, make an inverted Y-shaped skin incision along the sides of the digit that meets on the palmar aspect.[4]



Author Insight

This incision results in a straight line after suturing and allows removal of the digital pad. If the digit is removed because of a neoplastic condition, the incision shape may require modification to incorporate the skin margin necessary for wide surgical excision.

STEP 3

Ligate or cauterize arteries and veins that are <1 to 2 mm in diameter and located axially or abaxially at the dorsal (dorsal common digital vasculature) and ventral (palmar common digital vasculature) aspects of the digit.[5]

STEP 4

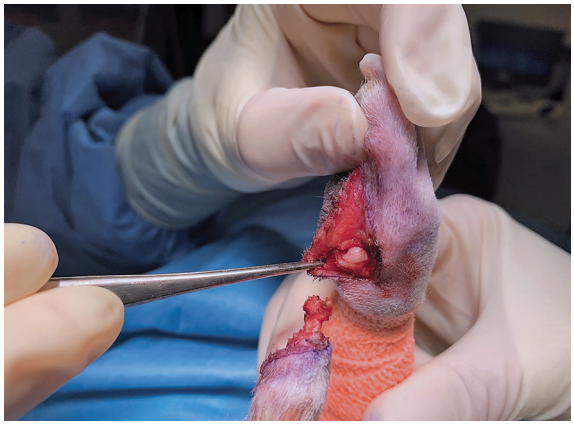
Transect the tendons of the superficial and deep digital flexor (palmar), as well as the common digital extensor (dorsal, thoracic limb) or long digital extension (dorsal, pelvic limb) at the level of the proximal phalanx and the metacarpal (or metatarsal) bone.[5]

STEP 5

Carefully transect the joint capsule at the level of the phalanx and the corresponding metacarpal (or metatarsal) bone to be amputated. Avoid direct mechanical damage to the cartilage,[5] and remove the digit. Perform a condylectomy if needed to allow cosmetic closure of the skin.

Author Insight

There is controversy in human and veterinary medicine on whether condylectomy increases pain. Condylectomy causes a disturbance of the joint cartilage and subchondral bone, which remains exposed to deeper tissue, potentially increasing pain.[6] The third and fourth metacarpal and metatarsal bones may require condylectomy, and the second and fifth metacarpal bones may be beveled on the medial and lateral aspect, respectively.



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STEP 6

Remove the tourniquet.

Author Insight

Hemostasis with cautery or ligations is often necessary before closure. The tourniquet can be removed at the end of the procedure, immediately before adding a soft, padded bandage. The authors remove the tourniquet prior to tissue closure to visualize excessive bleeding and ensure hemostasis prior to suturing. Removing the tourniquet prior to closure also minimizes how long the tourniquet is applying active pressure, decreasing tourniquet-associated morbidity.

STEP 7

Suture subcutaneous tissue with a simple interrupted pattern using a 3-0 or 4-0 monofilament absorbable suture (***A***). Suture the skin with a cruciate pattern using a 3-0 or 4-0 monofilament nonabsorbable suture (***B***).

STEP 8

Provide postoperative multimodal pain management with injectable analgesics (ie, mu agonist opioids) for the first 12 to 24 hours and oral analgesics (eg, NSAIDs, gabapentin, tramadol) after the patient recovers and has normal deglutition.

STEP 9

Use a soft, padded bandage for 1 to 2 weeks (if tolerated by the patient) to prevent trauma to the incision while walking. Restrict exercise for 3 weeks until the wound heals.

PROXIMAL & DISTAL INTERPHALANGEAL JOINT AMPUTATION

STEP 1

To exsanguinate the regional distal area of the limb, tightly apply an Esmarch bandage from the most distal aspect of the toes to 2 to 3 cm proximal to the carpus or the tarsus. Tightly secure the bandage at the proximal aspect of the limb to prevent blood from flowing into the limb during surgery. Cut the bandage from distal to proximal to expose the surgical site (up to the carpus or tarsus), leaving the most proximal aspect of the tourniquet intact. Be careful not to cut the skin.

Author Insight

Applying an Esmarch bandage prevents the limb from bleeding and removes blood from the limb. There are many advantages of a bloodless surgery, but it may be difficult to identify when large vessels are punctured, and ligation may be required. In addition, use of an Esmarch bandage can result in regional ischemia; the surgeon should work quickly and be conscious of surgical time to minimize ischemic morbidity of the distal aspect of the extremity. A tourniquet should not be used longer than 1 to 2 hours and should be removed as soon as possible.[3]

STEP 2

Make a skin incision that encircles the nail (around the ungual process), sparing the digital pad. Continue the incision proximally and dorsally (over the phalangeal bone) to expose the distal interphalangeal joint or the proximal interphalangeal joint depending on the determined level of amputation.

STEP 3

Sharply dissect soft tissue away from the bone and transect the extensor tendons (dorsal), flexor tendons (palmar), and collateral ligaments (lateral).

STEP 4

Disarticulate the joint.

Author Insight

There is controversy in human and veterinary medicine on whether condylectomy increases pain. Condylectomy causes a disturbance of the joint cartilage and subchondral bone, which remains exposed to deeper tissue, potentially increasing pain.[6] The third and fourth metacarpal and metatarsal bones may require condylectomy, and the second and fifth metacarpal bones may be beveled on the medial and lateral aspect, respectively.

Continues ▶

STEP 5

Suture the subcutaneous tissue with an appositional, interrupted knot-burying pattern to maximize wound healing and prevent wound dehiscence in a high-motion area. Create a Y-shaped pattern by pulling the digital pad over the cut end of the bone and suturing (both sides) laterally and dorsally.

STEP 6

Suture the skin with a simple interrupted pattern using a 3-0 or 4-0 monofilament nonabsorbable suture, which can typically be removed 2 to 3 weeks postoperatively.

STEP 7

Provide postoperative multimodal pain management with injectable analgesics (ie, mu agonist opioids) for the first 12 to 24 hours and oral analgesics (eg, NSAIDs, gabapentin, tramadol) after the patient recovers and has normal deglutition.

STEP 8

Use a soft, padded bandage for 1 to 2 weeks (if tolerated by the patient) to prevent trauma to the incision when the patient walks. Restrict exercise for 3 weeks until the wound heals.

Author Insight

The authors recommend applying a compressive bandage for the first week (if tolerated and no bandage morbidity occurs). Although motion at the surgical site is unavoidable, some surgeons prefer to apply a stiffer bandage by adding a palmar/plantar-located splint for one week to help minimize movement of the digits. Use of a splint should be weighed against the risk for morbidity due to increasing pressure points on a wound area.

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1 **DIAGNOSTIC/MANAGEMENT TREE** **PAGE 18**

Which of the following findings would *not* be expected in a cat with nonthyroidal illness?

A. Total thyroxine >3.5 µg/dL but within reference interval or within upper one-third of reference interval
B. Unexplained weight loss
C. Elevated ALT
D. Canine thyroid stimulating hormone <0.03 ng/mL

2 **DIAGNOSTIC/MANAGEMENT TREE** **PAGE 20**

What is the next diagnostic step for a dog with decreased total thyroxine (tT_4) on routine screening that is not on any medications that may affect tT_4 and does not show clinical signs of hypothyroidism?

A. Euthyroid sick syndrome should be considered.
B. Thyroid stimulating hormone levels should be measured.
C. Free T_4 levels should be measured via equilibrium dialysis.
D. Trial of levothyroxine should be administered.

3 **TOP 5** **PAGE 51**

Which of the following statements regarding a stress leukogram is *false*?

A. Neutrophilia is caused by decreased adherence to the vascular endothelium.
B. Prolonged circulation time may cause neutrophils to appear hyposegmented.
C. The segmented neutrophil count can double in dogs and triple in cats.
D. A left shift to band neutrophils and toxic changes are not expected due to lack of inflammatory response.

4 **CASE IN POINT** **PAGE 55**

Which of the following statements regarding feline cutaneous mast cell tumor (MCT) is *false*?

A. Most feline cutaneous MCTs are benign.
B. Feline MCT exfoliates poorly when a fine-needle aspiration technique is used.
C. Mitotic index is the most important prognostic factor for feline cutaneous MCT.
D. Feline cutaneous MCT recurrence is low after surgical removal, even if complete surgical excision is not obtained.

5 **PROCEDURES PRO** **PAGE 65**

Amputation of the _____ digit may affect weight-bearing function.

A. First
B. Second
C. Third

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

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**Mottet J, Kowollik N: BSAVA Congress Proceedings. 2019. 424-425.

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IMPORTANT SAFETY INFORMATION: HEARTGARD® Plus (ivermectin/pyrantel) is well tolerated. All dogs should be tested for heartworm infection before starting a preventive program. Following the use of HEARTGARD Plus, digestive and neurological side effects have rarely been reported. For more information, please see full prescribing information or visit www.HEARTGARDClinic.com.

[1] Data on file at Boehringer Ingelheim. [2] Data on file at Boehringer Ingelheim. [3] Ascarid for Dog. Companion Animal Parasite Council. https://capcvet.org/guidelines/ascarid/. Accessed December 2, 2020. [4] Hookworms for Dog. Companion Animal Parasite Council. https://capcvet.org/guidelines/hookworms/. Accessed December 2, 2020.

Boehringer Ingelheim

See page 71 for product information summary.