"For years I considered conducting a client survey, but I was afraid of what I would hear."

Diane Eigner, VMD,
Owner, The Cat Doctor
Philadelphia, PA

Combining Drugs for CRI

The benefits of analgesic constant rate infusions (CRIs) include providing effective, constant analgesia and avoiding the peaks and troughs seen with intramuscular techniques. The dose can be quickly altered based on patient needs, and CRIs can reduce the requirement for volatile anesthetics and allow better cardiovascular maintenance during general anesthesia. Controlled dosing at a distance prevents most patient interference, allowing for rest and recuperation.

Disadvantages can include increased set-up time and larger required drug volumes, potentially increasing cost and risk for profound bradycardia and respiratory depression. Infusion pumps or syringe drivers for accurate dosing and skilled and trained personnel for constant monitoring add further cost. Many drugs used for CRI are not licensed for use in animals and are controlled substances (eg, morphine, fentanyl, lidocaine, ketamine). A combination of morphine, lidocaine, and ketamine is often used as a CRI in dogs.

Transdermal analgesia, a different technique, relies on drugs with low molecular weight, high lipid solubility, and high potency (eg, fentanyl, buprenorphine). Practitioners should try newer analgesic techniques, starting with low doses and titrating up to provide optimal analgesia.

Commentary

The report provided a clinically relevant review on analgesic CRIs, recipes for combining drug CRIs in clinics with limited equipment, and tables with doses and regimens.

There is, however, some anecdotal information interchanged with referred literature; for instance, the article referred to the "cytoprotective" effect of systemic lidocaine infusion, suggesting this as a therapeutic option for disseminated intravascular coagulation (DIC) and systemic inflammatory response syndrome (SIRS). However, little evidence suggests that lidocaine has any effect to delay or correct DIC/SIRS. Although lidocaine can reduce spontaneous action potential (a main cause of neuropathic or chronic pain) and is useful as a minimum alveolar concentration–sparing drug, its cytoprotective effect needs further evaluation.

The article is a quick reference with practical (and important) information, but some fact checking is needed.—*Andre C. Shih, DVM, DACVA*

Source

Analgesic constant rate infusions in dogs and cats. Bromley N. *IN PRACT* 34:512-516, 2012.

For More

See **Pain Management: Constant-Rate Infusion** by Dr. Alonso G. P. Guedes at **cliniciansbrief.com/CRI**

Impedance Threshold Devices for CPR

CPR is intended to restore spontaneous circulation by providing blood flow to the heart and brain. Coronary perfusion pressure (CPP) is determined by the difference between aortic diastolic pressure and right atrial pressure (RAP). Interventions to maximize perfusion should increase aortic pressure and minimize increases in RAP. CPP is the difference between mean arterial pressure (MAP) and intracranial pressure (ICP); interventions to improve CPP should target MAP increase and ICP decrease. During conventional CPR, chest compression and ventilation contribute to abnormally high intrathoracic pressure (ITTP), restricting venous return, and increasing RAP from transmural transmission of ITTP to the atrium. Lowering ITTP decreases RAP and ICP and can increase cerebral and CPPs.

The impedance threshold device (ITD) can be attached between the endotracheal tube and breathing circuit, preventing air inflow via the endotracheal tube during chest recoil until cracking pressure is reached (usually 12 cm H_2O). ITD use can attenuate some negative consequences of CPR. Eight dogs were anesthetized and, following euthanasia (as part of an unassociated terminal study), standard CPR was performed with some dogs having an ITD in place. Dogs in the ITD group had increased carotid blood flow and CPP and decreased right atrial diastolic pressure. There was no difference in end-tidal CO_2, diastolic arterial blood pressure (BP), mean BP, or systolic BP. ITD use resulted in favorable hemodynamic results and warrants clinical investigation.

Commentary

An ITD, a simple and inexpensive device, reduces intrathoracic pressure during ventilation and chest compression, theoretically improving hemodynamics. This study showed improvement in specific hemodynamic parameters, despite limited sample size and model (ie, anesthetic overdose). Other models in veterinary medicine[1] and a human trial of ITDs[2] have shown no benefit. Success rates of CPR in human and veterinary medicine remain poor. Anything (especially something simple and inexpensive) that can improve outcomes is welcome, but it is premature to determine whether an ITD offers significant benefit to outcome or survival.—*Franciszek von Esse, VMD, DABVP*

Source

The effect of using an impedance threshold device on hemodynamic parameters during cardiopulmonary resuscitation in dogs. Buckley GJ, Shih A, Garcia-Pereira FL, Bandt C. *JVECC* 22:435-440, 2012.

1. **Cardiopulmonary effects of a new inspiratory impedance threshold device in acute hemorrhagic shock in dogs.** Vigani A, Shih AC, Buckley GJ, et al. *JVECC* 21:618-624, 2011.
2. **A trial of an impedance threshold device in out-of-hospital cardiac arrest.** Aufderheide TP, Nichol G, Rea TD, et al. *N Engl J Med* 365:798-806, 2011.

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WSAVA Global Veterinary Community GDV Treatment: An Expert Discussion

This study examined 2 methods for stomach decompression to manage gastric dilatation-volvulus (GDV). Gastric distension from GDV compresses major blood vessels (eg, caudal vena cava, portal vein, splanchnic vasculature), thus compromising the cardiovascular system. Because of cardiovascular compromise, gastric decompression is vital to GDV treatment. The 2 gastric decompression methods studied here included passage of a large-bore silicone orogastric tube and gastric trocarization via insertion of a 14-gauge over-the-needle IV catheter through the skin and into the most distended part of the stomach.

The 116 dogs in this study had been diagnosed with GDV with a right lateral abdominal radiograph, had the method of decompression noted in the medical record, and had undergone surgical correction: 31 were decompressed with an orogastric tube, 39 with trocarization, and 46 with both methods. Orogastric tubing was successful in 75.5% and trocarization in 86% of cases. In 1 case, trocarization resulted in splenic laceration that did not require surgical correction. The study concluded that both methods are safe and effective; thus, either can be used in GDV management.

Commentary

In the GDV patient, gastric decompression is never a substitute for and should never delay fluid resuscitation and analgesia administration. Complete gastric emptying is not necessary before surgical intervention, and it is more effectively performed with orogastric intubation during anesthesia. Preoperative gastric decompression is intended to reduce intraabdominal pressure, increase venous return, and provide relief from pain associated with severe gastric distention during resuscitation. With the limited sample size, this retrospective study indicated that either method of preoperative gastric decompression is safe in the GDV patient. However, compared with orogastric intubation, percutaneous trocarization may be less stressful on the patient, more easily and rapidly performed, and require less restraint.—*Elke Rudloff, DVM, DACVECC*

Global Commentary

As a gastroenterologist with a special interest in GI motility, I have had a long-time interest in the underlying cause(s), treatment, and prophylaxis for GDV. More than 20 years ago, with the support of the Morris Animal Foundation, a global leader in animal science research, I convened and chaired a panel of experts from human and veterinary medicine to reexamine this frustrating and enigmatic disease. That panel and the subsequent call for research proposals led to a much better understanding of the cause and treatment. Even so, we are, alas, still in the dark about its underlying cause. We know that gastric myoelectrical activity and contractility are disrupted with an associated delay in emptying and occur *after* GDV, but what actually initiates the process? Why do some large-breed, deep-chested, older dogs become aerophagic and yet fail to eliminate the air, rapidly leading to dilation and then torsion?

These authors nicely summarized the tenets of initial therapy and demonstrated the safety and success of initial decompression by either trocarization or gastric intubation. Both work well; what is critical is that intragastric pressure must be relieved before surgery. However if we knew the cause and could prevent it, much of this would be unnecessary.—*Colin F. Burrows, BVetMed, PhD, Hon FRCVS, DACVIM*

Source

Assessment of two methods of gastric decompression for the initial management of gastric dilatation-volvulus. Goodrich ZJ, Powell LL, Hulting KJ. *J SMALL ANIM PRACT* 54:75-79, 2013.

For More

For more information about global animal science research, including current calls for proposals, visit **morrisanimalfoundation.org/researchers**

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For an algorithm on **Gastric Dilatation Volvulus**, see page 18 of this issue.

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The Rise of *Ehrlichia* spp

onehealthinitiative.com

A 6-year-old, male Labrador retriever was examined in June 2011 for decreased activity and reluctance to climb stairs. The dog had a fever and stiff gait; history revealed that 2 ticks had been attached to the dog 2 months previously. Assay was positive for *Anaplasma*-specific antibodies. Doxycycline was dispensed for 21 days and carprofen as needed for pain; amoxicillin and Fortiflora (purina.com) were added 5 days later. The dog returned to normal in July.

In August, the dog presented for decreased appetite, lethargy, and recurrent vomiting. Fever and thrombocytopenia were noted; *Anaplasma*-species antibodies were detected on in-house test. Doxycycline was dispensed and PCR testing for *Anaplasma* and *Ehrlichia* spp initiated. Sequencing revealed 100% DNA similarity to *E muris*. Doxycycline was discontinued when the dog experienced vomiting and diarrhea; clostridial enteritis was diagnosed. Amoxicillin, metronidazole, and metoclopramide were dispensed. The dog improved but returned later for decreased activity and hematuria. A 10-day course of cephalexin was recommended for presumptive urinary tract infection; however, hematuria persisted and platelet count decreased. Doxycycline was reinstituted, and hematuria resolved; no additional medical problems were noted. Blood taken 1 month later showed seroreactivity to *Anaplasma* spp peptide. Results from IFA testing for other organisms and PCR testing for *Ehrlichia* spp, including *E muris,* were negative. The dog may have been coinfected with *A phagocytophilum* and *E muris* at initial presentation, although it is possible *E muris* transmission occurred later (before the second fever).

Commentary

E muris was first identified in mice in Japan in the mid-1990s. In 2011, archived adult *Ixodes* ticks collected in northern Wisconsin were analyzed by PCR testing; ~1% contained *E muris* DNA. There have been confirmed human cases in Minnesota and Wisconsin; symptoms in human patients are similar to those caused by *E canis*, *E chaffeensis*, and *E ewingii*. This may be the first dog identified with *E muris*. Several other *Ehrlichia* spp are being investigated for causing disease in humans, and we can expect that some will also cause disease in companion animals.—*Patricia Thomblison, DVM, MS*

Source

Ehrlichia muris in a dog from Minnesota. Hegarty BC, Maggi RG, Koskinen P, et al. *JVIM* 26:1217-1220, 2012.

Mycoplasma & the Coughing Ferret

Ferrets are predisposed to numerous respiratory diseases, the most virulent being canine distemper virus. In 2007, an outbreak of respiratory disease characterized by a dry, nonproductive cough was observed in ferrets 6–8 weeks of age at a United States distribution center; before arrival, the kits had been vaccinated for distemper at a Canadian breeding facility. The disease was characterized by high morbidity but low mortality; over the next 4 years, ~8000 ferrets were affected. Ferrets responded to supportive care with the exception of a dry cough that only temporarily decreased and sometimes persisted for up to 4 years. Postmortem findings included bronchointerstitial pneumonia with prominent hyperplasia of associated lymphoid tissue. Cytological and bacterial cultures from 12 affected ferrets were positive for fast-growing, glucose-fermenting *Mycoplasma* spp and negative for other bacteria. No bacteria or *Mycoplasma* spp were isolated from 10 healthy ferrets. While PCR and nucleic acid sequencing failed to identify the *Mycoplasma* spp, it was found to be most similar to *M molare* and *M lagogenitalium*. The authors suggested a causal relationship between the isolation of this *Mycoplasma* species and an emerging disease in ferrets. One potential trigger may be the stress of shipping.

Commentary

A new syndrome of ferret respiratory disease is described, involving a *Mycoplasma* spp-associated chronic respiratory disease, and should be considered in any ferret with respiratory signs. Other considerations should include canine distemper virus, influenza virus, bacterial pneumonia, and heartworm disease; diagnostics should aim to rule out these conditions. If bronchoalveolar lavage samples are obtained, a *Mycoplasma* spp culture must be specifically requested, as it will not grow on normal bacterial media. Treatment of the newly described *Mycoplasma* spp-associated disease has been unrewarding,[1] but a regimen similar to that used in *Mycoplasma* spp infections in rats (ie, combination therapy with enrofloxacin and doxycycline) may be a reasonable first choice.—*Sarah Churgin, DVM*

Source

Mycoplasmosis in ferrets. Kiupel M, Desjardins DR, Lim A, et al. *EMERG INFECT DIS* 18:1763-1770, 2012.

1. **Ferret respiratory system: Clinical anatomy, physiology, and disease.** Johnson-Delaney CA, Orosz SE. *Vet Clin North Am Exot Anim Pract* 14:357–367, 2011.

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See page 40 for product information summary.

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Description: ProZinc® insulin is a sterile aqueous protamine zinc suspension of recombinant human insulin.

Each mL contains:

recombinant human insulin	40 International Units (IU)
protamine sulfate	0.466 mg
zinc oxide	0.088 mg
glycerin	16.00 mg
dibasic sodium phosphate, heptahydrate	3.78 mg
phenol (added as preservative)	2.50 mg
hydrochloric acid	1.63 mg
water for injection (maximum)	1005 mg

pH is adjusted with hydrochloric acid and/or sodium hydroxide.

Indication: ProZinc (protamine zinc recombinant human insulin) is indicated for the reduction of hyperglycemia and hyperglycemia-associated clinical signs in cats with diabetes mellitus.

Dosage and Administration: USE OF A SYRINGE OTHER THAN A U-40 SYRINGE WILL RESULT IN INCORRECT DOSING.

FOR SUBCUTANEOUS INJECTION IN CATS ONLY.

ProZinc insulin should be mixed by gently rolling the vial prior to withdrawing each dose from the vial. Using a U-40 insulin syringe, the injection should be administered subcutaneously on the back of the neck or on the side of the cat.

Always provide the Cat Owner Information Sheet with each prescription.

The initial recommended ProZinc dose is 0.1 – 0.3 IU insulin/pound of body weight (0.2 – 0.7 IU/kg) every 12 hours. The dose should be given concurrently with or right after a meal. The veterinarian should re-evaluate the cat at appropriate intervals and adjust the dose based on both clinical signs and glucose nadirs until adequate glycemic control has been attained. In the effectiveness field study, glycemic control was considered adequate if the glucose nadir from a 9-hour blood glucose curve was between 80 and 150 mg/dL and clinical signs of hyperglycemia such as polyuria, polydipsia, and weight loss were improved.

Further adjustments in the dosage may be necessary with changes in the cat's diet, body weight, or concomitant medication, or if the cat develops concurrent infection, inflammation, neoplasia, or an additional endocrine or other medical disorder.

Contraindications: ProZinc insulin is contraindicated in cats sensitive to protamine zinc recombinant human insulin or any other ingredients in the ProZinc product. ProZinc insulin is contraindicated during episodes of hypoglycemia.

Warnings: User Safety: For use in cats only. Keep out of the reach of children. Avoid contact with eyes. In case of contact, immediately flush eyes with running water for at least 15 minutes. Accidental injection may cause hypoglycemia. In case of accidental injection, seek medical attention immediately. Exposure to product may induce a local or systemic allergic reaction in sensitized individuals.

Animal Safety: Owners should be advised to observe for signs of hypoglycemia (see Cat Owner Information Sheet). Use of this product, even at established doses, has been associated with hypoglycemia. An animal with signs of hypoglycemia should be treated immediately. Glucose should be given orally or intravenously as dictated by clinical signs. Insulin should be temporarily withheld and, if indicated, the dosage adjusted.

Any change in insulin should be made cautiously and only under a veterinarian's supervision. Changes in insulin strength, manufacturer, type, species (human, animal) or method of manufacture (rDNA versus animal-source insulin) may result in the need for a change in dosage.

Appropriate diagnostic tests should be performed to rule out other endocrinopathies in diabetic cats that are difficult to regulate.

Precautions: Animals presenting with severe ketoacidosis, anorexia, lethargy, and/or vomiting should be stabilized with short-acting insulin and appropriate supportive therapy until their condition is stabilized. As with all insulin products, careful patient monitoring for hypoglycemia and hyperglycemia are essential to attain and maintain adequate glycemic control and to prevent associated complications. Overdosage can result in profound hypoglycemia and death. Progestogens, certain endocrinopathies and glucocorticoids can have an antagonistic effect on insulin activity. Progestogen and glucocorticoid use should be avoided.

Reproductive Safety: The safety and effectiveness of ProZinc insulin in breeding, pregnant, and lactating cats has not been evaluated.

Use in Kittens: The safety and effectiveness of ProZinc insulin in kittens has not been evaluated.

Adverse Reactions: Effectiveness Field Study

In a 45-day effectiveness field study, 176 cats received ProZinc insulin. Hypoglycemia (defined as a blood glucose value of < 50 mg/dL) occurred in 71 of the cats at various times throughout the study. Clinical signs of hypoglycemia were generally mild in nature (described as lethargic, sluggish, weak, trembling, uncoordinated, groggy, glassy-eyed or dazed). In 17 cases, the veterinarian provided oral glucose supplementation or food as treatment. Most cases were not associated with clinical signs and received no treatment. One cat had a serious hypoglycemic event associated with stupor, lateral recumbency, hypothermia and seizures. All cases of hypoglycemia resolved with appropriate therapy and if needed, a dose reduction.

Three cats had injection site reactions which were described as either small, punctate, red lesions; lesions on neck; or palpable subcutaneous thickening. All injection site reactions resolved without cessation of therapy.

Four cats developed diabetic neuropathy during the study as evidenced by plantigrade stance. Three cats entered the study with plantigrade stance, one of which resolved by Day 45. Four cats were diagnosed with diabetic ketoacidosis during the study. Two were euthanized due to poor response to treatment. Five other cats were euthanized during the study, one of which had hypoglycemia. Four cats had received ProZinc insulin for less than a week and were euthanized due to worsening concurrent medical conditions.

The following additional clinical observations or diagnoses were reported in cats during the effectiveness field study: vomiting, lethargy, diarrhea, cystitis/hematuria, upper respiratory infection, dry coat, hair loss, ocular discharge, abnormal vocalization, black stool, and rapid breathing.

Extended Use Field Study

Cats that completed the effectiveness study were enrolled into an extended use field study. In this study, 145 cats received ProZinc insulin for up to an additional 136 days. Adverse reactions were similar to those reported during the 45-day effectiveness study and are listed in order of decreasing frequency: vomiting, hypoglycemia, anorexia/poor appetite, diarrhea, lethargy, cystitis/hematuria, and weakness. Twenty cats had signs consistent with hypoglycemia described as: sluggish, lethargic, unsteady, wobbly, seizures, trembling, or dazed. Most of these were treated by the owner or veterinarian with oral glucose supplementation or food; others received intravenous glucose. One cat had a serious hypoglycemic event associated with seizures and blindness. The cat fully recovered after supportive therapy and finished the study. All cases of hypoglycemia resolved with appropriate therapy and if needed, a dose reduction.

Fourteen cats died or were euthanized during the extended use study. In two cases, continued use of insulin despite anorexia and signs of hypoglycemia contributed to the deaths. In one case, the owner decided not to continue therapy after a presumed episode of hypoglycemia. The rest were due to concurrent medical conditions or worsening of the diabetes mellitus.

To report suspected adverse reactions, or to obtain a copy of the Material Safety Data Sheet (MSDS), call 1-866-638-2226.

Information for Cat Owners: Please refer to the Cat Owner Information Sheet for more information about ProZinc insulin. ProZinc insulin, like other insulin products, is not free from adverse reactions. Owners should be advised of the potential for adverse reactions and be informed of the associated clinical signs. Potential adverse reactions include: hypoglycemia, insulin antagonism/resistance, rapid insulin metabolism, insulin-induced hyperglycemia (Somogyi Effect), and local or systemic reactions. The most common adverse reaction observed is hypoglycemia. Signs may include: weakness, depression, behavioral changes, muscle twitching, and anxiety. In severe cases of hypoglycemia, seizures and coma can occur. Hypoglycemia can be fatal if an affected cat does not receive prompt treatment. Appropriate veterinary monitoring of blood glucose, adjustment of insulin dose and regimen as needed, and stabilization of diet and activity help minimize the risk of hypoglycemic episodes. The attending veterinarian should evaluate other adverse reactions on a case-by-case basis to determine if an adjustment in therapy is appropriate, or if alternative therapy should be considered.

Effectiveness: A total of 187 client-owned cats were enrolled in a 45-day field study, with 176 receiving ProZinc insulin. One hundred and fifty-one cats were included in the effectiveness analysis. The patients included various purebred and mixed breed cats ranging in age from 3 to 19 years and in weight from 4.6 to 20.8 pounds. Of the cats included in the effectiveness analysis, 101 were castrated males, 49 were spayed females, and 1 was an intact female.

Cats were started on ProZinc insulin at a dose of 0.1-0.3 IU/lb (0.2-0.7 IU/kg) twice daily. Cats were evaluated at 7, 14, 30, and 45 days after initiation of therapy and the dose was adjusted based on clinical signs and results of 9-hour blood glucose curves on Days 7, 14, and 30.

Effectiveness was based on successful control of diabetes which was defined as improvement in at least one blood glucose variable (glucose curve mean, nadir, or fructosamine) and at least one clinical sign (polyuria, polydipsia, or body weight). Based on this definition, 115 of 151 cases (76.2%) were considered successful. Blood glucose curve means decreased from 415.3 mg/dL on Day 0 to 203.2 mg/dL by Day 45 and the mean blood glucose nadir decreased from 407.9 mg/dL on Day 0 to 142.4 mg/dL on Day 45. Mean fructosamine values decreased from 505.9 µmol/L on Day 0 to 380.7 µmol/L on Day 45.

Cats that completed the effectiveness study were enrolled in an extended use field study. The mean fructosamine value was 342.0 µmol/L after a total of 181 days of ProZinc therapy.

How Supplied: ProZinc insulin is supplied as a sterile injectable suspension in 10 mL multidose vials. Each mL of ProZinc product contains 40 IU recombinant human insulin.

Storage Conditions: Store in an upright position under refrigeration at 36-46°F (2-8°C). Do not freeze. Protect from light.

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FOCUS Standard Cytology Scale: What Is in Your Practice?

Results of skin and ear cytology samples are often used to initiate and monitor therapy. A semiquantitative scale for recording results (see **Cytology Scale**) and testing the reproducibility of reading and scoring cutaneous cytology was developed. Sixty examiners (29 very experienced, 31 less experienced) were asked to examine glass slides (n = 10) and photographs (n = 18) of cutaneous cytology and score the specimen using a scale (see **Cytology Scale**). Experienced examiners received no instructions or coaching; less experienced participants were advised to scan the slides at low power first. Participants were asked to repeat the evaluation and scoring 5 hours later. The intraobserver reproducibility was 84.3% (experienced group) and 82.6% (less experienced group). Interobserver reproducibility for both experienced and less experienced groups was nearly identical for slides (81.6% and 80%, respectively) and photographs (91.0% and 90%, respectively).

Commentary

This study showed that practices can develop a standardized reporting system for skin and ear findings to be read by veterinarians or veterinary technicians by developing a scale (or using the one mentioned) and having a short training session using glass slides or photographs. Permanent mounts of glass slides representative of the scale for training and reference could be beneficial. This would be useful for any field that relies heavily on cytological skills.—*Karen A. Moriello, DVM, DACVD*

Source

Reproducibility of a semiquantitative method to assess cutaneous cytology. Budach SC, Mueller RS. *VET DERMATOL* 23:426-e80, 2012.

Cytology Scale

- 0 = No bacteria/yeast/inflammatory cells present
- 1+ = Occasional bacteria/yeast/inflammatory cells present, but slide must be scanned carefully for detection
- 2+ = Bacteria/yeast/inflammatory cells present in low numbers but easily detectable
- 3+ = Bacteria/yeast/inflammatory cells present in larger numbers and quickly and easily detectable
- 4+ = Massive amounts of bacteria/yeast/inflammatory cells present and quickly and easily detectable

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At-Home Treatment for Hypoglycemic Crises

Hypoglycemia is a serious complication of diabetes mellitus. Glucagon rapidly elevates blood glucose levels and is administered SC and IV in humans with hypoglycemic crises. The amino acid sequence of glucagon is identical in humans and dogs; this study investigated the effects of SC and IV administration of glucagon on glucose concentration and insulin and cortisol secretion in dogs. Five healthy beagles received 1 mg glucagon or placebo (ie, sterile water) IV or SC. Blood samples were collected pre- and postadministration and analyzed for insulin-like reactivity, glucose, ACTH, and cortisol secretion. Glucagon was well tolerated in all dogs; somnolence was the only observed adverse effect. Glucagon administration resulted in increased glucose concentrations over baseline at 10, 20, and 30 minutes postadministration with peaks at 20 minutes and significantly increased insulin-like reactivity. IV administration resulted in higher glucose concentrations than SC administration. SC administration did not result in significant increase in ACTH or cortisol concentrations; however, IV administration resulted in a significant increase in cortisol 10 minutes postadministration. SC glucagon may have potential for at-home canine hypoglycemic emergencies.

Commentary

SC glucagon injection increased glucose levels to 97–146 mg/dL within 20 minutes of administration, which the authors argued would succeed based on recent human studies. Although not as effective as the IV route, human emergency kits with SC glucagon could be used by dog owners to help their pets overcome severe hypoglycemia. In addition, the SC glucagon caused significant increases in insulin secretion that may provide a new stimulation test for future studies of diabetic dogs. Cortisol elevation was limited. Ultimately, this pilot study suggested the need for additional research on emergency glucagon intervention and diabetic testing. It also suggested the potential of an alternative to the glucagon CRI in initial insulinoma or insulin overdose therapy.—*Ewan Wolff, DVM*

Source

Metabolic and hormonal responses to subcutaneous glucagon in healthy beagles. Zeugswetter FK, Schornsteiner E, Haimel G, Schwendenwein I. *JVECC* 22:558-563, 2012.

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Adjunct Therapy for Liver Disease

Silymarin, a standardized extract of milk thistle fruits and seeds, contains at least 7 flavonolignans; silibin is considered the primary active ingredient. The primary phase metabolite, silibinin glucuronide, is metabolized and secreted in bile wherein concentrations are 100× concentrations in serum. Silibinin is water insoluble and not readily absorbed by intestines; however, milk thistle extracts can be combined with solubilizing substances to improve oral bioavailability. The mechanism of action is understood as an antioxidant free radical scavenging and an inhibition of lipid peroxidation in hepatocytes, peripheral blood, and several other body tissues, making it useful as a protectant for the liver. The multiple cellular effects of silibinin include various inhibitions of inflammatory mediators. In humans with nonalcoholic fatty liver disease, silibinin can decrease C-reactive protein, inflammatory cytokines, and indices of hepatic fibrosis.

Silibinin is considered a safe drug, with no deaths or life-threatening symptoms reported in humans. In veterinary medicine, applications include administration in toxicity cases, hepatic disease (eg, hepatitis, cirrhosis), or fatty liver disease. Not to be considered a sole treatment, silibinin is a useful adjunct to acute and chronic disease affecting liver function. There is limited evidence regarding silibinin pharmacokinetics in domestic small animals and large animal herbivores, so its use warrants further investigation.

Commentary

Silymarin and its major constituent silibinin have been used for the treatment of liver disease for thousands of years. In addition, it is undergoing research as a promising anticancer agent in various in vitro and in vivo cancer models (eg, skin, breast, lung, colon, bladder, prostate, kidney). Studies have also shown that silibinin may help lower cholesterol and increase good cholesterol in humans. Silibinin is an interesting example of how an ancient herb can translate into modern Western medicine.—*Heather Troyer, DVM, DABVP, CVA*

Global Commentary

Treatment of inflammatory liver disease can be a challenge. The basis of therapy lies in immunomodulation, usually with corticosteroids; however, recent evidence suggests that cyclosporine may be more effective. Ursodeoxycholic acid, a synthetic bile salt, is also useful in treating many liver diseases. Because most liver damage is associated with oxidative damage within the hepatocyte, adjunctive use of antioxidants has long been recommended. This includes S-adenosylmethionine (SAMe) and vitamin E. This research suggested that the silibinin in milk thistle, a folk remedy to treat liver disease in humans, has strong antioxidant properties. As the authors suggested, however, controlled studies of its efficacy in veterinary medicine are lacking and sorely needed.—*Colin F. Burrows, BVetMed, PhD, Hon FRCVS, DACVIM*

Source

Milk thistle and its derivative compounds: A review of opportunities for treatment of liver disease. Hackett ES, Twedt DC, Gustafson DL. *JVIM* 27:10-16, 2013.

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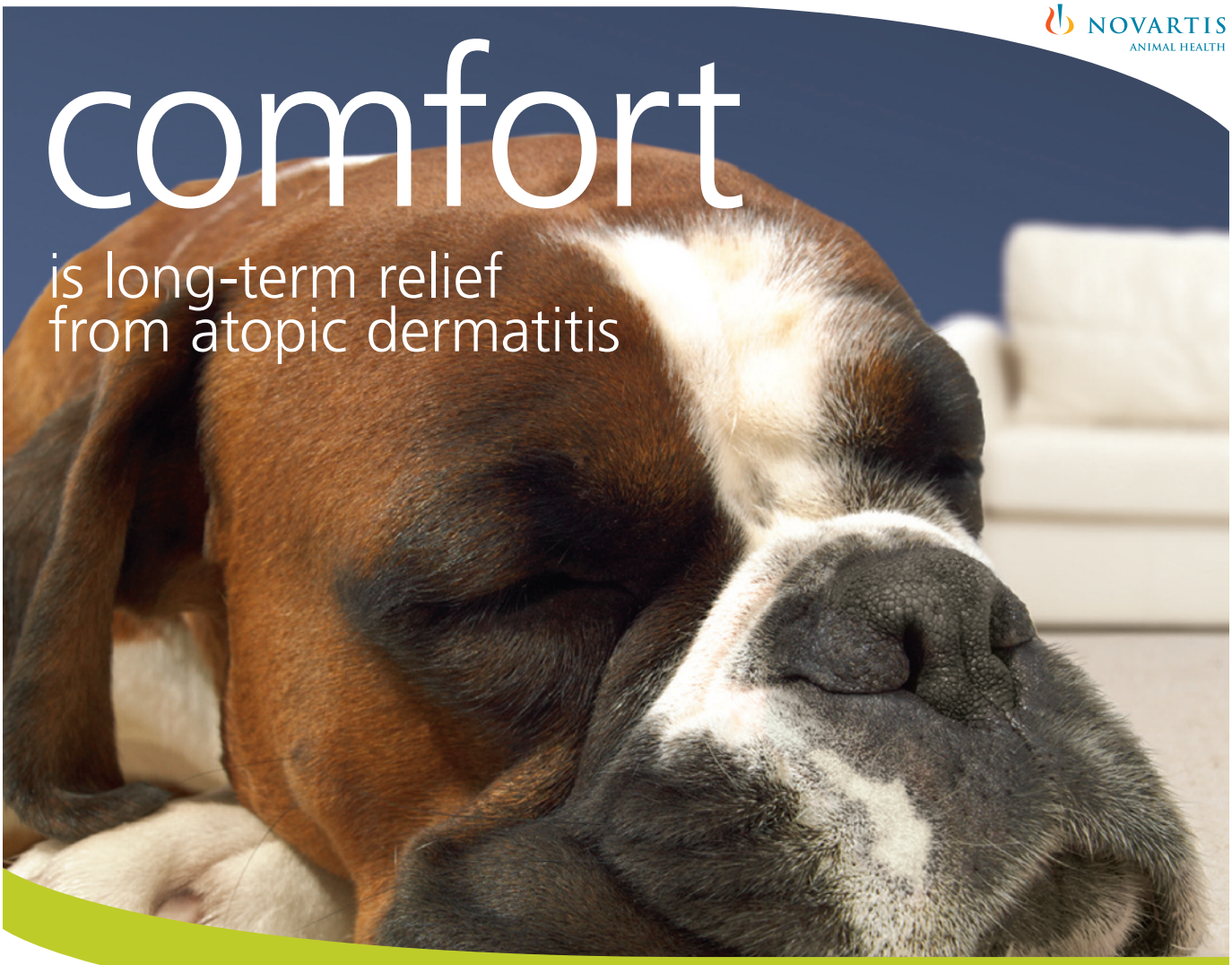

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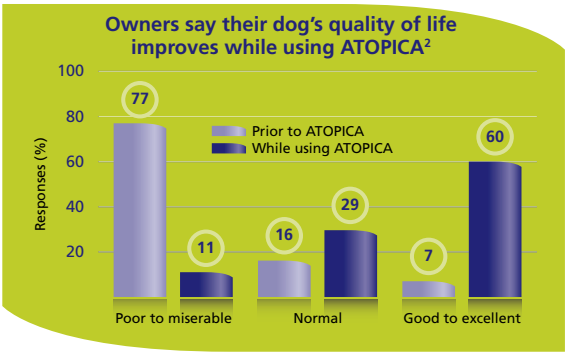

As with all drugs, side effects may occur. In a field study, the most common side effects were gastrointestinal signs.Gingival hyperplasia and papillomas may also occur during the initial dosing phase. ATOPICA is a systemic immunosuppressant that may increase the susceptibility to infection. ATOPICA is not for use in reproducing dogs or dogs with a history of neoplasia. See page 42 for brief summary information.

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References: 1. ATOPICA User Survey, Forward Research (2004). 2. ATOPICA Customer Satisfaction Study (2008). 3. Steffan J et al. Vet Dermatol (2003) 14, p11-22.
4. Steffan J *et al.* JAVMA (2005) 226, p1855-1863.

Periodontal Possibilities

Matrix metalloproteinases (MMPs), which degrade connective tissue, are essential to the inflammatory process of periodontal disease. Doxycycline inhibits MMPs, even at subantimicrobial doses. To identify the subantimicrobial dose of doxycycline (SDD) for treatment of periodontal disease in dogs, 20 beagles received doxycycline hyclate at 0, 1, 2, 3, or 5 mg/kg (n = 5 dogs/dose group). Serum doxycycline concentrations were measured at baseline and 0.5, 1, 1.5, 2, 3, 4, 5, 6, 8, 12, and 24 hours postadministration; the SDD was identified to be 1 or 2 mg/kg. To evaluate efficacy, 15 beagles with moderate to severe periodontal disease were divided into 3 groups and given doxycycline at 0, 1, or 2 mg/kg q24h for 1 month. Gingival samples were collected and gingival attachment and bleeding upon probing measured at baseline and after 1 month. Results showed significant improvement in gingival attachment and bleeding on probing in the 2 mg/kg group, but not in others. Zymographic analysis showed lower gelatinolytic intensities of MMP in tissue samples in week 4 than in week 0. Doxycycline at 2 mg/kg q24h is an effective SDD for treating periodontal disease in dogs. Long-term treatment with SDDs could improve gelatinolytic inflammatory diseases (eg, periodontitis and arthritis) in dogs.

Commentary

Although this report appeared to have promising short-term results, the information should not be applied in the clinical setting without a long-term benefit and adverse event study in dogs affected with different stages of periodontal disease. Unfortunately, what works in human dentistry cannot always be applied to companion animals. Administering doxycycline to canine patients without eliminating periodontal pockets, extracting teeth affected with advanced periodontal disease, and strict attention to plaque control will not help patients or clients.—*Jan Bellows, DVM, FAVD, DAVDC, DABVP*

Source

Experimental determination of a subantimicrobial dosage of doxycycline hyclate for treatment of periodontitis in Beagles. Kim SE, Kim S, Jeong M, et al. *AM J VET RES* 74:130-135, 2013.

Ongoing Surveillance of Canine Influenza Virus

Canine influenza virus (CIV), or influenza A subtype H3N8, was transmitted from horses to dogs and adapted to enable transmission between dogs, causing influenza-like signs. The incubation period for CIV is 2–4 days; antibodies to the H3 viral protein are detectable ~7 days postinfection. CIV has been identified in 39 states.

From 2005 through June 2009, serum samples were collected from pet and shelter dogs with influenza-like signs to estimate the seroprevalence of H3N8 CIV and determine intrinsic and exposure factors associated with seropositivity. Serum samples were analyzed from 1,268 dogs in 42 states; overall seroprevalence was 49%. Of seropositive dogs, 59% were from Colorado (overall highest seroprevalence), New York (second highest), and Florida (third highest). Year, geographic region, and exposure setting were associated with seropositivity. The study was limited by an unequal representation of states, variability of serum samples submitted each year, and unequal representation of pet and shelter dogs. The number of seronegative dogs with influenza-like signs was not compared, and study dogs were not randomly selected. Thus, results cannot be extrapolated for all dogs in the United States; however, data do suggest continued need for H3N8 surveillance and development of protocols to reduce risk for CIV transmission in communal canine housing.

Commentary

In 2005, our hospital saw 23 pet dogs seropositive for H3N8 CIV with severe, secondary suppurative pneumonia. However, the overall incidence of pneumonia or death is extremely low. This study reminds us of our duty to provide proper preventive medicine, hygiene, ventilation, and isolation in group boarding, grooming, or shelter facilities, and that continued surveillance of H3N8 CIV seroprevalence is important, as is watching for emergent pathogens in a rapidly evolving part of nature.—*Heather Troyer, DVM, DABVP, CVA*

Source

Prevalence of and exposure factors for seropositivity to H3N8 canine influenza virus in dogs with influenza-like illness in the United States. Anderson TC, Crawford PC, Dubovi EJ, et al. *JAVMA* 242:209-216, 2013.

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References:
1. Crawford C, Spindel M. Canine influenza. In: Miller L, Hurley K, eds. *Infectious Disease Management in Animal Shelters*. Ames, IA: Wiley-Blackwell; 2009:173–180.
2. Canine influenza backgrounder. AVMA Website. Available at: http://www.avma.org/public_health/influenza/canine_bgnd.asp. Updated September 7, 2009. Accessed January 10, 2011.
3. Data on file, Merck Animal Health.

MAH-VC-526b
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MERCK Animal Health

FOCUS Weighing the Benefits of Bathroom Scale Diagnostics

Static weight bearing can be a valuable objective measure of patient recovery from orthopedic surgery or following physiotherapy. Gait analysis conducted on dynamic force platforms remains the gold standard for evaluating lameness, although it can be complex and costly. This study evaluated conventional bathroom scales for measuring changes in hindlimb static weight bearing in dogs with unilateral osteoarthritis (OA) of the stifle. The study group (n = 43) had undergone surgical treatment to repair a ruptured cruciate, had subsequent OA in the surgical knee, and were compared with healthy controls (n = 21).

Static weight bearing was measured using 2 identical factory-calibrated bathroom scales, 1 under each hindlimb. Measurements were recorded from both scales while the dog stood as straight and square as possible. Weight measurements were compared against subjective evaluation of static weight bearing, orthopedic examination for degree of lameness, dynamic force platform evaluation, radiographic examination (OA dogs only), and overall clinical assessment. Sensitivity and specificity for the OA group were 39% and 85%, respectively. Agreement between the bathroom scale method and dynamic force platform analysis was slight to moderate. Bathroom scales can be a useful objective measure of lameness, particularly when measuring response to physical therapy, although small sample size and inability to rule out OA in the control group may have compromised findings.

Commentary

This study found that bathroom scales could detect large differences in symmetry and had variable agreement with the other tests (0%–75%). The statistical kappa agreement between the scales and other testing modalities was fairly low.

Although bathroom scales are much cheaper than a force plate system, their use for determining repeatable interpatient data is suspect. Given the higher specificity, the best use is likely detecting ongoing pain in individual dogs. When comparing this study with previous studies of asymmetry analyses, differences in statistical tests used notwithstanding, the bathroom scales seem inferior.[1,2] —*Jonathan Miller, DVM, MS, DACVS*

Source

Use of bathroom scales in measuring asymmetry of hindlimb static weight bearing in dogs with osteoarthritis. Hyytiäinen HK, Mölsä SH, Junnila JT, et al. *VET COMP ORTHOPAED TRAUMATOL* 5:390-396, 2012.

1. **Accuracy of asymmetry indices of ground reaction forces for diagnosis of hind limb lameness in dogs.** Fanchon L, Grandjean D. *Am J Vet Res* 68:1089-1094, 2007.

2. **The effect of measurement method on static weight distribution to all legs in dogs using the Quadruped Biofeedback System.** Phelps HA, Ramos V, Shires PK, Werre SR. *Vet Comp Orthop Traumatol* 20:108-112, 2007.

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Research Note: Diagnostic Markers for Transitional Cell Carcinoma

Transitional cell carcinoma (TCC) is the most common bladder cancer in dogs, and its prevalence is increasing. Most dogs are diagnosed late in the disease course and do not respond to therapy as well as dogs diagnosed earlier. A diagnostic screening test has low positive predictive value. MicroRNAs (miRNAs) have been used in human medicine as disease biomarkers and in determining prognosis. In mammals, miRNAs play a role in cell proliferation, differentiation, and apoptosis; in humans, they may be upregulated in cancerous cells.

One objective of this study was to determine expression of miRNAs in urinary bladder samples obtained from dogs. Diseased urinary bladder tissue samples were obtained from formalin-fixed paraffin-embedded archived samples; grossly normal bladder tissue samples were obtained from animals undergoing necropsy for reasons unrelated to the study. Included were tissues from 4 grossly normal bladders, 13 with nonneoplastic inflammatory bladder disease, and 18 with TCC. There was a significant difference in the expression of some miRNAs from all 3 groups. These results support the potential use for miRNAs as diagnostic biomarkers for identifying dogs with TCC.

Source

Expression of microRNAs in urinary bladder samples obtained from dogs with grossly normal bladders, inflammatory bladder disease, or transitional cell carcinoma. Vinall RL, Kent MS, deVere White RW. *AM J VET RES* 73:1626-1633, 2012.

Guinea Pig Pruritus

The most common cause of pruritus in guinea pigs is sarcoptiform mange, caused by the mite *Trixacarus caviae* that burrows into the skin, creating epidermal tunnels and eliciting a cell-mediated immune response. The mite's life cycle is 10–14 days. Most transmission is direct from carrier animals. Lesions are typically on the head, shoulders, dorsum, or flanks but can become generalized. Lichenification can occur with chronic infection. Secondary bacterial infections are common, and seizures have been reported.

Affected guinea pigs become thin and lethargic; the disease can be fatal. Diagnosis is made via skin scrapings and visualization of eggs and mites. The mites resemble *Sarcoptes scabiei* var canis; however, *T caviae* mites are smaller and have longer hair-like dorsal setae. There are no licensed antiacaricidal drugs for guinea pigs.

Seventeen mixed-breed guinea pigs with active mite infestations received either topical selamectin (15 mg/kg, $n = 9$) as a single dose or ivermectin (400 µg/kg) SC q10d ($n = 8$) for 4 injections. Pruritus resolved in 10 days for all animals; all were microscopically mite-free on day 30 (selamectin group) or day 40 (ivermectin group). Neither infection recurrence nor adverse reactions were noted in either group.

Commentary

Some animals can be subclinical carriers and can introduce the disease into a colony. As with other species of sarcoptic mites, they can cause transient dermatitis in humans. Although there was no significant difference in treatment outcomes, most owners would much prefer a one-time topical than an injection series. Topical ivermectin has also been suggested, but >1 treatment is recommended. These are extralabel uses of antiparasiticides, and owners should be advised. Cleaning bedding and living quarters is also important in management.—*Patricia Thomblison, DVM, MS*

Source

Comparison of efficacy, safety, and convenience of selamectin versus ivermectin for treatment of *Trixacarus caviae* in pet guinea pigs (*Cavia porcellus*). Eshar D, Bdolah-Abram T. *JAVMA* 241:1056-1058, 2012.

GI EXCHANGE:
Immune support for a strong start

What benefits can probiotics have for puppies and kittens?

Although puppies and kittens are born with nearly fully developed immune systems, the immune system continues to mature during the first few months of life. Gastrointestinal (GI) microflora play a critical role in this process. Probiotics fed to puppies and kittens can help them develop strong and healthy immune systems. They can also support GI tract health by minimizing the adherence and colonization of pathogenic bacteria. This helps reduce the risk of diarrhea or soft stools commonly seen in puppies and kittens.

Ebenezer Satyaraj, PhD
Group Manager, Nutritional Immunology, Nestlé Purina PetCare

How does *Enterococcus faecium* SF68, the probiotic in Purina Veterinary Diets® FortiFlora® Canine and Feline Nutritional Supplements, help nutritionally manage diarrhea?

SF68 has been proven to strengthen the immune system and promote normal intestinal microflora — a key factor in managing diarrhea. In one study, shelter cats with diarrhea were fed SF68 or a placebo. The percentage of cats with diarrhea lasting two days or longer was significantly lower in the probiotic group (7.4%) than in the control group (20.7%).[1] SF68 also helps reduce variability of fecal quality in puppies and kittens.

How does SF68 support immune system health?

In another study, puppies supplemented with SF68 from weaning to 1 year of age were compared to a control group. All were vaccinated for canine distemper virus (CDV). Antibody response to the CDV vaccination was greater in SF68-supplemented puppies than in the controls. SF68-supplemented puppies also had higher levels of fecal IgA, which helps enable the gut to reduce pathogens and neutralize toxins. This response demonstrated that SF68 promotes a strong immune system, at the local (gut) level and systemic level (as demonstrated by enhanced vaccine response).[2,3]

1. Bybee SN, et al. Effect of the probiotic *Enterococcus faecium* SF68 on presence of diarrhea in cats and dogs housed in an animal shelter. *J Vet Intern Med* 2011:1–5.
2. Benyacoub J, et al. Supplementation of food with *Enterococcus faecium* (SF68) stimulates immune functions in young dogs. *J Nutr.* 2003;133:1158-62.
3. Satyaraj E. Emerging Paradigms in Immunonutrition. *Topics in Companion Animal Medicine*, Feb 2011:26(1):25-32.

Visit PurinaVeterinaryDiets.com/NutritionExchange

Feline Calcium Oxalate Urolithiasis: A Dietary Possibility

Changes in nutrition may be involved in the progressive increase in feline calcium oxalate (CaOx) urolithiasis, as oxalates are a product of the incomplete oxidation of dietary carbohydrate. This study examined whether a high carbohydrate diet would induce endogenous oxalate synthesis, causing increased urinary CaOx excretion and increasing risk for CaOx urolithiasis. A pilot study (n = 4 cats) established that when diet changed, CaOx excretion levels adapted and reached a steady state after 5.9 ± 0.7 days. For the experiment, 12 healthy adult female cats were first fed a high protein (HP) diet, then a high carbohydrate (HC) diet, followed by a high fat (HF) diet. Urine was collected on days 9–11 of each phase and analyzed for specific gravity, pH, urine oxalate (UOx) and urine creatinine (Ucreat) concentrations and total UOx excretion. UOx and Ucreat concentrations were significantly lower with HP compared with HC and HF. However, neither UOx excretion nor UOx:Ucreat ratio were significantly influenced by diet. Blood was collected on day 12, and plasma oxalate concentration was significantly lower when cats ate HP compared with HF. HC diets were not proved to induce endogenous oxalate synthesis in cats: possibly the metabolic pathway involved in oxalate synthesis did not reach threshold or the mechanism is more complex than proposed.

Commentary

This study attempted to discover why feline CaOx urolithiasis prevalence has recently increased. By offering 3 different diets, the researchers investigated differences in UOx excretion. HP was associated with slightly more acidic and concentrated urine, with no significant difference in UOx excretion. Several limitations were present; for instance, young adult, intact, lean, female cats were used, while CaOx stones are more common in older, overweight, neutered cats. The cats were fed experimental semi-purified, wet diets rather than commercially available dry products. Further research is needed to define risk factors for CaOx urolithiasis.—*Craig Datz, DVM, MS, DABVP, DACVN*

Source

Changes in dietary macronutrient profile do not appear to affect endogenous urinary oxalate excretion in healthy adult cats. Dijcker JC, Hagen-Plantinga EA, Hendriks WH. *VET J* 194:235-239, 2012.

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THC Toxicity

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The hemp plant *Cannabis sativa* contains the toxic compound Δ^9-tetrahydrocannabinol (THC). Dogs can be intoxicated through inhalation of smoke, ingestion of the plant, or ingestion of products made with leaves, concentrated THC, or hashish oil. Signs, usually seen within 30–60 minutes of ingestion, can include CNS depression, ataxia, mydriasis, increased sensitivity to motion or sound, hyperesthesia, ptyalism, tremors, and acute onset of urinary incontinence. A retrospective study was conducted in a state with legalized medical marijuana to determine whether the increase in medical marijuana licenses correlated with marijuana toxicity in dogs and investigate the use of a urine drug screening test (UDST) when diagnosing marijuana ingestion in dogs. Medical records of 125 dogs were evaluated: 76 with known marijuana exposure or a positive UDST, 6 with known marijuana ingestion and a negative UDST, and 43 with known marijuana ingestion that were not tested. The increase in THC-intoxicated dogs appeared to correlate with increased medical marijuana licenses, increasing 4-fold in 5 years, while humans registered for medical marijuana increased 146-fold. Increased clinician awareness, population changes, or increased willingness of clients to seek veterinary attention might have affected these numbers. UDSTs may be unreliable and only helpful if the test is positive. The human UDST has not been validated for use in dogs, and its usefulness remains controversial.

Commentary

With its increased use in human medicine, marijuana is becoming a more common toxicant in veterinary medicine. Onset of signs depends on the route of exposure and ranges from 5–60 minutes. Fortunately, it is seldom lethal; most patients respond in 1–5 days. Although decontamination by emesis is often unsuccessful (marijuana is commonly used as an antiemetic in human medicine), activated charcoal with a cathartic may be beneficial. An illicit urine drug screen is helpful in confirming this diagnosis, although this may not be reliable.[1]—*Garret Pachtinger VMD, DACVECC*

Source

Evaluation of trends in marijuana toxicosis in dogs living in a state with legalized medical marijuana: 125 dogs (2005-2010). Meola SD, Tearney CC, Haas SA, et al. *JVECC* 22:690-696, 2012.

1. **Evaluation of a human on-site urine multi-drug test for emergency use with dogs.** Teitler J. *JAAHA* 45:59-66, 2009.

Tennis Elbow & the Feline Patient

In this prospective study, medial humeral epicondylitis was characterized based on anatomic, radiographic, and histologic observations in 60 European shorthair cats that died (or were euthanized) for medical reasons. Elbow instability was not noted in any cats. Radiographs of both elbows were taken using extended craniocaudal and extended and flexed mediolateral projections. Histologic samples from normal elbows and those with new bone formation at the medial epicondyle were compared. Radiographic evidence of medial humeral epicondylitis including chronic degeneration, mineralization, and metaplastic bone formation were noted in 6 cats (10%); 2 had histologic evidence of ulnar nerve displacement and epineural fibrosis. Results suggested that medial humeral epicondylitis is common in cats and has potential clinical sequelae. Active pronation and supination are important movements in cats, especially for climbing and hunting. Whether this predisposes cats to epicondylitis is unknown. Early stage epicondylitis may be overlooked in cats, particularly in the absence of soft tissue mineralization on radiographs.

Commentary

This prospective study examined 60 deceased cats with no history of orthopedic disease. Radiographs were taken of the elbows and intricate histologic evaluation was performed. In more severe cases of medial epicondylitis, cartilage defects, local mineralization and thickening of the joint capsule, and compression with degenerative changes in the ulnar nerve were seen. Inflammation was not seen, which is consistent with the human version (ie, tennis elbow), in which inflammation is only present in the early stage. This analysis by the University of Zurich lends more precise information on the pathology of elbow arthritis in cats. The effect of joint disease on the ulnar nerve is fascinating. Early diagnosis and treatment with disease-modifying agents, weight loss, and NSAIDs would be beneficial to these suffering patients.—*Jonathan Miller, DVM, MS, DACVS*

Source

Medial humeral epicondylitis in cats. Streubel R, Geyer H, Montavon PM. *VET SURG* 41:795-802, 2012.

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Patterns of Pruritus: A Diagnostic Tool

Pruritus can be a complicating factor or major feature of diseases, including flea infestations (FI), flea bite hypersensitivity (FBH), and canine atopic dermatitis (CAD); in many cases, pruritus may be the initial presenting clinical finding. Records from 346 dogs (91 CAD, 110 FI, 145 FBH) were analyzed determine if unique characteristics of the pruritus pattern were helpful in diagnosis. Pruritus was a sensitive diagnostic finding for dogs with CAD (84%) and FBH (81%) but not flea infestations (61%). In addition to exhibiting behaviors more frequently associated with pruritus (eg, chewing, licking, rubbing), dogs with CAD and FBH were more intensely pruritic than dogs with FI. The most common locations of the pruritus varied among FI (ventral abdomen and/or medial thigh, radius and/or carpus and/or tarsus), FBH (back, dorsolumbosacral area, tail), and CAD (face and/or neck, lateral thorax and/or axillary areas, paws).

Commentary

Several flow charts are available for working up patients with pruritus but, in reality, diagnostic suggestions stem from history and signs. Flow charts are guides, not mandates. This information emphasized that there are patterns of pruritus in dogs with no apparent skin lesions (or evidence of fleas). From a practical perspective, scabies is worth mentioning; the severity of the pruritus from scabies far exceeds that of FI, FBH, or CAD; only combined yeast (severe) and bacterial infections and the rare case of advanced epitheliotropic lymphoma come close to this degree of pruritus.

Scabies is traditionally described as a disease with ventral distribution, but by the time it is seen, the lesions are usually generalized. Other differentiating factors include a purely papular eruption and a dog that is intensely pruritic to the point of

ignoring everything else. Using the study, it is relatively easy to prioritize the differential diagnoses of dogs with apparent pruritus as the sole presenting complaint. *—Karen A. Moriello, DVM, DACVD*

Source

Characterization of pruritus in canine atopic dermatitis, flea bite hypersensitivity and flea infestation and its role in diagnosis. Bruet V, Bourdeau PJ, Roussel A, et al. *VET DERMATOL* 23:487-E93, 2012.

FOCUS 3 Cases of Thromboembolism

Atrial fibrillation (AF) is the most common pathologic arrhythmia in dogs. Three dogs with AF and a complicating thromboembolism were described. A 13-year-old spayed, mixed-breed dog was referred for additional treatment of congestive heart failure (CHF) from degenerative valve disease and severe mitral regurgitation. Despite attempts to stabilize the patient, it died 12 hours after discharge.

A 5-year-old, neutered Bernese mountain dog was referred for lethargy, decreased appetite, and vomiting. Key findings for both included AF and an echo-dense spherical atrial mass consistent with a thrombus. Treatment with warfarin, aspirin, and other drugs was initiated. Echocardiogram 6 weeks postpresentation showed no evidence of the mass; sinus rhythm was restored with direct current cardioversion under anesthesia.

A 7-year-old male Shetland sheepdog was referred for treatment of CHF. During evaluation and treatment, the dog rapidly deteriorated and developed apparent severe left leg pain. The limb was cool with blanched skin. Color Doppler results suggested absence of blood flow in the left femoral artery. The dog was euthanized, and a large, firm, white thromboembolus was found in the aorta occluding the left external iliac artery.

Commentary

The multifactorial causes of thrombosis (Virchow's triad) affects the ability to predict dogs at increased risk for this complication. Diagnostic screening of the left atrial chamber at the onset of AF is feasible and noninvasive; echocardiography can be performed with newly diagnosed AF and should be encouraged if signs consistent with aortic thromboembolism develop.

Prophylactic anticoagulant intervention (not routine) should be implemented when a thrombus or consistent signs are observed. Although warfarin and aspirin were referenced in this article, there is no consensus on the best anticoagulant for these cases. Clopidogrel is an alternative to aspirin for inhibition of primary hemostasis. Warfarin, unfractionated heparin, and low molecular weight heparin block secondary hemostasis. Multiple factors, including clinician familiarity, cost, owner preference, and ability to monitor efficacy, may determine therapy.*—Lydia Soydan, DVM*

Source

Thrombotic complications associated with atrial defibrillation in three dogs. Usechak PJ, Bright JM, Day TK. *J VET CARDIOL* 14:453-458, 2012.

Supplement to NAVC *Clinician's Brief*
Sponsored by an educational grant from Elanco

Making Your Pharmacy Stand Out

Increasing availability of veterinary products outside of the hospital has impacted veterinary hospital profits—and *can* impact your patients' health. To keep both pharmacy sales and patients healthy, veterinarians need to shift their strategy of how they sell products by making them stand out in this ever-expanding marketplace. In the 4th and last installment of *Unleashing Your Pharmacy's Potential*, our experts discuss the challenges and potential solutions of market competition as well as strategies for making your pharmacy stand out.

How should I be pricing my products?

The Effect of Market Competition

There is no question that market competition for pharmacy products has impacted veterinary product pricing. Many veterinarians question whether they can compete and how. How *should* hospitals be pricing their pharmacy products in such a competitive market?

When evaluating pricing, it is important to consider the client's perspective. Clients perceive veterinary products cost more because they are comparing prices to what they see online or in box stores that are high volume, low fixed cost businesses. The client may not be considering the cost of practicing higher quality medicine. They are looking at product prices, and view products as commodities. They believe the price of the box of heartworm preventive they purchase at your hospital should not be significantly higher than the box they can purchase from the store down the road.

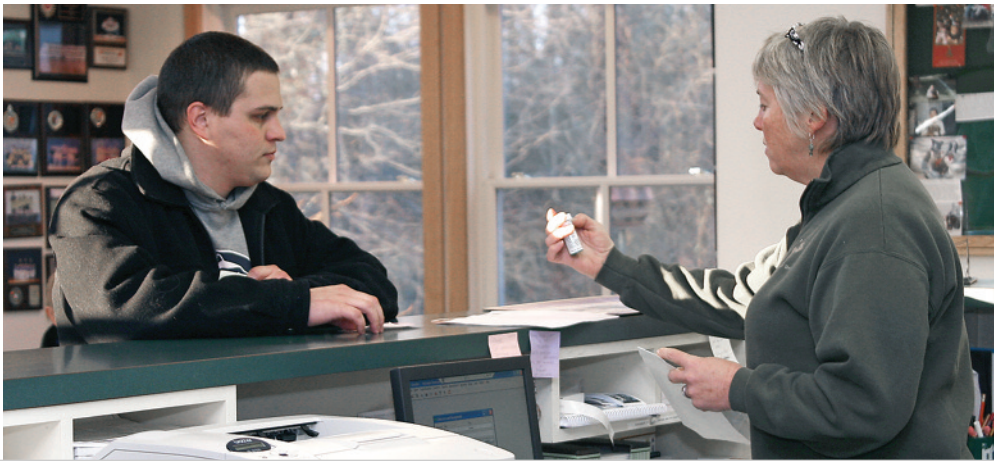
Unfortunately, veterinarians are not always aware of what they are competing against. It is important to canvass your hospital's area and the online market to see what these markets are charging. If the big box retail store a half mile away is selling the exact same box of heartworm preventive you do for $12 less, you need to be aware of that. If your price is significantly higher, this can build on the myth that all of your prices are inflated.

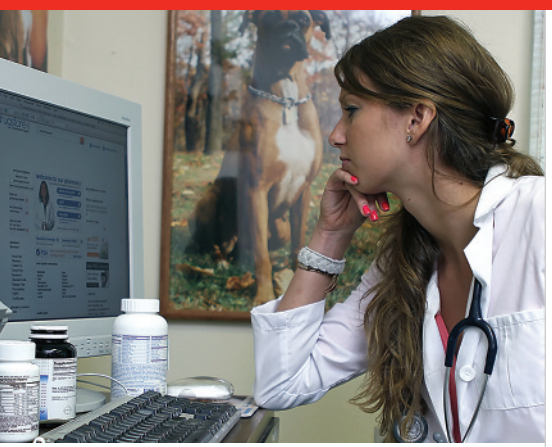
This does not mean you should give away product. The margin for some of these products, such as monthly preventives, is going to be smaller than in the past, but competitive pricing can still yield a healthy margin. Keep in mind: competitive pricing is *not* the same as price matching.

Competitive Pricing vs Price Matching

So what is the difference? While it may seem subtle, differentiating these two terms is critical. Price matching—when the practice offers to match a competitor's product price—can quickly turn into fee matching, where clients expect your hospital to match the costs of other products

> I think price matching is reactive; it's not analytical. If you actually run the numbers, you might find that you would make more profit selling 80% of X numbers of product at full price than you would selling 100% at the price-matched figure. The data needs to drive the decisions and it's not.
>
> —*David F. McCormick, MS*





When a client complains, 'I can get that cheaper online' we should be armed and ready to go. We should be able to show that client we are competitively priced. When they suddenly realize, 'Oh, it's only a dollar difference?' they're going to buy it locally in almost every situation.

—Ernie Ward, DVM

and services, such as spay/neuter fees. It can become a slippery slope and may result in clients wanting to know why you were trying to charge a higher price in the first place, questioning whether they are being overcharged for everything.

On the other hand, products do need to be priced competitively. As mentioned, this requires being aware of market prices. Online and box store markets will typically mark prices up by 30% to 35%, which would still be a reasonable margin for your practice. At the same time, your practice can provide and charge for services that are not available to clients when they purchase product elsewhere.

How do I address my clients' concerns that they're paying too much for product?

Establishing Trust

To address client concerns about your hospital's product pricing, it is important to establish trust. Unfortunately, most clients do not realize many products are already being priced competitively by your practice. If your hospital has already determined what local market prices are and subsequently established a competitive pricing strategy, don't be afraid to confidently share that information with your clients. By clearly demonstrating you are aware of price concerns and care enough to price competitively, you will help establish and enforce client trust. Clients appreciate transparency; open communication will help create this.

Educating Clients

Often, clients believe that purchasing a less expensive product outside of the veterinary hospital is a way to get a good deal—but this is not necessarily the case. This is where client education is critical.

For example, clients looking to purchase a flea and tick preventive at the local drugstore might ask a store employee if a product is the same as what they would purchase from their veterinarian. A human pharmacist filling a veterinary prescription might substitute a different medication or even change a prescribed dosage. In both cases, the individuals simply might not be aware of what would be appropriate for that specific pet. These situations can put pets in

The CRAFT formula: A simple way to assess client compliance

The American Animal Hospital Association has found that most veterinarians overestimate client compliance rates.[1] The CRAFT formula is the foundation for any compliance program. **C**ompliance can only be achieved when a specific and consistent **R**ecommendation is made, the client **A**ccepts that recommendation, and the practice **F**ollows **T**hrough to ensure compliance.[1]

Compliance = Recommendation + Acceptance + Follow Through

When looking to improve compliance for preventive products consider these tips:

Recommendation:

Do you have several products on the shelf or are recommendations to clients inconsistent?

Make a specific product recommendation that is consistent from the entire team. Document recommendations in the medical record.

Acceptance:

Is the number of clients buying any preventive product low (eg, only 20% of clients are buying at least one dose of heartworm preventive)?

Focus on the WHY of your product recommendations. Provide pricing and dispensing options that meet client needs. Record clients' rejections in the medical record.

Follow Through:

Is the total number of doses purchased less than what you recommended (eg, 70% of your clients purchase only 6 months of heartworm preventive although you are recommending 12 months)?

Provide client support after their purchase: send repurchase reminders, offer administration reminder services, offer automatic refill options.

danger if the product being used is ineffective or contraindicated.

The value of the veterinary team's knowledge and expertise when purchasing products comes from the education you provide to clients. It is important your entire team educates in a consistent manner that specifically addresses why the product you recommend is the right one based on their pet's needs. For instance, if you know a pet swims daily, stating this is the reason WHY you recommend Product X, an oral flea preventive, ensures the client understands the reason behind your recommendation. Using education that is based on the uniqueness of the client's pet allows you to add value to a product that otherwise may be difficult to differentiate.

In what ways can I make my pharmacy stand out from the competition?

Provide Great Service

When a client purchases a pharmacy product from a nonveterinary source, the service provided is generally limited to the transaction—the purchase. This provides an opportunity for your hospital to stand out.

One service your practice offers is the education clients receive about products, why they are being used, and how to use them. This also can come in the form of personalized follow-up; especially when clients are using a product for the first time. Make it a point to let your clients know they are not going to be able to benefit from your knowledge about their pets specific needs if they purchase product elsewhere.

Product manufacturers also help reinforce the value of purchasing through your hospital by offering product guarantees or rebates on purchases. In many cases, these guarantees and rebates are available only when products are purchased through veterinarians. Ensure your clients understand the value of these benefits by sharing real stories of positive experiences other clients have had regarding manufacturer guarantees.

Offering convenient payment options and customizing how you dispense product, such as offering single doses, are additional services your hospital might provide. Not all clients are able to afford purchasing a 12- or even 6-month supply of heartworm preventive at one time. Although per unit cost of single doses may be higher, they may be more convenient for the owner. Taking this a step further, the hospital might consider setting up automatic shipping to ensure clients receive what they need, when they need it. An extra bonus is that this can serve as an automatic reminder to clients that it is time to give the pet's monthly medication—a plus for compliance.

Providing services such as automatic shipping and monthly reminders for medication requires more work for the practice, but it creates a competitive edge with service clients cannot get anywhere else and helps build client loyalty. It also can provide justification for occasional higher prices—if clients value these services, they understand why the price may be different.

There is an indirect education and compliance side effect that occurs when you offer clients the convenience of an online pharmacy. You initiate a behavior pattern where they come back to your website and they see your educational materials.

—Byron Farquer, DVM, AVA

Develop your digital marketing strategy

In today's technology driven world, integrating your online and offline marketing is a must. Whether by social media, email, or blog, keeping your clients engaged with YOU is important to maintaining and growing client relationships. Actively look at ways to use technology to enhance product compliance, including offering text message reminders or posting videos on how to administer medications.

Make It Convenient

A number of studies have found that convenience, not price, drives consumers' purchasing decisions by a margin of nearly 2:1.

Like anything, it's not one-size-fits-all. Some clients will want a 12-month supply of heartworm preventive because the per unit price is less. In this case, you can help clients with compliance—send reminders that it's time to give Daisy her heartworm pill. This takes your service up a notch, and that's where we have to get to—the Nordstrom level of customer service.

—Denise Tumblin, CPA

> Don't tell clients, 'Well, you can get this for $4 at Walmart,' and send them out the door. If you feel compelled to do that, at least follow up with, 'or you can go home with everything you need right now. Our prices are competitive and you don't have to take your pet home and then go back out again and wait in line.'
>
> —*Karyn Gavzer, MBA, CVPM*

Make it easier for clients to purchase their pharmacy products from you. Ask them how they would like their prescriptions: As liquid or chewable? How many months' worth? Find out how they would like to receive reminders for when their pet is due for medication or follow-up blood work. Reinforce with your staff how much more convenient it is for clients to make their purchases right there, while at the hospital, and how this can affect compliance (and thus the pet's health). If the client is sent down the road to fill a prescription, when are they going to do it? It may be a day or more before the client is able to make the stop to the pharmacy down the road, delaying that pet's treatment.

One obstacle to client convenience can be the practice business hours. An online pharmacy can effectively overcome this obstacle. Technology is in place to handle pricing, tracking, medical records, and shipping—even single doses. People's buying behaviors have already been established to make purchases online: take advantage of that. Ensure your staff understand how your online pharmacy works and find opportunities to inform your clients of its availability. Market it through social media using clients' own stories of how convenient they found it. Including an online pharmacy to your practice's website, along with up-to-date pet health information, can improve not only the pharmacy's bottom line, but clients' knowledge and compliance as well.

Promote Your Hospital as a Local Business

Remember: your hospital has a relationship with clients other sources of products do not have. Use this relationship by staying involved with your clients throughout the year. Proactively interact regarding how their pet is doing, how much preventive medication they have, and whether they are experiencing problems.

Become involved in your local chamber of commerce, support local sport teams or schools, partner with other local businesses—all of these activities reinforce the local message that dollars spent in your community stay in the community. Keeping that relationship strong makes it more likely that clients will come to you for their pharmacy needs.

Lastly, inform your clients that as a local business, you are going to provide service, convenience, and guarantees they will not get elsewhere. More importantly, if they have a problem with anything they purchased from you, they can walk right in to your hospital and know they will get the care that they and their pets need.

Reference

1. Compliance: taking quality care to the next level. American Animal Hospital Association, 2009. Available at: https://secure.aahanet.org/eweb/images/student/pdf/Compliance.pdf

▶ Additional information from this roundtable is available at elancovet.com

Meet Our Experts

Byron Farquer, DVM, AVA	Simmons & Associates
Karyn Gavzer, MBA, CVPM	KG Marketing & Training, Inc.
David F. McCormick, MS	Simmons & Associates
Denise Tumblin, CPA	Wutchiett Tumblin and Associates
Ernie Ward, DVM	Owner, Seaside Animal Care, Calabash, NC
Moderator Ron Cott, DVM	University of Missouri College of Veterinary Medicine

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◀ FROM page 8

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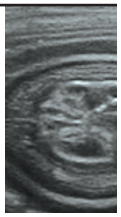
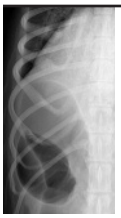


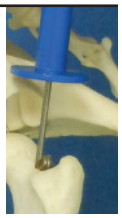
JOHN MATTOON, DVM, DACVR, is professor of radiology at Washington State University and course director of the NAVC Institute's Small Animal Abdominal Ultrasound course. His current research focus is clinical applications of all diagnostic imaging modalities. He is a frequent author and speaker at national and international meetings and is currently completing the third edition of *Veterinary Diagnostic Ultrasound*. COMPARATIVE IMAGERY PAGE 63

KENDRA V. POPE, DVM, CVA, CVCH, CVFT, CVTP, practices acupuncture and traditional Chinese veterinary medicine at Veterinary Specialty and Emergency Center in Levittown, Pennsylvania. Her interests include integrative and comparative oncology and holistic therapies for the treatment of chronic disease. Dr. Pope completed her training in acupuncture, Chinese herbal medicine, food therapy, and Chinese massage (*Tui-na*) at the Chi Institute of Traditional Chinese Veterinary Medicine in Reddick, Florida, as well as a rotating small animal internship at University of Pennsylvania. A MATTER OF OPINION PAGE 29

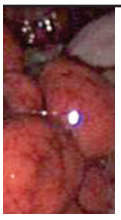
LISA L. POWELL, DVM, DACVECC, is clinical professor of small animal emergency and critical care medicine at University of Minnesota. Her area of interest is respiratory disease with an emphasis on mechanical ventilation, traumatic injuries, morbidity and mortality rounds, and sepsis. A frequent author and speaker, Dr. Powell is coauthor of *Small Animal Emergency and Critical Care: Case Studies in Client Communication, Morbidity, and Mortality* and has presented at NAVC Conferences. Dr. Powell graduated from Texas A&M University before completing an internship at the Animal Medical Center in New York City and a residency in emergency and critical care medicine at Tufts University. MANAGEMENT TREE PAGE 18



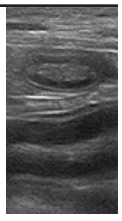
JEAN K. REICHLE, DVM, MS, DACVR, practices at Animal Specialty and Emergency Center in West Los Angeles. Her clinical interests include small mammal elbow dysplasia and imaging. After a rotating internship at VCA West Los Angeles Animal Hospital, Dr. Reichle completed a residency in radiology and earned an MS in radiological health sciences at Colorado State University, where she was assistant professor for 3 years. She earned her DVM from The Ohio State University. CLINICAL VIEW PAGE 60



ELKE RUDLOFF, DVM, DACVECC, is clinical instructor at Lakeshore Veterinary Specialists in Glendale, Wisconsin. Her interests include fluid resuscitation and trauma management, topics on which she has published book chapters and peer-reviewed articles. Dr. Rudloff has mentored 25 ACVECC diplomates and is the 2008 recipient of the Ira Zaslow Award for distinguished service in veterinary emergency and critical care. She completed her residency at the Animal Emergency Center in Glendale, Wisconsin, and earned her DVM from Purdue University. PROCEDURES PRO PAGE 21



CRAIG B. WEBB, PhD, DVM, DACVIM (Small Animal), is associate professor at Colorado State University, where he is head of the medicine section and a gastroenterology specialist. He frequently gives CE lectures and runs wet lab courses on GI diseases, including a special NAVC Conference session on GI endoscopic techniques. Dr. Webb earned a PhD in neuroscience and, following an internship at Alameda East Veterinary Hospital, trained as a small animal internal medicine resident at Colorado State University. Dr. Webb earned his DVM from University of Wisconsin–Madison. TOP 5 PAGE 85



JENNIFER WHITE, BVSc, is a radiology resident at Washington State University. Dr. White worked in general practice in Chicago before completing a small animal rotating medicine and surgery internship at VCA Aurora/Berwyn and working overnight emergency for 1 year. She earned her veterinary degree from Massey University in Palmerston North, New Zealand. COMPARATIVE IMAGERY PAGE 63 ■ cb

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Colonic Torsion in a Dog

Jean K. Reichle, DVM, MS, DACVR
Animal Specialty & Emergency Center
West Los Angeles, California

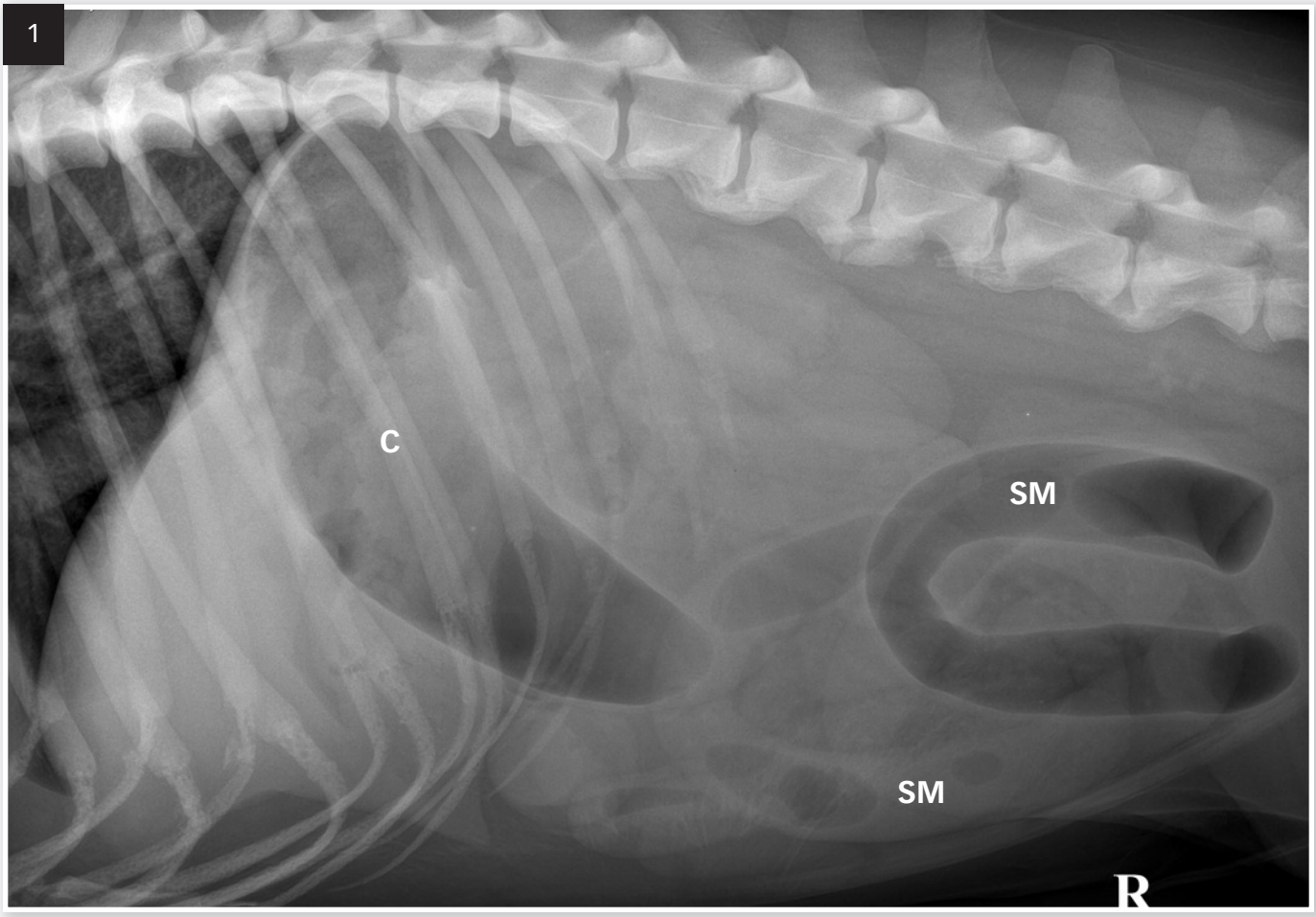
An 8-year-old castrated Siberian husky mixed-breed presented for vomiting and depression in the morning. The dog was 5% dehydrated, tachycardic, and painful on abdominal palpation.

Results of CBC and serum biochemistry profile were unremarkable. Abdominal radiographs (**Figures 1** and **2**) showed a severely gas-distended intestinal segment in the cranial to middle abdomen; other loops of bowel were mildly distended. The colon was not identified in its normal location. Intestinal obstruction from intestinal torsion, possible foreign body, or intussusception was suspected.

Severe fluid- and gas-distended intestines were identified on ultrasound, but a cause of obstruction was not identified. The

Abdominal radiographs (Figure 1, right lateral; Figure 2, ventrodorsal) showing severe gas distention of the colon (C) with displacement right of midline; there is also fluid and gas distention of the small intestines (SM). When radiographically assessing the intestinal tract, it is important to differentiate colon from small intestine. In this case, colonic torsion was suspected because of the segment of extreme dilation and lack of identification of normal colon.

1



Prolonged vascular compromise can result in tissue necrosis, bowel rupture, sepsis, and death.

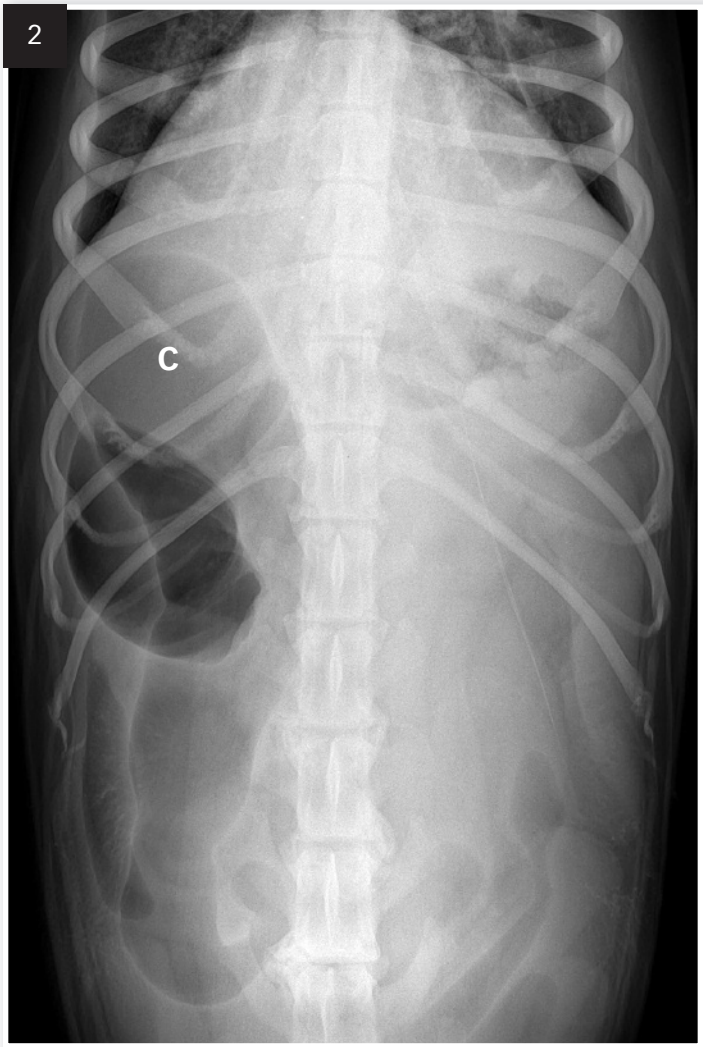
patient was treated with crystalloid fluid therapy and exploratory laparotomy was performed. The colon, from the level of the ileocolic junction to the pelvic inlet, was severely distended and rotated approximately 90°. Partial torsion of the colon was diagnosed; the cause was undetermined.

The affected bowel remained distended and had diminished tone. Vascular supply to the segment had not been permanently damaged; thus, resection and anastomosis were not pursued.

Colopexy was performed by suturing the unaffected descending colon to the left peritoneal wall using nonabsorbable suture and a muscle-flap technique. Prophylactic gastropexy was also performed using a muscle-flap technique. The abdomen was lavaged with warm saline before closure. The patient had postsurgical diarrhea for 2 days but was clinically normal at suture removal 2 weeks later. ■ cb

Torsion is a twist; volvulus is torsion of an intestine causing obstruction.

2



A Note on Torsion

Torsion is a twist; volvulus is torsion of an intestine causing obstruction. Torsions of the small intestine, colon, or mesentery are rare but potentially fatal. Presenting signs can include abdominal pain, depression, tenesmus, hematochezia, diarrhea, vomiting, anorexia, and hypovolemic shock. The imaging finding of segmental or diffuse-but-severe intestinal distention, rapid progression of clinical signs, and shock should prompt suspicion of torsion. Early recognition and surgical exploration are important in dogs suspected to have intestinal torsion, as prolonged vascular compromise can result in tissue necrosis, bowel rupture, sepsis, and death. Torsion correction can result in reperfusion injury and shock. Resecting necrotic tissue without attempting to untwist the torsed portion is recommended.

Colonic torsions have been reported in collies and German shepherd dogs.[1-4]

See **Aids & Resources**, back page, for references & suggested reading.

CAN JAK INHIBITION BREAK THE CYCLE OF PERSISTENT ITCH?

In canine allergic dermatitis, there is a vicious cycle of persistent itching and scratching that may be more common than you think. Recent research has shown that in the US alone, there are approximately 8.2 million medicalized dogs with acute or chronic itch.

WHAT CAUSES CANINE ITCH?

Allergies due to fleas, particles in the environment such as dust mites, and foods are among the most common triggers of itch, which can be either acute or chronic. One type of allergic disease is atopic dermatitis, which can look very similar to other allergic conditions, making the diagnosis challenging for the veterinarian.

By the time a veterinarian is presented with an itchy dog, the owner is usually desperate to find a treatment that is fast, safe, provides relief to the pet, and restores normalcy to the family. For owners of dogs with allergic skin disease, current treatment options have limitations. Treatments may be associated with short-term and long-term side effects or slow onset of action, so pet owners often feel like they are trading one problem for another. A need exists for a new therapeutic approach, which offers quick relief and can be used safely both short-term and long-term.

WHAT ARE CYTOKINES AND JANUS KINASE (JAK) ENZYMES, AND HOW DO THEY CONTRIBUTE TO ITCH?

Historically, allergic skin disease was thought to be a type 1 hypersensitivity reaction mediated by cutaneous mast cells and IgE. However, we now know that cytokines produced by lymphocytes and other cells contribute to canine itch.

Cytokines are secreted signaling proteins that play a key role in cell-to-cell communication; but, their dysregulation can contribute to a variety of diseases. Some cytokines are associated with itch and inflammation, such as those seen in allergic skin disease. When dogs have elevated levels of certain cytokines, they are likely to have itch behavior. Certain itch-inducing, or pruritogenic, cytokines can mediate itching or can signal other cells to release additional mediators of itching and inflammation.

The binding of these cytokines to receptors on the cell surface causes the activation of intracellular enzymes called Janus kinase, or JAK. JAK enzymes, in conjunction with cytokine receptors, are integral to cytokine signaling. Activation of JAK enzymes causes a signal to be sent from the cell surface to the nucleus and propagates the signals that lead to inflammatory and pruritic responses. For instance, JAK-1 is involved in the signaling pathway of many cytokines including Interleukin (IL)-31, a recently identified cytokine that plays a key role in canine itch. Activation of JAK-1 can stimulate the production of proteins that transmit signals to the brain to trigger itching and inflammation of the skin.

TARGETED THERAPIES MAY BE THE ANSWER.

There remains a need for novel therapeutic approaches that provide fast, safe, and effective control of itching and inflammation associated with allergic dermatitis and atopic dermatitis throughout the lifetime of the animal. New therapies that target JAK-1 may decrease the activity of pruritogenic and pro-inflammatory cytokines, rapidly stopping the continuous cycle of itch and inflammation without the side effects seen with current therapies. Breaking the itch cycle will also give the veterinarian time to diagnose the underlying cause of the itch while allowing the dog's skin to heal. Ultimately, this will help improve the quality of life for the dogs and their owners.

CYTOKINES MAY BE THE KEY—GET THE FACTS ON JAK

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Imaging Intestinal Obstruction

Linda Lang, DVM, Jennifer White, BVSc, & John Mattoon, DVM, DACVR
Washington State University

Small intestinal obstruction from foreign material, masses, and intussusceptions is a common cause of vomiting.[1] Recognizing radiographic and ultrasonographic signs is necessary for correct diagnosis.[2,3]

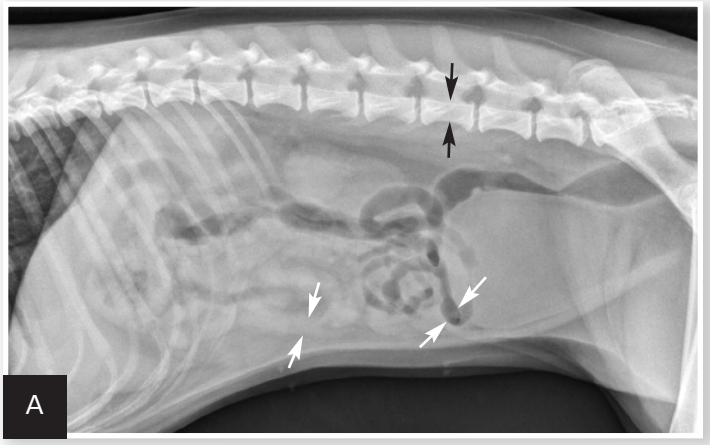
A backup of ingesta proximal to the obstruction site can cause bowel distention (**Figures 2–6**). Complete and some chronic partial obstructions can cause significant bowel dilation, and often the colon is empty. Depending on the obstruction site, the segment of bowel distention may be short or long. Compared with the small intestine, the colon is typically larger in diameter and contains fecal material. Differentiating small intestine from colon is crucial for accurate diagnosis: mistaking colon for small intestine can lead to incorrect diagnosis of small bowel obstruction, while mistaking distended small intestine for colon can lead to a missed diagnosis of small intestinal obstruction (**Figure 6**). Both lateral and ventrodorsal views are essential for accurate assessment, although both may not be presented in this collection.

Ultrasonography is often used to assess vomiting and can reliably diagnose small bowel obstruction.[4-6] Compared with radiography, ultrasonography can identify underlying causes more frequently.[4-6] Challenges include the presence of bowel gas (hiding foreign material), ultrasonographer experience, relatively small field of vision, and differentiation of small intestine from colon.

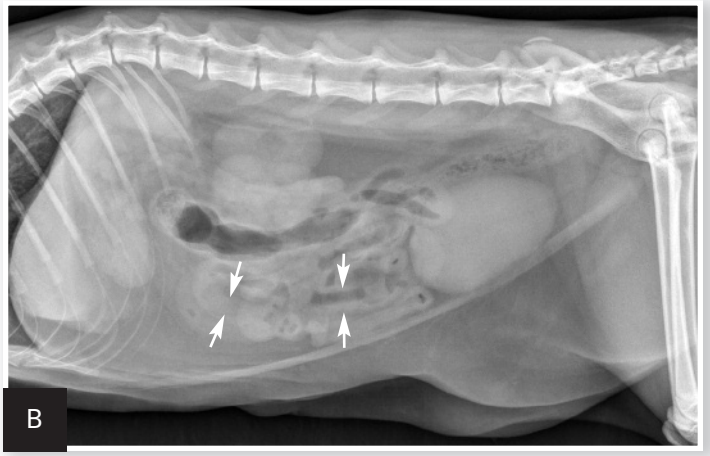
Overlap exists between normal (**Figure 1**) and obstructive bowel diameter.[4] Proximal obstructions can have a short segment of duodenal distention, and distal obstructions can have longer segments of small intestinal distention. Recognizing mixed populations of normal and distended bowel is common in small intestinal obstruction. The small intestine should contain only homogeneous soft tissue opacity (fluid, liquid ingesta) and/or gas. Heterogeneous material (often feces-like) is a sign of potential obstruction from foreign material or inhibition of passage of normal ingesta.

MORE ▶

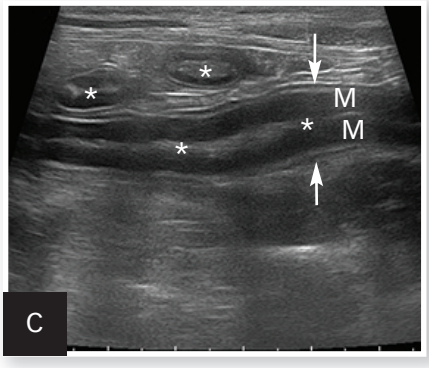
1 Normal Small Intestinal Diameter, Contents, & Distribution



In dogs, a ratio of 1.6:1 for small intestinal diameter (white arrows) relative to height of fifth lumbar (L5) vertebral body (black arrows) is the upper limit of normal intestinal diameter for clinical use.[2] A small intestine:L5 ratio that is >1.6:1 and/or a mixed bowel population (some normal, some distended segments) may indicate obstruction.

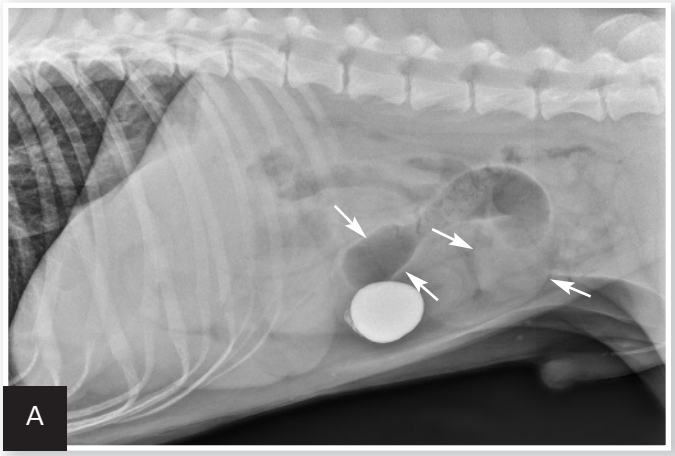


In cats, normal small intestinal diameter (between white arrows) is considered ≤1.2 cm from serosal to serosal surface.[7]

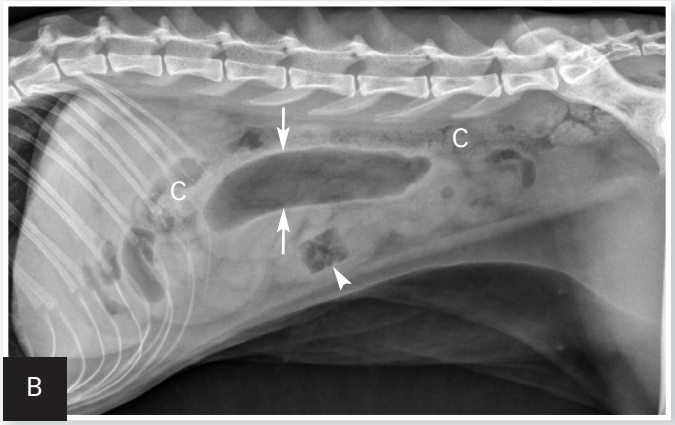


Sagittal ultrasound image of a canine duodenum (between arrows). The small intestine is usually empty or contains minimal fluid and/or gas (*). Bowel-wall layers are readily identified with the hypoechoic mucosal layer (M) being thickest, surrounded by thin submucosal (hyperechoic), muscularis (hypoechoic), and serosal (hyperechoic) layers. Transverse images of small intestine are present in the near field.

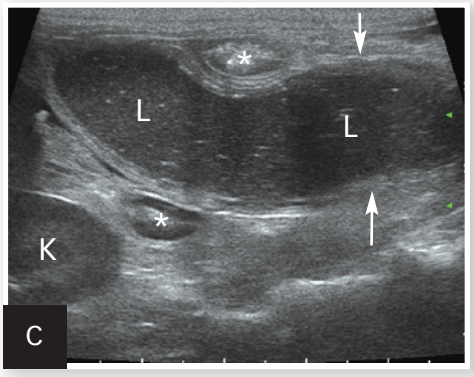
2 Foreign Body Small Intestinal Obstructions



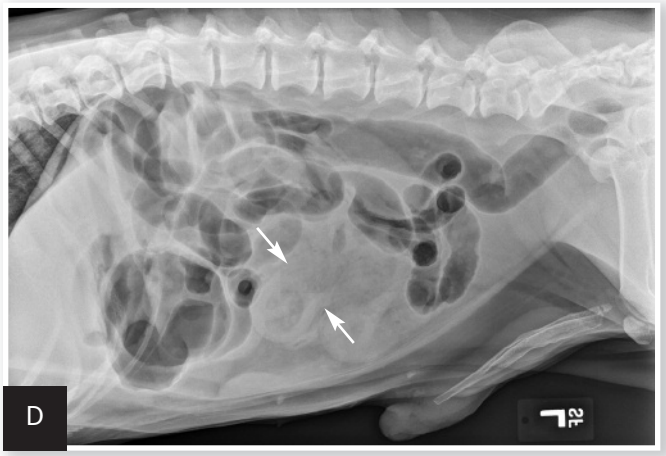
A foreign body (ie, rock) is identifiable in this canine small intestine. The markedly dilated segment of jejunum (**arrows**) leading up to the foreign body (~4× the height of L5) is significant.



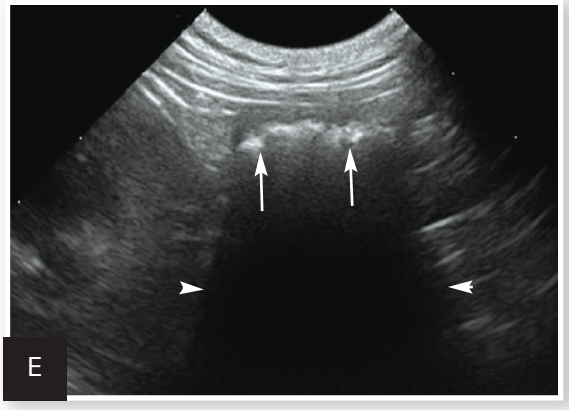
Markedly gas-distended segment of jejunum (**arrows**) measuring ~2.2 cm in diameter is present ventral to the feces-filled colon (C) in this cat. The foreign body (**arrowhead**) appears as an abnormal, rectangular, heterogeneous radiolucent (gas) structure. Note the presence of normal bowel.



A longitudinal segment of severely fluid-distended small intestine (**arrows**) adjacent to normal bowel seen in transverse sections (*), suggesting obstruction. The greatly dilated lumen (L) shows speckled, echogenic fluid with readily observable movement in real-time examination. Potential cause (eg, foreign material, mass, intussusception) should be investigated. (K = caudal pole of kidney)



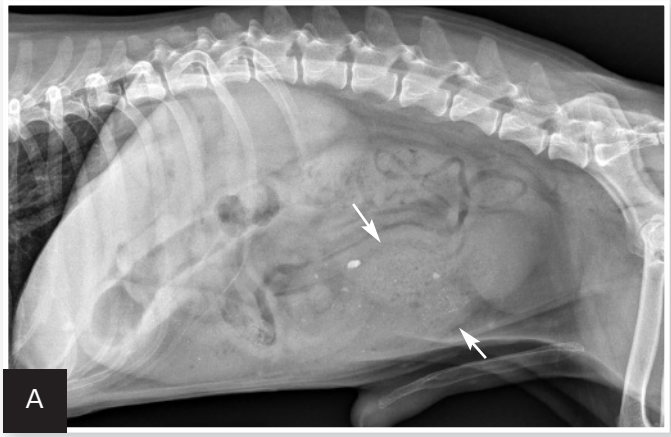
Small intestinal foreign material recognized as heterogeneous soft tissue opacity (**arrows**). Nearly all the small intestine is abnormally distended, indicating a distal small intestinal obstruction. The colon is empty. Distal small intestinal obstructions caused by radiographically nonopaque material warrants consideration of diffuse functional ileus. Differentiation between mechanical and functional small bowel dilation (eg, parvovirus infection, mesenteric torsion) can be difficult.



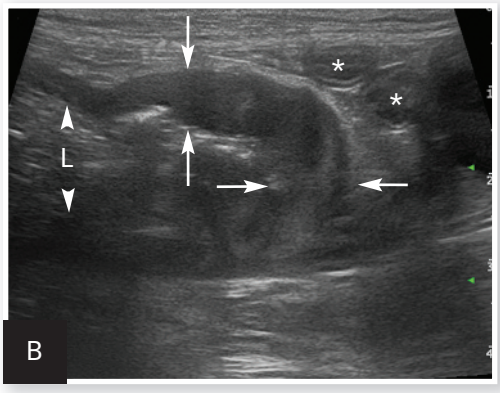
Ultrasound of small intestinal foreign material typically appears hyperechoic (**arrows**) with strongly distal acoustic shadowing (**arrowheads**), although this can vary depending on composition, shape, and number. Foreign material will not change shape with peristalsis and often has an organized surface for differentiation from intraluminal gas, which typically causes reverberation artifacts (ie, comet tails).

3 Inconclusive Radiographs & Definitive Ultrasound Images

Masses associated with small intestine may result in mechanical obstruction with typical signs of bowel dilation and abnormal luminal content. A mass not apparent on radiography may be diagnosed using ultrasonography.

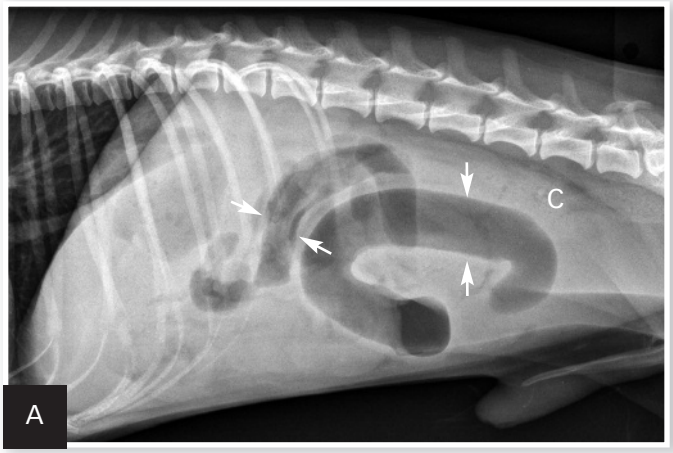


Lateral abdominal radiograph of a dog with small intestinal obstruction. There is marked segmental small intestinal dilation (arrows) with heterogeneous soft tissue and mineral opaque material in the lemen. The cause (ie, the mass) is not identifiable radiographically; there is a large amount of normal empty small intestine.

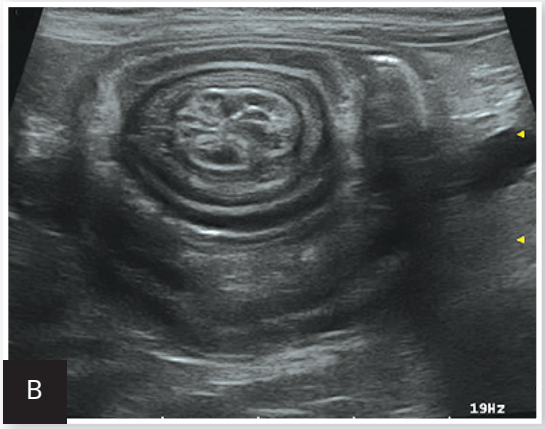


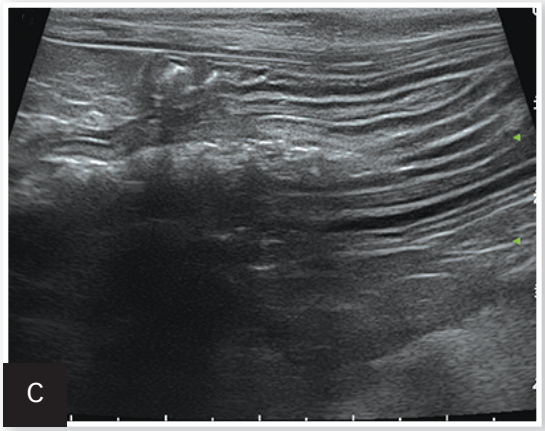
Focal loss of wall layering and eccentric thickening of the intestinal wall (arrows) are present on ultrasound image showing abnormally dilated small intestinal lumen (L, between arrowheads) orad to the mass. Normal empty small intestinal segments are seen in the transverse section in the near field (*). Surgery confirmed diagnosis of mucinous adenocarcinoma.

4 Intussusception Causing Small Bowel Obstruction



Marked diffuse small intestinal dilation (arrows). (C = colon)



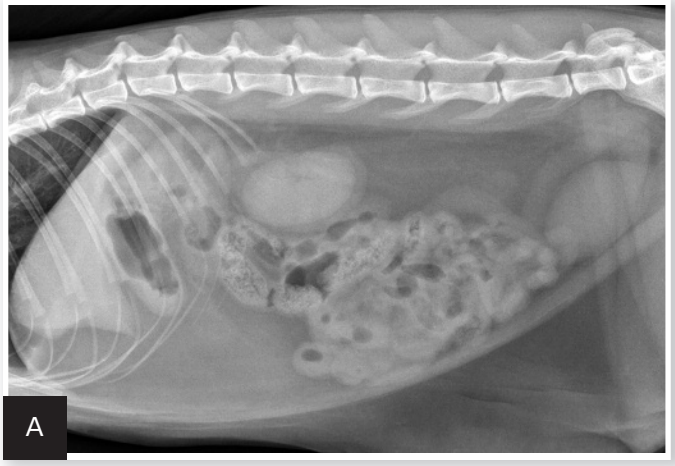


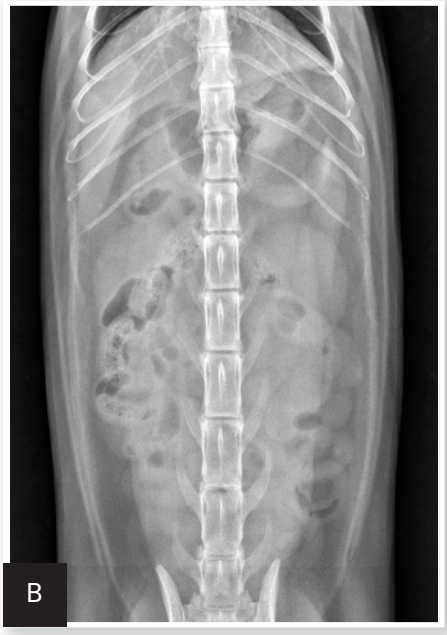
Invagination of 1 portion of the GI tract (intussusceptum) into the lumen of another (intussuscipiens); this is often referred to as the *target sign* when seen in the transverse plane because of the multiple layers of adjacent intestinal walls.

MORE ▶

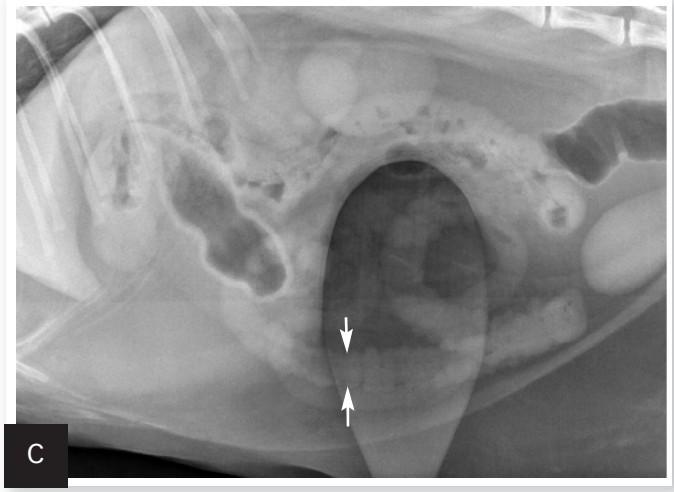
5 Linear Foreign Body Obstructions

Linear foreign material often causes small bowel bunching, plication, or corrugation with or without severe intestinal dilation. String foreign bodies, more common in cats, can cause plication and/or corrugation, often without severe dilation. In dogs, cloth foreign bodies are more common and obstruction is often severe.

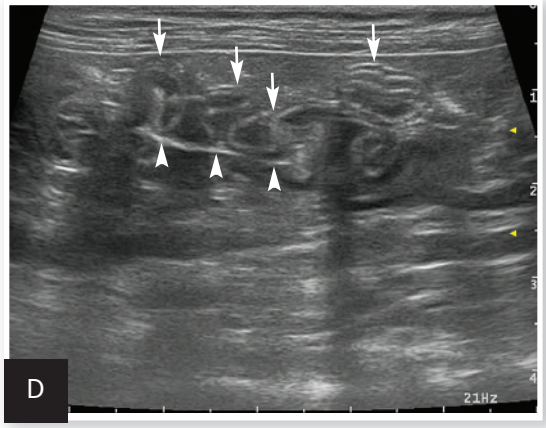




Lateral (A) and ventrodorsal (B) abdominal radiographs of a cat with string foreign body. Note the plicated (ie, ribbon candy) shape of small intestinal segments, bunched centrally. Pockets of triangular and odd-shaped abnormal intraluminal gas are present, common with linear foreign bodies.



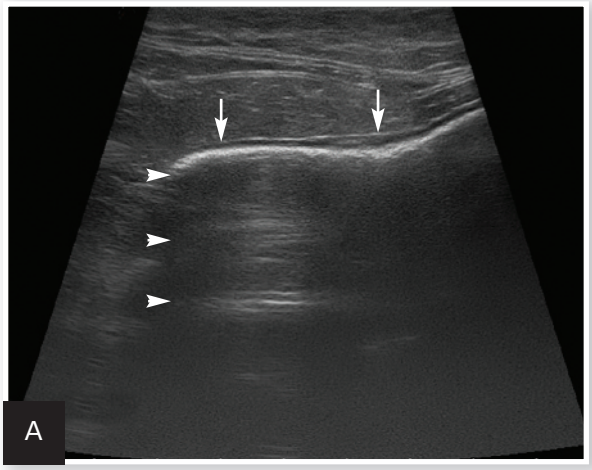
To differentiate normal centralized small intestine from pathologic intestinal bunching, a plastic or wooden spoon may be used to place pressure on the lateral abdomen to disperse the intestinal segments. This cat demonstrated corrugation (ie, undulating serosal margins) of a segment of small intestine, seen in some cases of linear foreign body ingestion causing intestinal plication.



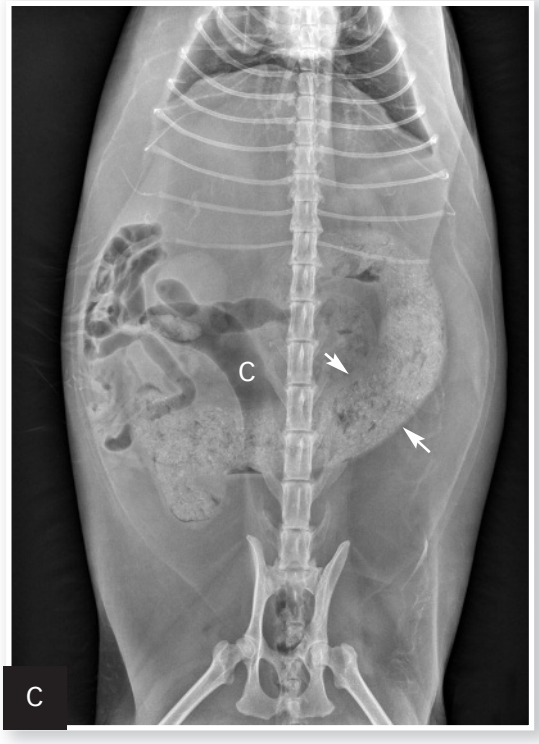
Intestinal plication (arrows) may be seen via ultrasound; in some cases, linear foreign material (arrowheads) may be visible within the small intestinal lumen.

6 Differentiating Small Intestine from Colon

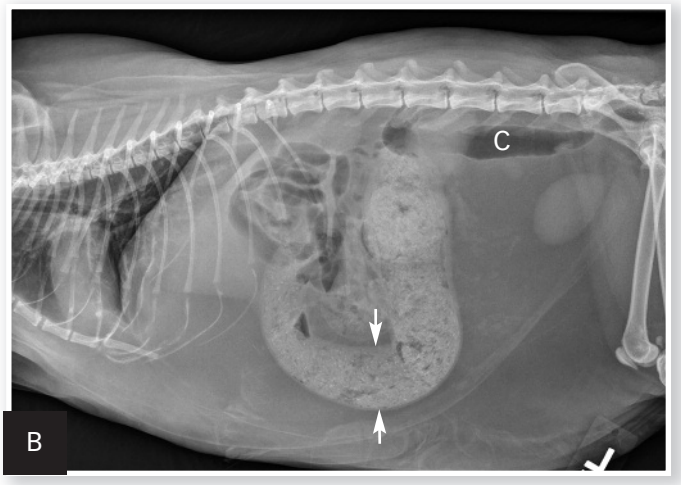
This older cat presented for vomiting; ultrasonography was the first diagnostic modality.



Ultrasound image of an enlarged intestine (arrows) showing large amount of reverberation artifact (arrowheads) caused by luminal gas. This prohibits visualization of the far wall of this loop of bowel. The ultrasound impression was a distended colon.



See **Aids & Resources**, back page, for references & suggested reading



Lateral (B) and ventrodorsal (C) abdominal radiographs of severely distended segment of bowel identified sonographically and properly diagnosed as severe small intestinal obstruction (arrows). Of note, there is fecal-like material in the small intestine. An ileocecocolic mass was diagnosed during exploratory laparotomy. This mass was apparently obscured by gas during ultrasound examination. (C = colon) ■ cb

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Human Medication Intoxications

Andrew Linklater, DVM, DACVECC
Lakeshore Veterinary Specialists
Glendale, Wisconsin

You have asked…

How do I treat common human medication intoxications in veterinary patients?

The expert says…

Because veterinary patients commonly present for human medication ingestion, veterinarians should have treatment plans for patients that have ingested these medications, including over-the-counter and prescription medications (eg, NSAIDs), new classes of antidepressant medications, amphetamines (used in the treatment of attention deficit-hyperactivity disorder [ADHD]), marijuana, and vitamin D.

As with any patient, it is imperative to stabilize airway, breathing, and circulation first.

General Approach

As with any emergent patient, it is imperative to stabilize airway, breathing, and circulation first. Carefully questioning the owner often reveals the ingested toxin. Asymptomatic patients that present <4 hours after ingestion may benefit from emesis induction with apomorphine (dogs) or xylazine (cats). If the patient is stable, administration of activated charcoal may be warranted (for treatment agents see **Table 1**, next page). In addition, contraindications for emesis (**Contraindications for Inducing Emesis**, next page) should be considered before induction. When needed, gastric lavage should be performed in an anesthetized, intubated patient to provide comfort and limit risk for aspiration.

MORE ▶

Table 1 Agents Used for Toxic Exposures

Agent	*Dose/Schedule*	*Notes/Adverse Events*
20% IV lipid emulsion	1.5 mL/kg bolus, then 0.25 mg/kg/min for 30–60 min	Discontinue if lipemia develops or if treatment is ineffective
Acepromazine	0.05–0.2 mg/kg IV or IM	Titrate dose; hypotension
Activated charcoal	1–2 g/kg PO q8h	Enterohepatic recirculation or extended release warrants additional doses
Apomorphine	0.03 mg/kg IV (dogs)	Sedation
Chlorpromazine	0.5 mg/kg IV	Sedation
Cyproheptadine	1.1 mg/kg (dogs) q4–6h 2–4 mg total dose (cats) q4–6h	Oral or rectal dosing
Diazepam	0.25–0.5 mg/kg IV q1h; repeat up to 3 doses	Continuous infusion option
Maropitant	1 mg/kg SC	
Methocarbamol	50–100 mg/kg slow IV	Sedation
Midazolam	0.2–0.4 mg/kg IV or IM	Sedation
Misoprostol	2–5 µg/kg PO q8h	Wear gloves to handle (GI/uterine contractions, abortifacient possibility)
Ondansetron	0.6–1 mg/kg SC	
Pamidronate	1.3–2 mg/kg IV diluted over 2 hours	May repeat in 4–7 days
Pantoprazole	0.5–1 mg/kg slow IV q24h	Give diluted
Phenobarbital	4 mg/kg IV, 4 doses as needed	Loading dose; titrate based on level of sedation
Propofol	4–8 mg/kg induction IV	0.1–0.6 mg/kg/min infusion for continuous sedation; requires intubation
Propranolol	0.02–0.06 mg/kg slow IV 0.1–0.2 mg/kg PO q8h	Titrate dose to effect
Xylazine	0.4–1.1 mg/kg IM (cats)	Yohimbine reversal

Contraindications for Inducing Emesis

Patient Considerations	Toxin Considerations
Respiratory distress and/or disease	Corrosives
Seizures	Acid substance
Neurologic impairment	Alkali substance
Bradycardia	Sharp objects
Weakness	Potential danger to staff
Inability to protect airway	Significant vomiting already occurred
GI and/or abdominal disease	Underlying disease predisposing to aspiration (eg, laryngeal paralysis, megaesophagus)

General supportive care measures depend on clinical signs and may include antiemetic therapy, IV fluid therapy, blood pressure monitoring, oxygen therapy, and/or symptomatic supportive care.

NSAIDs

NSAIDs, which interrupt prostaglandin production by inhibiting cyclooxygenase, can result in decreased blood flow to renal and GI systems. Liver and platelet function may also be affected with large-quantity or chronic ingestion. Toxicosis severity and treatment duration may be impacted by dehydration; time until decontamination and/or treatment; and preexisting hepatic, renal, or GI disease. Vomiting and diarrhea, secondary to GI irritation, are the most common signs, but they may not be evident initially.

Accidental NSAID ingestion untreated for >8 hours can cause risk for acute renal failure and GI ulceration. When large doses are ingested, decontamination and ≥48 hours of twice-maintenance IV fluids are recommended to prevent renal injury. GI protectants (eg, misoprostol, H_2-blockers, proton pump inhibitors, sucralfate) may be beneficial. Misoprostol can help maintain GI blood flow. Proton pump inhibitors and H_2-blockers help reduce gastric acid while sucralfate coats the ulcerated region; both should be administered if a GI ulcer is suspected. Simple renal injury may respond to fluids and medications; oliguria and anuria require intensive monitoring and/or dialysis. Liver injury has been reported with some NSAID ingestion and may warrant further therapy. Baseline serum biochemistry and daily monitoring for at least 48 to 72 hours are recommended.

Antidepressant Medications

Most antidepressant medications work via reuptake inhibition or altered transport of serotonin, norepinephrine, or dopamine (**Table 2**). Many are rapidly absorbed and come in extended-release or long-acting formulas. Clinical signs of toxicosis can vary, depending on the medication; selective serotonin reuptake inhibitors (SSRIs) can result in serotonin syndrome, affecting the cardiovascular (eg, hyper- or hypotension, tachycardia), GI (eg, vomiting, diarrhea), and neurologic (eg, sedation, agitation, ataxia, tremors, seizures) systems.[1]

Standard decontamination is recommended but should be avoided in symptomatic patients. Supportive and symptomatic care are the mainstay of therapy. Fluid therapy does not enhance elimination but may help correct dehydration and acidosis; sodium bicarbonate may be given to patients with severe acidosis. Passive and/or active cooling may be necessary for hyperthermic patients. Propranolol or esmolol may be used for supraventricular tachyarrhythmias, norepinephrine or epinephrine for hypotension, and benzodiazepines for sedation or treatment of tremors or seizures.[1-3] Methocarbamol has been

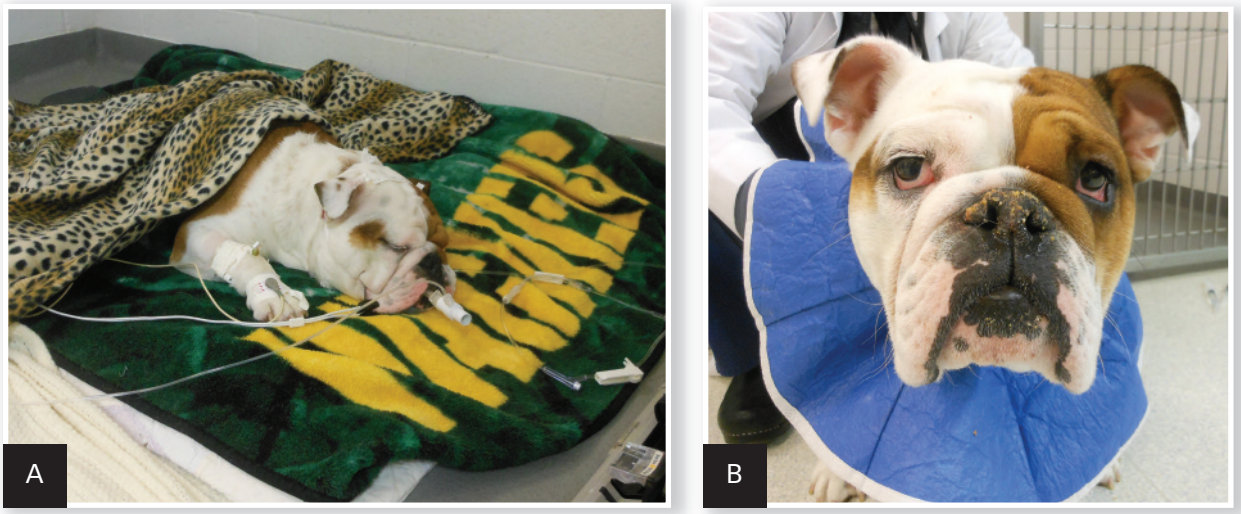
MORE ▶

Table 2 **Common Antidepressant Medications**

Generic Name	*Common Brand Names*	*Mechanism*
Amitriptyline	Elavil	SNRI (TCA)
Atomoxetine	Strattera	NRI
Bupropion	Wellbutrin	NDRI
Clomipramine	Anafranil	SNRI (TCA)
Duloxetine	Cymbalta	SNRI
Fluoxetine	Prozac	SSRI
Mirtazapine	Remeron	NaSSA
Paroxetine	Paxil	SSRI
Selegiline	Anipryl, L-deprenyl	MAOI
Sertraline	Zoloft	SSRI
Venlafaxine	Effexor	SNRI
Viloxazine	Vivalan	NRI

Supportive and symptomatic care are the mainstay of therapy.

MAOI = monoamine oxidase inhibitor, NaSSA = noradrenergic and specific serotonergic antidepressant, NDRI = norepinephrine-dopamine reuptake inhibitor, NRI = norepinephrine reuptake inhibitor, SNRI = serotonin-norepinephrine reuptake inhibitor, SSRI = selective serotonin reuptake inhibitor, TCA = tricyclic antidepressant



1 **One-year-old intact male bulldog presented after ingestion of the owner's Adderall (amphetamine–dextroamphetamine). The dog presented hyperthermic and tachycardic and developed seizures. It required sedation, antiepileptic medications, and β-blockers to control signs (A). Endotracheal intubation and intermittent oxygen supplementation were required because of heavy sedation. Thirty-six hours later (B), the dog was normothermic, had a normal heart rate, and no longer had seizures. Several days after presentation, it was reportedly doing well.**

recommended as an alternative therapy for tremors. Phenothiazine use remains controversial. Seizures not responsive to benzodiazepines may be treated with barbiturates. Although it is not specifically studied in toxicologic overdoses, status epilepticus not responsive to benzodiazepines and barbiturates may respond to propofol or inhalant (isoflurane) anesthesia.[3-8] Specific therapy includes serotonin antagonism with cyproheptadine.

ADHD Medications

ADHD amphetamines (**Table 3**) are stimulants that inhibit norepinephrine and dopamine reuptake in the brain. Clinical signs are neurologic (eg, agitation, shaking/trembling, circling, seizures, disorientation, coma, death), cardiovascular (eg, tachycardia, hypertension, potential reflex bradycardia), and GI (eg, vomiting, abdominal pain). Standard decontamination should be used judiciously because of possible inability to protect the airway.

Seizures not responsive to benzodiazepines may be treated with barbiturates.

Additional treatment (**Figure 1**) is symptomatic and supportive; phenothiazines (eg, acepromazine) are the first-line agents for excessive stimulation and may also be used to treat hypertension and hyperthermia. Keeping the patient in a quiet, dark room to minimize stimulation may help. Use of benzodiazepines in patients with stimulatory signs is controversial; however, they may be used for seizures. Seizures not responsive to benzodiazepines may respond to barbiturates or propofol.[3-9] Excessive muscle fasciculations may also be treated with methocarbamol.

Table 3 **Common ADHD Medications**

Generic Name	*Common Brand Names*
Amphetamine–dextroamphetamine	Adderall
Dexmethylphenidate	Focalin
Dextroamphetamine	Dexedrine, Dextrostat
Lisdexamfetamine	Vyvanse
Methylphenidate	Ritalin, Concerta, Daytrana, Metadate

IV fluids and cooling may be necessary for patients with elevated body temperatures. Because some ADHD medications are lipophilic, IV lipid solutions may be considered; however, there are little data available on their use with these medications.

Marijuana

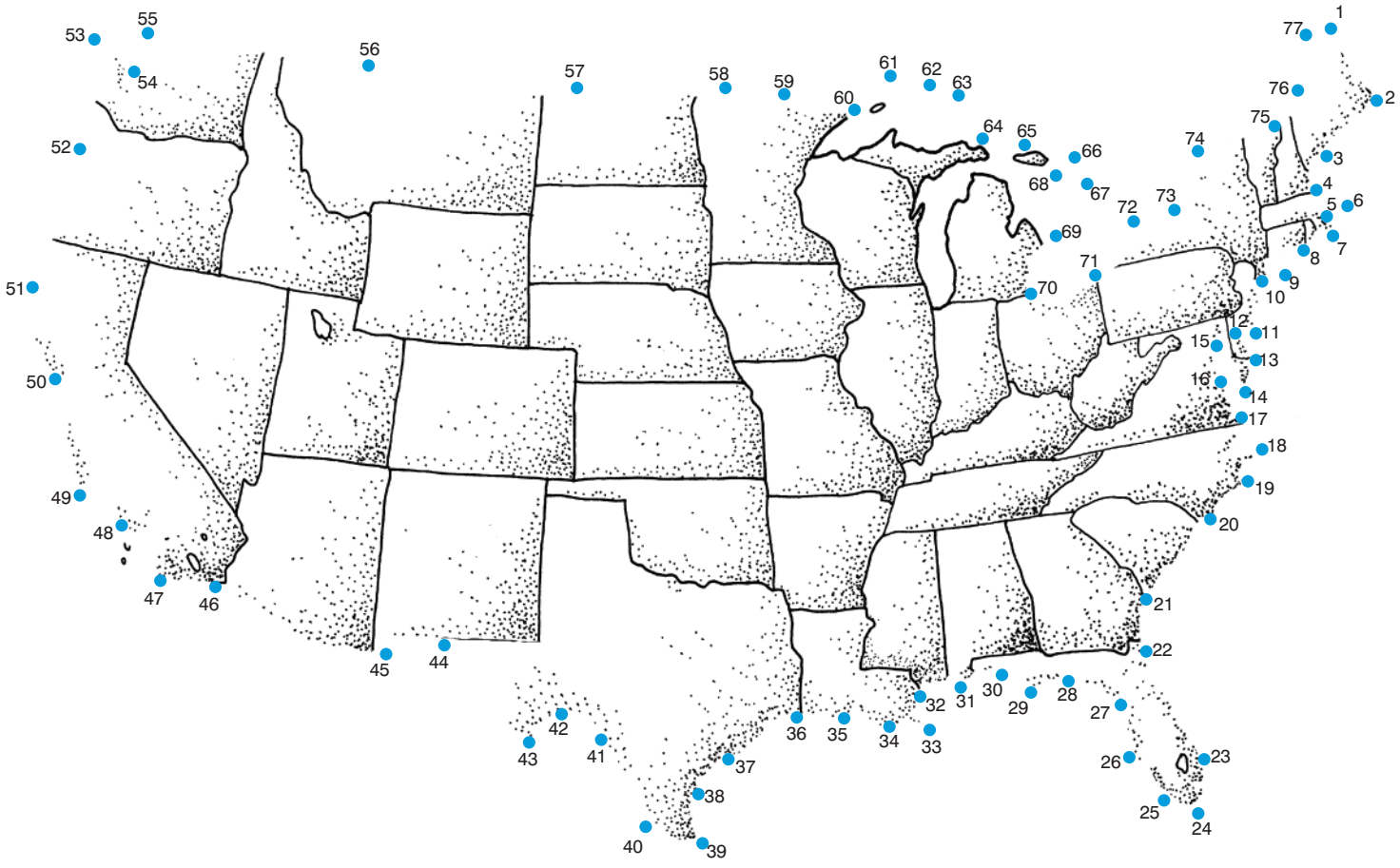
Marijuana (*Cannabis sativa*), legally prescribed for humans in select states, contains Δ^9-tetrahydrocannabinol (THC), which alters neurotransmitter activity. Patients typically present with altered mental status, ataxia, and dilated pupils; potential agitation, seizures, and/or coma may result in death. Additional signs can include vomiting, diarrhea, arrhythmias, tachypnea, and incontinence. In dogs, over-the-counter urinary tests are unreliable for diagnosis.

Decontamination should be avoided when altered mental status is present, and emesis is often unrewarding. Supportive care is the mainstay of treatment. Because renal elimination of THC is minimal, the benefit of diuresis is questionable; fluids may be used to treat dehydration. Benzodiazepines can be used safely for agitation, seizures, and tremors; monitoring temperature, respirations, and heart rate is essential. Most patients recover uneventfully within 24 to 96 hours; however, ingestion of large quantities may require aggressive supportive care. IV lipid infusions have been advocated anecdotally and used successfully by the author.

Vitamin D

Vitamin D_3 is available as a sole supplement, in multivitamins (which may also contain toxic levels of iron, xylitol, and vitamin A), or in rodenticides. Initial clinical signs (8–12 hours after ingestion) are vague and include lethargy, vomiting, diarrhea, and inappetence resulting in hypercalcemia and renal failure (occurring 36–48 hours after ingestion), which cause polyuria/polydipsia, weakness, hematemesis, and arrhythmias. Decontamination should be initiated immediately, as vitamin D_3 has a prolonged action and treatment can be challenging and costly if hypercalcemia develops. When decontamination is not possible or is incomplete, IV lipid emulsion may also help prevent hypercalcemia, as vitamin D is fat soluble. Ionized calcium levels should be monitored q24h for 5 to 7 days. When ionized hypercalcemia is present, therapies (eg, saline diuresis, furosemide, steroids, salmon calcitonin) may need to be combined. Pamidronate inhibits osteoclast function and has prolonged activity, making it an attractive alternative if other therapy is unavailable or ineffective. ■ cb

See **Aids & Resources**, back page, for references & suggested reading.



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IDEXX LABORATORIES

Triaging Behavior Problems

This two-article feature provides commonsense approaches to investigating, managing, and treating behavior cases. The following presents methods for triaging behavior complaints; the companion article (page 79 of this issue) addresses how to approach treatment of any behavior problem in any pet.

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Key Questions

Does the patient pose a risk for injuring:

1. Humans (eg, owners, strangers, adults, children, veterinary team members)?
2. Other animals (eg, housemates, unfamiliar animals, neighboring livestock)?
3. Itself (eg, self-injurious or escape behaviors, behaviors that lead owners to consider euthanasia)?

Key Considerations

- If the pet poses a real risk for injuring or harming others, this must be discussed with the owners.
- Providing an idea of how easy or difficult improving the situation may be is recommended.
- The home environment (eg, young children), owner lifestyle (eg, frequent travel), and health issues (eg, chronic illness) should be considered and potential lifestyle changes discussed.
- Empathy is important; if practitioners are overly critical, owners may withdraw and not follow advice.
- If practitioners are unsure about specific treatment after they have completed triage, they should consider referral.

Addressing behavior problems can be difficult in a general practice setting. Owners may raise concerns as afterthoughts at the end of appointments, and practitioners may feel pressured to tackle a full behavioral workup in 20 minutes instead of the 2 hours a specialist might take.

Behavioral Triage

Behavioral triage refers to assessing the degree of urgency and relative risk associated with a behavior problem. The *urgency* of a behavior problem is determined by its effect on patient safety and welfare: a dog with separation anxiety that escapes through a second-floor window has a higher degree of urgency than one that defecates inappropriately; a cat too anxious to come out from under the bed except to eat and drink has a lower quality of life than one that becomes scared only when guests are present.

Relative risk includes the owner's perception of the problem's severity and the degree of risk the problem poses for other animals and humans, particularly when addressing aggression. Performing behavioral triage and assessing relative risk can be organized by taking a **B.I.T.E.** out of the behavior.

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B Back Off & Buy Time

Treating behavior issues is not an emergency, regardless of a client's sense of urgency. The problem did not develop overnight and cannot be solved immediately. Assure clients that most behavior problems can be improved. Let clients know that at this initial triage consultation that it is important for the veterinarian to know what the pet is *doing*. Provide clients with instructions on staying safe and sane until a later meeting to discuss *why* the pet is having these problems and *how* to affect a long-term change in behaviors.

I Investigate

Assess the client's presenting complaint in terms of absolute and relative risk. Rule out primary physical problems that can create behavior changes and secondary issues that may exacerbate preexisting behavior problems.

Determine whether the patient is aggressive and if so, how dangerous it is (eg, biting, causing other injuries) and who is at risk (eg, unfamiliar or familiar humans, children, cohabitating animals, unfamiliar animals). Next, evaluate the problem's effect on the quality of life of the patient and others in the household, both human and animal. Are owners unable to leave the home together because of a pet's separation anxiety? Do other pets isolate themselves because of one pet's aggression?

Next, obtain a minimum database: thorough physical examination (sedating fractious animals, if necessary), CBC, serum biochemistry profile, urinalysis, and fecal analysis. If specific medical problems are suspected, additional appropriate diagnostics should be pursued.

Euthanasia

Some owners may be looking for permission to rehome or euthanize their pet. Finding another home for a pet with a behavior problem may make the problem better or worse, or there may be no change in the pet's behavior.

Euthanasia can be a reasonable decision if a pet is truly suffering, putting others at risk because of a behavior problem, or if treatment is not a viable option. A full behavioral consult may be needed to determine the most appropriate course of treatment.

Owners who have been told that they should euthanize the pet but are not at peace with this often aren't aware that behavior problems can be treated. These patients should be triaged and referral to a specialist should be considered. Even if euthanasia is the end result, all reasonable options have been explored.

T Teach & Tourniquet

Owners are frequently misinformed about pet behavior and its causes. Inform them that, regardless of signs, most behavior problems are rooted in anxiety; this is especially useful when dealing with dogs that are aggressive toward humans. Many owners think that aggressive dogs are being "dominant." Educate owners that pets are likely using aggression to escape situations that make them fearful and anxious. Once they are educated, owners may better understand how to keep everyone safe while changing the pet's behavior.

Tourniquets are primarily avoidance techniques (see **Addressing Any Behavior Problem**, page 79 of this issue). Use information from the focused history to provide the owner with explicit written instructions for keeping the pet out of triggering situations until a full behavior consultation can be scheduled. For example, dogs that become aggressive on walks should not be walked or walked only when and where they are unlikely to encounter other humans or animals. Fighting cats should be kept in separate parts of the home.

In extreme cases, the pet can be boarded for a few days to provide clients with a break and allow emotions to cool. This can give clients considering euthanasia an opportunity to reevaluate whether they want to pursue treatment or confirm that euthanasia is their preferred option.

E Empathize

Owners may have difficulty talking about a pet's behavior problems. They may be embarrassed or fear being blamed. To help clients, it is critical to empathize with them. Let them know that they are not alone and that the entire clinical staff understands how much they care for the pet and want to help it.

Conclusion

Looking at the bigger picture, the triage appointment should be concluded by giving clients homework: completing behavioral history forms, writing accounts of their pets' behaviors, taking pictures of the living arrangements, and making videos of the behaviors (except aggressive behaviors). With this additional information, a diagnosis can be made and a treatment plan (see **Addressing Any Behavior Problem**, page 79 of this issue) can be implemented. ■ cb

See **Aids & Resources**, back page, for references & suggested reading.

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[1]Data on file. Hill's Pet Nutrition, Inc.

Addressing Any Behavior Problem

This two-article feature provides simple and comprehensive steps to address behavior cases. The following addresses treating any behavior problem in any pet; the companion article (page 75 of this issue) presents methods for triaging behavioral complaints.

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Keystone Veterinary Behavior Services
Villanova, Pennsylvania

Lori Gaskins, DVM, DACVB
St. Matthew's University
Grand Cayman, Cayman Islands

How can general practitioners quickly devise a treatment plan for patients with behavior issues?

Patients with behavior problems may present a daunting challenge to general practice veterinarians. Even for those who are well versed and interested in veterinary behavior, performing a full behavior workup—collecting a thorough history (for forms, see **suggested reading**), making a diagnosis, and devising and explaining a comprehensive treatment plan—simply is not possible in a 20-minute office visit.

The first 3 steps that follow are appropriate for all behavior issues and can be implemented to help the owner and patient even before pursuing full diagnosis. Steps 4 and 5 can be added to provide a comprehensive behavioral treatment plan after a definitive diagnosis has been established.

Step 1: Avoidance

If you can predict it, you should prevent it, because practice makes perfect. Avoiding situations that trigger problem behaviors achieves 3 important results. First, avoidance increases safety, which is paramount when the problem includes aggression. Even in the absence of aggression, animals with behavior problems are often at risk for physical harm, relinquishment, or euthanasia. Second, avoidance reduces stress and anxiety for pet and owner. Owners need ways to prevent issues so that they are not overwhelmed trying to change behaviors 24 hours a day.

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Third, avoidance prevents unwanted learning. A pet with a behavior problem or exposed to anxiety-provoking stimuli is learning with each occurrence. Through classical conditioning, the animal learns to associate the feelings of anxiety and accompanying autonomic responses (eg, rapid heartbeat, increased respiratory rate, panting, pupillary dilation) with that situation. For example, a dog with separation anxiety may grow anxious when the owner dresses for work.

Operant conditioning may occur when a patient's undesirable behavior produces a response from which it receives some degree of relief. For instance, if encroaching strangers retreat after a fearful cat claws at them, the cat's anxiety is somewhat alleviated. Owners can also accidentally reward anxious behavior. If owners come home while the dog is howling, it may learn to associate howling with the owners' reappearance. If the patient continues to learn to associate these situations with a stress response and reacts accordingly, teaching a new set of autonomic and conscious behavioral responses can become an uphill battle.

Problems can be avoided passively (ie, after problematic situations occur) or actively (ie, before problematic situations occur). If a dog growls, snaps, or bites when a human disturbs it while it is on the couch, the passive approach is for owners to leave the dog alone when it is on the couch, thereby avoiding a reaction from the dog. The active approach is to keep the dog off the couch, thereby preventing the problematic behavioral sequence. Options include restricting access to the room, making the couch inaccessible by flipping up the cushions, or keeping the dog on leash to prevent it from jumping on the furniture.

Tools for Avoidance

Household Management

Household management tools can be used in such situations as dogs barking at neighbors outside the house, cats with redirected aggression when they see animals outside, and dogs that become aggressive when visitors enter the home:

- Baby gates/exercise pens; Frontgate (frontgate.com) offers dog gates that do not require wall mounting, fit wider openings, and include small openings that allow cats to pass unhindered
- Crates (may require desensitization to confinement)
- Window films (wallpaperforwindows.com) that block the view but not incoming light
- Physical outdoor fences for property

Physical Management

Used to humanely gain control over an animal's physical actions:

- Head collars: Gentle Leader (premier.com)
- Body harnesses
- Basket muzzles: Jafco (jafcomuzzles.com), Baskerville muzzles
- Leashes—short for walks; long lightweight for indoor draglines, double to attach to collar and body harness/head collar

Step 2: Relationship Building

The relationship between an owner and a pet with behavior problems is often frayed. Rebuilding a healthy, trusting, predictable relationship is an important component in treating any behavior problem. This starts with reward-based training to give both pet and owner a common language (request–response–reward). Using these newly trained responses in a *Nothing in Life Is Free* (NILIF) program[1] can establish predictability in the relationship and provide a clear communication method. Owners can consider this similar to teaching children good manners by asking them to say "please" for anything they want; pets can do the same by sitting.

Unpredictability can develop from normal owner–pet interactions. One example occurs when owners allow pets on furniture sometimes but refuse access other times (eg, if the pet is wet). Although this unpredictability may not seem random to the owner, it may to the pet. For animals with behavioral disorders, unpredictable reactions can be a source of anxiety.

Unpredictability may also result from owner attempts to correct behavior problems, especially if punishment is used. The owner's behavior may seem unpredictable because the animal was not previously punished for the behavior. In addition, punishment must happen immediately with the commencement of behavior and must be administered consistently. This is difficult, if not impossible, outside of planned training sessions. Some

punishments, (eg, alpha rolling or growling at dogs, using noisemakers with cats, shaking a bird's cage, hitting) may frighten pets or make them aggressively protect themselves.

Step 3: Tool Implementation

Clients often do not know how to implement the prescribed avoidance and relationship-building steps. Their understanding and compliance can be enhanced with specific recommendations for tools that can accomplish these steps (see **Tools for Avoidance** and **Tools for Relationship Building**).

Proper use of products and techniques can be demonstrated, such as fitting a dog with a head collar or introducing clicker training to a bird. If the clinic does not stock such items, providing client handouts for recommended products can be useful.

Step 4: Behavior Modification

Problematic behavior can be changed. Behavior-modification techniques typically used by veterinary behaviorists include operant conditioning, classical conditioning, desensitization and counter-conditioning, and extinction. As with performing a complicated surgery, these complicated techniques require learning additional skills. General practitioners who are unfamiliar with behavior modification can initiate steps 1, 2, and 3, then refer the patient to a board-certified veterinary behaviorist or veterinarian experienced in such techniques (see **Resources & Referrals**).

Step 5: Pharmaceutical & Adjunct Treatments

Legally and ethically, a diagnosis that supports use of a specific medication must be made before a psychotropic drug is prescribed. Only 3 products are available in the United States and labeled for use in behavior patients: Clomicalm (clomicalm.novartis.us) and Reconcile (reconcile.com) for separation anxiety in dogs and Anipryl (anipryl.com) for cognitive dysfunction in dogs. All other behavior modifying drug use is considered off label and can increase the practitioner's and practice's liability, especially if a third party (human or animal) is injured. In the absence of a diagnosis, a consultation with or referral to a board-certified veterinary behaviorist or a veterinarian experienced in such matters is strongly advised before pharmaceuticals are prescribed.

Over-the-counter agents (eg, pheromones, homeopathy, herbal supplements) are not free of adverse effects. Dietary approaches, such as Hill's Prescription Diet b/d (hillsvet.com) and Royal Canin Veterinary Diet Calm (royalcanin.us) may also be considered. Clinical and adverse effects should always be closely evaluated.

MORE ▶

Tools for Relationship Building

Reinforcers or Rewards

- Help owners determine a reward gradient so they can give the best reward for the most difficult behaviors:
  - Every pet has its favorite rewards.
  - High-value treats and toys should be used to teach new tricks and then saved for behavior modification.
  - Owners of special-diet pets should be provided a list of resources for acquiring acceptable treats.
- Enrichment measures:
  - Games, toys, walks, and clicker training can help reduce stress and build the owner–pet bond when used properly.
  - Games can include hide-and-seek (*not* for dogs with separation anxiety) or finding owner-hidden treats or toys.
  - Food-dispensing toys can be beneficial.

Resources & Referrals

Veterinarians

- American College of Veterinary Behaviorists **dacvb.org**
- American Veterinary Society of Animal Behavior **avsabonline.org**

Technicians

- Society of Veterinary Behavior Technicians **svbt.org**
- Academy of Veterinary Behavior Technicians **avbt.net**

Trainers

- Karen Pryor Academy **karenpryoracademy.com**

Clients who are looking for quick fixes may assume these treatments are panaceas and pressure veterinarians for medications. Novice behavior practitioners should not feel compelled to use treatments with which they are unfamiliar and uncomfortable.

Conclusion

This 5-step plan can help practitioners quickly initiate treatment through avoidance techniques, relationship-building exercises, and the tools needed for both. The remaining steps can be implemented for a comprehensive treatment plan by scheduling a full behavioral consult or referring.

However, many owners never go beyond the first 3 steps, especially if the problems are not severe. The outcome can still be successful, as the pet and owner no longer experience these problems and their bond has been strengthened. ■ cb

See **Aids & Resources**, back page, for references & suggested reading.

For More

See the companion article, **Triaging Behavior Problems**, on page 75 of this issue.

Tx at a Glance

5-Step Approach to Any Behavior Problem

1. Avoidance

- Avoid situations that predictably cause problem behavior (until step 4 can be initiated).
- List problematic situations and how to avoid them.

2. Relationship Building

- Teach a new trick with positive reinforcement (rewards).
- Provide predictable interactions (NILIF).
- Do not administer inappropriate punishments.
- Discuss additional relationship-building techniques or enrichments.

3. Tools for Implementing Treatment Plan

- For avoidance and safety, implement household and physical management.
- For relationship building, encourage use of treats or toys to teach new tricks, as well as other enrichments as needed.
  - Save favorite treats or toys for use in behavior modification.

4. Behavior Modification

- Examples of behavior modification techniques
  - Classical conditioning: Pair currently problematic stimulus with treats in attempt to change pet's association with stimulus. For example if a dog barks at people on walks, every time a person passes the dog should receive treats; ideally, the dog starts to look for treats instead of becoming anxious when it sees people.
  - Operant conditioning: Find alternate behaviors that are incompatible with problematic behaviors. Increase the alternates through positive reinforcements; consider appropriate punishments (eg, time outs, removing attention) to decrease problematic behaviors.
  - Desensitization and counterconditioning: Determine gradients for desensitization and alternate behaviors for counter-conditioning. Stay below threshold of emotional response to change the behavior.
- Use additional behavior modification techniques as needed.

5. Pharmaceutical & Adjunct Treatments

- Determine whether they are necessary based on diagnosis.
- Get informed consent from owner for administration of off-label drugs.
- Prescribe additional adjunct treatments as needed.

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Reference: 1. Data on file, Merck Animal Health.

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TOP 5 Liver Conditions in Dogs

Craig B. Webb, PhD, DVM, DACVIM (Small Animal)
Colorado State University

TOP 5 Liver Conditions in Dogs

1. Hepatitis or hepatic insult
2. Hepatic fibrosis or cirrhosis
3. Copper-associated hepatitis
4. Congenital portosystemic vascular anomalies (PSVA)
5. "Nonhepatic" hepatic disease

The liver serves as the control-and-command center for virtually all metabolic processes: production, packaging, and distribution of proteins, lipids, and carbohydrates; hormonal and enzymatic control of metabolic pathways; metabolism of biologics; transformation of xenobiotics; decontamination and removal of toxins; and recirculation, recycling, and refilling of gallbladder contents. When the liver does not function at full capacity, clinical manifestations are often ubiquitous and possibly devastating.

1 Hepatitis or hepatic insult

Acute

The liver can be exposed to ingested toxins, blood-borne pathogens, and drugs and their metabolites, providing numerous causes for acute insult. Signs can include anorexia, fever, vomiting, and abnormal mentation. Jaundice is the classic sign of hepatic failure, with RBC hemolysis as another important differential for hyperbilirubinemia.

Leptospirosis appears to be increasingly prevalent and usually involves both the liver and kidneys. Other possible infectious agents include infectious canine hepatitis (canine adenovirus-1), *Clostridium piliformis*, bacteria (especially *Escherichia coli*), and *Toxoplasma gondii*. Ingestion of *Amanitum* spp mushrooms, blue–green algae, and some drugs (eg, sulfonamides, carprofen, amiodarone) can result in acute and significant liver disease. Consequences of insult may be idiosyncratic and unpredictable, and signs may vary.

The liver can be exposed to ingested toxins, blood-borne pathogens, and drugs and their metabolites, providing numerous causes for acute insult.

ALT and bilirubin are the most pertinent biochemical indicators of hepatic insult, although low BUN, albumin, cholesterol, and glucose levels along with prolonged clotting times are indicative of fulminant hepatic failure. Supportive care is essential. Glucocorticoids may be contraindicated (infection) or of minimal benefit in the acute setting. Acetylcysteine has been used in critical patients with a loading dose of 140 mg/kg IV, followed by additional treatments at 70 mg/kg.

Chronic

Signs of chronic canine hepatitis, often nonspecific and systemic, include vomiting, lethargy, decreased appetite, polyuria/polydipsia (PU/PD), and weight loss. Increased ALT enzyme activity, usually the most telling biochemical abnormality, is frequently monitored as a quantifiable indicator of treatment response.

MORE ▶

PSVA = portosystemic vascular anomalies, PU/PD = polyuria/polydipsia

Although the primary disease cause may be undetermined, several treatable causes warrant diagnostic examination with histopathology, metal analysis, and bacterial culture. Chronic hepatitis may present as a slow progression of changes started by acute insult. Culturing bile, not liver tissue, may yield better growth.[1] There is often an immune-mediated component to chronic hepatitis progression, warranting immunomodulatory therapy. Prednisone has been the preferred drug, but Colorado State University has recently had success using cyclosporine at a starting dose of 5 mg/kg q24h.[2] Unlike prednisone, cyclosporine does not induce canine liver enzyme elevation.

Hepatitis cases (acute and chronic) can be treated with ursodeoxycholic acid at 7.5 mg/kg q12h to enhance bile flow, dilute toxic bile acids, and provide both immunomodulatory and antioxidant effects. Antioxidants may benefit cases of canine hepatitis: *S*-adenosylmethionine (SAMe; 10 mg/kg q12h), silymarin (100–200 mg/dog q24h), and vitamin E (100–400 IU/day).

2 Hepatic fibrosis or cirrhosis

Chronic hepatitis may progress to a cirrhotic liver (**Figure 1**) as fibrin replaces liver parenchyma, causing permanent changes in hepatic architecture. This is a morphologic diagnosis of prognostic significance. The presentation, often severe, can include weight loss, ascites, and jaundice. A PCV/TP can quickly rule out hemolytic anemia as the cause of jaundice, and a serum bile acids test is redundant if the total bilirubin is significantly elevated. Ascites may be a result of portal hypertension from the cirrhotic liver, hypoalbuminemia from loss of liver function, retention of sodium or water via stimulation of the renin–angiotensin–aldosterone system, or a combination thereof.

1

Diffuse, severe nodular changes (arrow) throughout all lobes of the liver and a decrease in liver size, consistent with hepatic cirrhosis. As hepatic parenchyma is lost and scar tissue forms, the liver attempts to regenerate, but all semblance of normal architecture (and eventually function) is lost. One alternative rule-out might be benign hepatic nodular hyperplasia, but case presentation and biochemical abnormalities would distinguish the two differentials before biopsy (moderate elevation in ALP activity as compared to systemic signs of liver failure).

Although the diagnostic work-up (eg, histopathology, metal analysis, culture) is similar to that of less marked cases of chronic hepatitis, it is often too late for specific beneficial treatment, even if a primary cause is identified (eg, copper-associated hepatitis). Supportive care may include palliative abdominocentesis if the ascites compromises respiration, but the newly emptied space will likely refill. Spironolactone (1–2 mg/kg q24h) combined with furosemide may be used when fluid removal is less critical; however, it may increase risk for hepatic encephalopathy from alkalosis or hypokalemia effects. Cirrhosis and ascites are negative prognostic indicators against which colchicine at 0.025 mg/kg q24h may be tried; however it lacks proven benefit. Prednisone and nonspecific liver protectants are indicated, but the prognosis can be grave.

3 Copper-associated hepatitis

As a form of chronic hepatitis, copper-associated hepatitis is thought to result from an inherited enzymatic defect in several breeds, especially Bedlington terriers but also Dalmatians, Labrador retrievers, and West Highland white and Skye terriers. Excessive hepatic copper is a treatable component of chronic hepatitis cases (common in Doberman pinschers, cocker spaniels, mixed breeds) in which copper accumulation may be secondary to the disease. The copper chelator D-penicillamine at 10 to 15 mg/kg q12h is preferred for removing excess copper, and elemental zinc at 10 mg/kg q12h can decrease GI copper absorption; however, the two should not be used simultaneously.

Most commonly seen as a chronic hepatopathy, copper-associated liver disease can present as an acute illness or acute hemolytic crisis (rare), so qualitative or quantitative assessment of hepatic copper content should be a standard diagnostic of liver biopsy.

4 Congenital portosystemic vascular anomalies (PSVA)

The liver is normally the first stop for blood carrying digestive and absorptive efforts of the GI tract to the rest of the body. Various congenital vascular anomalies can result in blood bypassing the liver, causing release of digestive content systemically without screening or preparation and resulting in decreased liver function. The nomenclature has recently been clarified by WSAVA Standards.

PSVA = portosystemic vascular anomalies, PU/PD = polyuria/polydipsia

For More

Read **Top 5 Liver Conditions in Cats** by Dr. Craig B. Webb in the April issue of *Clinician's Brief* or visit **cliniciansbrief.com/top-5-liver-conditions-cats**

The most common presentation is in young dogs with stunted growth and/or abnormal mentation, but more subtle signs of PSVA (eg, GI, PU/PD, weight loss, lethargy, poor hair coat) in older pets are increasingly appreciated; other signs are generally related to the nervous or urinary system. Serum biochemistry profile and urinalysis may reflect the dysfunction (ie, low or low-normal glucose, cholesterol, albumin, BUN, microcytic anemia or target cells, ammonium biurate crystalluria); however, pre- and postprandial serum bile acids testing (not liver enzyme elevation) may best establish decreased liver function, although it is not specific to PSVA.

When the clinical presentation and serum bile acids test are consistent with decreased liver function, PSVA can be confirmed and characterized by abdominal ultrasonography. A single extrahepatic (small breed) or intrahepatic (large breed) shunt is frequently visualized. Advanced imaging or histopathology can be used if ultrasonography is equivocal or if primary portal vein hypoplasia (formerly microvascular dysplasia or noncirrhotic portal hypertension) is suspected.

It is necessary to determine whether the PSVA patient requires surgical (most single shunts) or nonsurgical (primary hypoplasia, multiple acquired shunts) treatment. Medical management includes dietary intervention (low-quantity, high-quality protein) and pharmaceutical manipulation of gut ammonia production (lactulose, 0.5 mL/kg q8–12h; neomycin, 22 mg/kg q8h).

5 "Nonhepatic" hepatic disease

Nonhepatic liver disease includes the following reactive hepatopathies: vacuolar hepatopathy, steroid hepatopathy, and benign nodular hyperplasia. Elevations in liver enzyme activities do not necessarily indicate primary liver disease. The liver senses various conditions or diseases and reacts with enzyme elevations; hence the term *reactive hepatopathy*. Overlooking these differentials may lead to unproductive diagnostic efforts.

Steroids and anticonvulsants can induce elevated canine liver enzyme activities. Benign nodular hyperplasia in older dogs can mimic enzymatic and ultrasonographic changes similar to those seen in neoplastic disease. Growth in young dogs, bone cancer in older dogs, and endocrinopathies (eg, Cushing's disease, diabetes mellitus) can result in elevated liver enzymes. Idiopathic vacuolar hepatopathy is a histopathologic diagnosis consistent with exogenous steroid administration, Cushing's disease, or other systemic illness. After identifying and treating the primary disease, nonspecific therapy (eg, antioxidants) aimed at the liver may be administered. Elevated liver enzymes in a dog without clinical signs may be reevaluated in 4 to 6 weeks before pursuing a more extensive diagnostic work-up.

Closing thoughts

The liver is involved in most every aspect of life. Therefore, primary liver disease makes the list of differentials for most presentations, while secondary liver involvement must be considered in most nonliver diseases. ■ cb

See **Aids & Resources,** back page, for references & suggested reading.

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Test Yourself on this Month's Articles!

TOP 5 PAGE 15

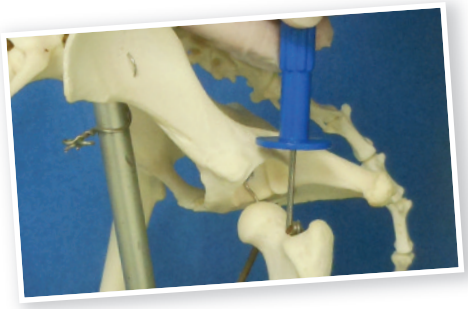
1. What are the top 5 skin masses diagnosed with in-house cytology?
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____

MANAGEMENT TREE PAGE 18

2. Which of the following is *not* a GDV complication?
   A. Sepsis
   B. DIC
   C. Cardiac arrhythmias
   D. Alopecia

PROCEDURES PRO PAGE 21

3. Which is *not* a typical site in bone marrow sampling?
   A. Proximal humerus
   B. Proximal femur
   C. Vertebral body
   D. Iliac crest



A MATTER OF OPINION PAGE 29

4. Which of the following statements is *not* true?
   A. The number of American adults reporting use of Chinese herbal medicines increased from 1997 to 2002.
   B. Several studies have reported efficacy in treating hyperthyroidism, hepatitis, and neoplasia using Chinese herbal medicines.
   C. Prescription of herbal medications is tightly regulated.
   D. Use of incompatible herbal formulas and incorrect pattern diagnoses frequently causes adverse effects.

CLINICAL VIEW PAGE 60

5. Colonic torsions have been reported in:
   A. Collies and German shepherd dogs
   B. Pugs and puggles
   C. Golden and flat-coated retrievers
   D. Cats

COMPARATIVE IMAGERY PAGE 63

6. The small intestine should contain only _____ & _____ on radiographs.
   A. Bones, bone fragments
   B. Radioopaque calculi, fluids
   C. Homogenous soft tissue opacity (fluid, liquid ingesta), gas
   D. Heterogeneous material, feces

ASK THE EXPERT PAGE 69

7. Patients with NSAID intoxication are at risk for acute renal failure and GI ulceration if left untreated for:
   A. >2 hours
   B. >4 hours
   C. >6 hours
   D. >8 hours

APPLIED BEHAVIOR PAGE 75

8. What steps are best to perform behavioral triage and assess relative risk?
   B _____
   I _____
   T _____
   E _____

APPLIED BEHAVIOR PAGE 79

9. What 5 steps can address any behavior problem?
   Step 1: _____
   Step 2: _____
   Step 3: _____
   Step 4: _____
   Step 5: _____

TOP 5 PAGE 85

1. List the top 5 liver conditions in dogs.
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____

Answer Key
1: vaccine reaction, follicular cyst, lipoma, histiocytoma, mast cell tumor 2: D 3: C 4: C 5: A 6: C 7: D 8: back off and buy time, investigate, teach tourniquet techniques, empathize 9: avoidance, relationship building, tool implementation, behavior modification, pharmaceutical and adjunct treatments 10: hepatitis/hepatic insult, hepatic fibrosis/cirrhosis, copper-associated hepatitis, congenital portosystemic vascular anomalies (PSVA), "non-hepatic" hepatic disease

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Companion Therapy and **Nestlé Purina** are now cosponsors of **Colorado State University's Small Animal Residency in Sports Medicine & Rehabilitation**, designed for veterinarians demonstrating strong clinical aptitude in sports medicine or rehabilitation. The 3-year program allows residents to conduct research, complete clinical assignments, and teach. More information on this program can be found at **colostate.edu**.—*Press release 3/2013*

More Research in Asia-Pacific

Alltech and **Karnataka Veterinary, Animal, & Fisheries Sciences University** (KVAFSU) have launched the **KVAFSU–Alltech Nutrition Research Alliance Program** to find strategies for increasing milk production to satisfy India's growing population. Other allied programs include development of an in vitro method to expedite screening of various specialized feed additives and ingredients, student research support, and education for Indian dairy farming communities. This collaboration joins Alltech's other global research alliances searching for long-term answers to key issues facing agricultural industries. Visit **alltech.com** for more information.—*Press release 3/2013*

Organic Relief

Releaves, a nonsynthetic, whole food dietary supplement intended for all animals, is now available from **Harrison's Pet Products**. Releaves blends red palm fruit oil enhanced with organic red raspberry leaves and extract to provide relief for common medical conditions with hormonal causes. Visit **HEALx.com** for more information.—*Press release 3/2013*

Protect the Love, Protect Your Pet

Ceva Animal Health has launched a multimedia campaign for **Vectra**. The **"Protect the Love"** campaign, comprised of national print, broadcast, and online advertising, aims to educate owners on the importance of vector-borne disease protection for pets and drive traffic to participating practices. Owners are encouraged to visit **firstdosefree.com** to download a coupon to receive their first dose of Vectra at no cost. To find more information on Vectra or participate, visit **vectrapet.com**.—*Press release 4/2013*

Call for Research Proposals

The **American College of Veterinary Internal Medicine Foundation** (ACVIMF) and **Veterinary Pharmacology Research Foundation** (VPRF) have invited investigators to submit proposals for research that evaluates safety and effectiveness of veterinary therapies, explores new drug therapies for animals, develops and validates models of animal diseases or conditions, or ensures that food supply is not compromised by drug therapy. Collaborations between pharmacologists and ACVIM Diplomates are encouraged. The deadline for submitting proposals is May 31. For more information on VPRF or submitting a proposal, visit **ACVIMFoundation.org**.—*Press release 3/2013*

Witness a New Heartworm Test

The United States Department of Agriculture (USDA) has approved a new version of **Zoetis' WITNESS HW Heartworm Antigen Test Kit**, launched mid-April. Enhancements to biologics, improvements to the buffer and sample pad, and increased signal strength at the control line increase the test's sensitivity. The test, intended for use on dogs and cats, uses immunochromatography Rapid Immuno Migration technology to detect the presence of adult *Dirofilaria immitis* antigens in blood. Visit **zoetisus.com/diagnostics** for more information.—*Press release 4/2013*

Complimentary CD

CareCredit is offering a complimentary educational CD for all members of the veterinary practice team. ***Better Client Conversations, Better Client Relationships*** features Wendy S. Myers from Communication Solutions for Veterinarians. Myers shares communication tips, such as how to manage difficult conversations and dissatisfied clients and how body language can put clients at ease. Visit **carecredit.com/veterinary** for more information.—*Press release 4/2013*

Clinician–Client Communication

RoundingWell has announced a new Web-based system that allows clinicians and clients to communicate outside of the veterinary office. The system offers patient health check-ins and real-time risk assessments, allowing clinicians to identify which patients need immediate care. These check-ins are comprised of questions and educational pieces customized for a pet's specific health status. Via the Clinician Console feature, clinicians in multiple locations can view the patient and provide collaborative care. Visit **roundingwell.com** for more information.—*Press release 3/2013* ■ cb

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◀ FROM page 96

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GASTRIC DILATATION-VOLVULUS • Lisa L. Powell

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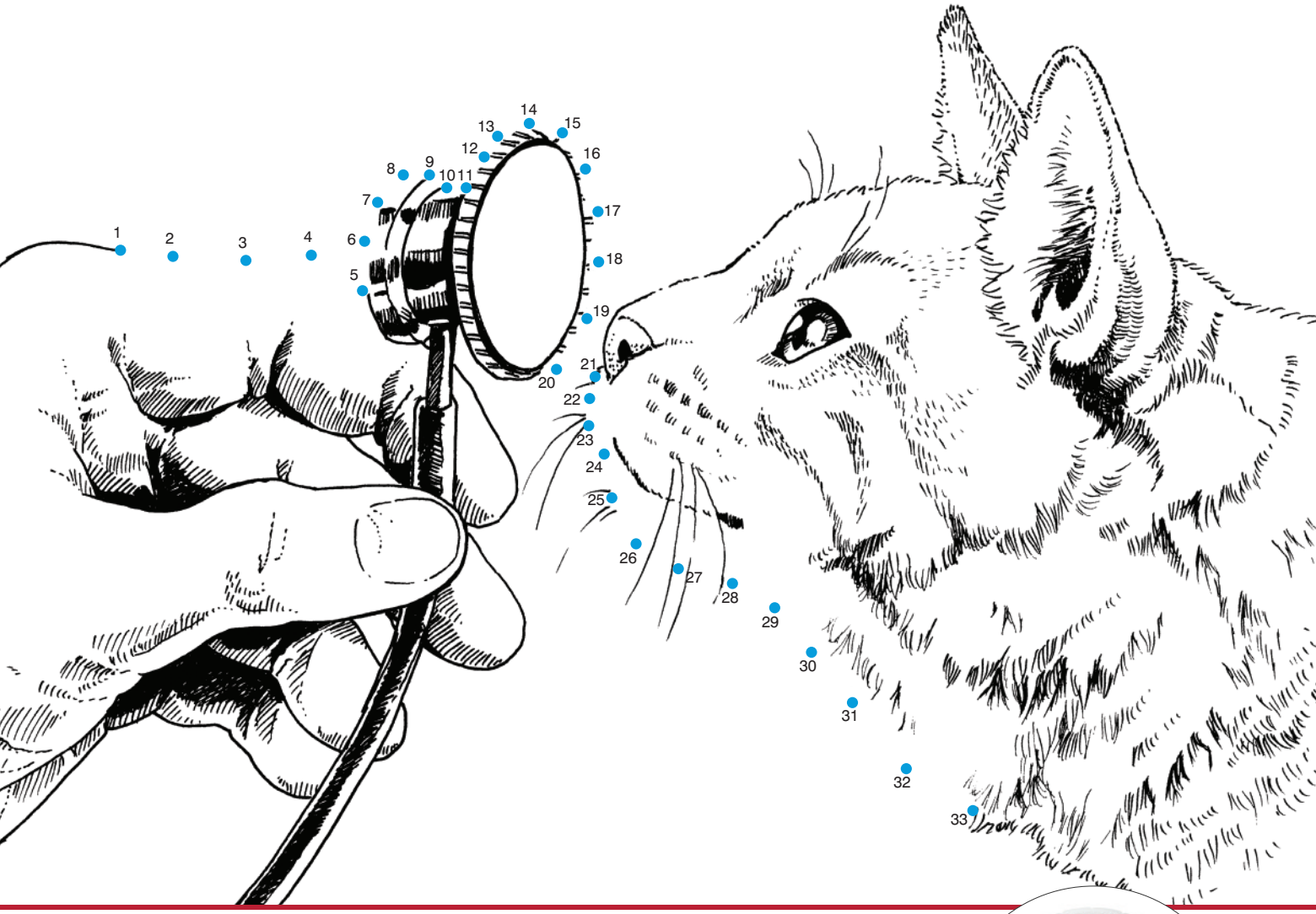

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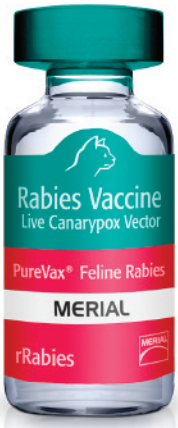

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