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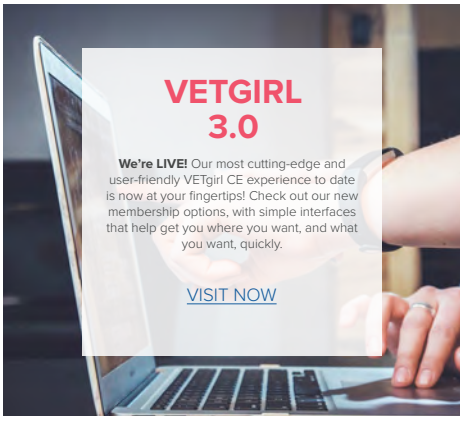

QUARTERLY BEAT / DECEMBER 2019

Because you deserve to eat a meal using silverware instead of tongue depressors.

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lasagna soup - slow cooker

ingredients

1 pound of ground beef
1 large yellow onion, diced
½ to 1 teaspoon garlic powder
2½ teaspoons salt, divided
1 teaspoon black pepper, divided
28 ounces of chicken broth
1 can (8 oz.) tomato sauce
1 large can (28 oz.) diced tomatoes
(no need to drain)
1 cup water
1 teaspoon oregano
1 to 2 teaspoons dry parsley

LATER:
8 to 10 ounces lasagna noodles
or Malfada noodles
fresh basil
shredded cheese (your choice)

directions

1 On medium-high heat, brown the ground beef and break up into small pieces (5-6 minutes). Add in diced onion and cook for a few minutes.

2 Season with garlic powder, 1 teaspoon of salt, ½ teaspoon of black pepper. Drain out the oil and dump into the slow cooker.

3 Add all the REMAINING ingredients into the slow cooker (up to noodles). Add 1 cup of water, remaining 1½ teaspoons of salt and ½ teaspoon of pepper.

4 Cook on LOW for 7 hours or on HIGH for 5 hours.

5 Separately, I boil the lasagna noodles (broken into pieces first) or Malfada noodles in hot water until they are soft and cooked. Add the noodles to the crock pot after the allotted cooking time and cook for an additional 30 minutes.

6 Once cooked, scoop out and sprinkle your favorite cheese on top along with fresh basil.

7 Alternatively, you can scoop into ovenproof bowls and melt cheese on top and put it in the oven (broiler) for a few minutes, but who has the time?

Submitted by Justine Lee

DIAGNOSIS & MANAGEMENT OF CONSTIPATION IN CATS

SUSAN LITTLE, DVM, DABVP (FELINE)
@catvetsusan, catvet@vin.com

In the VETgirl Real-Life Rounds webinar, "Management of Constipation in Cats," Dr. Susan Little, DABVP reviewed the diagnostic workup and approach for treatment of constipation in cats. Learn tips from the feline pro!

KEY HIGHLIGHTS

Constipation is the infrequent and difficult evacuation of feces with retention of feces within the colon and rectum. Obstipation is intractable constipation. Some of the more common underlying causes of constipation include certain drugs, stressors, litter box aversion, difficulty in defecating (pain, neurologic problems), excessive fecal bulk, dehydration (e.g., associated with chronic kidney disease), intra- or extra-luminal colon masses, narrowed pelvic canal, and idiopathic megacolon.

1 CLINICAL SIGNS AND DIAGNOSIS

The clinical signs of constipation are typically obvious to the owner, such as tenesmus, and scant hard dry feces, sometimes with blood. However, cats will also strain in the litter box due to lower urinary tract obstruction and owners may misinterpret this as due to constipation. Other clinical signs are non-specific, such as vomiting, inappetence, and lethargy.

Physical examination confirms the presence of large amounts of feces in the colon sometimes accompanied by abdominal pain. The colon often palpates as a long firm tube or feces may be palpated as discrete concretions. A careful evaluation (e.g., musculoskeletal system, caudal spinal cord function, anorectal area) should be made for underlying causes. A rectal exam under sedation may be necessary in some patients to evaluate for masses, pelvic fracture malunion, or anal gland abnormalities. A minimum database (complete blood count, serum chemistries/electrolytes, urinalysis) should be assessed, especially to determine hydration and electrolyte status and identify underlying diseases. Survey abdominal radiographs are useful to confirm the diagnosis and assess severity as well as to evaluate for potential underlying causes, such as previous pelvic trauma and arthritis. In some cases, further diagnostics such as a barium enema or colonoscopy may be warranted.

2 ACUTE MANAGEMENT

The first step in acute management is correction of dehydration with fluid therapy followed by removal of obstructing feces. Obstipated cats will require warm water or isotonic saline enemas (5-10 mL/kg) administered slowly with a lubricated 10-12 French feeding tube.

(continued)

DIAGNOSIS & MANAGEMENT OF CONSTIPATION IN CATS

SUSAN LITTLE, DVM, DABVP (FELINE)
@catvetsusan, catvet@vin.com

(cont)

In severe cases, manual manipulation of the feces via abdominal palpation or per rectum (manual disimpaction) under general anesthesia with endotracheal intubation (in case of vomiting) is also required. In these cases, opioids should be administered for pain relief. An alternative to enemas is administration of an oral polyethylene glycol (PEG 3350) and electrolyte solution intended for colonoscopy preparation (e.g., CoLyte, GoLytely). A nasoesophageal tube is placed and the solution is given as a slow trickle (6-10 mL/kg/hour) over 4-18 hours. Defecation usually results in 6-12 hours.

3 LONG TERM MANAGEMENT

In addition to management of any underlying conditions, long term medical treatment may involve dietary therapy, laxatives, or prokinetic agents. Dietary therapy may include high fiber diets (>20% on as fed basis), low residue diets, or biome-manipulating diets. Increased dietary fiber increases the production of short chain fatty acids which stimulate feline colonic smooth muscle contraction. Dietary fiber is also a bulk laxative and will increase fecal bulk, which will not be beneficial for all patients. Feeding a canned diet is often recommended to reduce fecal bulk and to ensure adequate water intake and hydration. A certain amount of trial and error is necessary to determine the best diet type for an individual patient. It is also important to ensure adequate water intake by various methods, such as feeding canned diets. Most water bowls designed for cats are too small; cats dislike having their whiskers touch the side of containers. Dog water bowls are larger and more appropriate.

Litter box modification may be helpful for cats with arthritis. Most cat litter boxes are too small and have high sides. A winter boot tray or an under-the-bed type of storage box with low sides is a better alternative to make access easier. The litter box should also be in an accessible but private area, avoiding the need to navigate stairs if possible.

Hyperosmotic laxatives include lactulose and PEG 3350 (without electrolytes, e.g., MiraLax, RestoraLAX); they stimulate colonic fluid secretion and propulsive motility. The dose of lactulose solution is 0.5 mL/kg, PO, BID-TID. The dose of PEG3350 is 1/8 to 1/4 tsp. BID in food. Cisapride stimulates contraction of feline colonic smooth muscle. A typical starting dose is 2.5 mg/cat BID, PO and it is better absorbed when given with food. Doses up to 7.5 mg/cat, TID have been reported. The drug is only available from compounding pharmacies in most countries.

Surgery can be considered for cats that are refractory to medical and dietary therapy. There are various techniques available, including partial colectomy, subtotal colectomy (most common), or total colectomy. A subtotal colectomy describes the removal of the majority of the colon, excluding the ileocolic sphincter and cecum.

Preservation of the ileocolic valve decreases postoperative diarrhea caused by bacterial overgrowth and decreased water absorption. Surgical complications are uncommon and include contamination of the surgical site and dehiscence of the anastomosis; both are prevented by proper surgical technique. Diarrhea normally disappears 4-6 weeks after surgery. In a minority of cats, the soft stools persist.

References available on request.

LEARN MORE

TREATMENT AND MONITORING OF DIABETES IN DOGS AND CATS

PATTY A. LATHAN, VMD, MS, DACVIM
Associate Professor, Mississippi State University

In this VETgirl-Merck Animal Health webinar "Management of diabetes in dogs and cats," Dr. Patty Lathan, VMD, MS, DACVIM reviewed all you need to know about diabetes mellitus in dogs and cats! Tune in free for a limited time HERE.

KEY HIGHLIGHTS

The goals of treating diabetes include improvement of the patient's (and owner's) quality of life, control of clinical signs, avoidance of complications from diabetes (such as diabetic neuropathy) and from over-treatment with insulin (hypoglycemia), and diabetic remission (in cats). Proper treatment includes identifying and treating or eliminating any cause of insulin resistance (infection, obesity, etc.), dietary management, and insulin therapy.

1 DIET

Although large controlled studies are lacking, a high protein, low carbohydrate diet is generally recommended in diabetic cats. Canned food is ideal, as these diets are usually lower in carbohydrate content and are more filling due to the added water content. Several prescription diets have been formulated to meet low carbohydrate specifications (including Hill's m/d, Purina DM, and Royal Canin DS 44 dry). Given the higher caloric density of dry foods, the canned foods usually have lower carbohydrate contents and are preferred in obese patients. Weight loss cannot be over-emphasized, as obesity promotes insulin resistance. Obese cats are four times more likely to develop DM in the first place!

Weight loss of 1-2% body weight per week should be achieved using food restriction.

Although high fiber diets have been recommended in dogs, they are not ideal for all diabetics. High fiber diets tend to cause weight loss, which is undesirable in dogs that are underweight or at an ideal body weight. In these dogs, a high quality maintenance dog food with a moderate fiber content is preferred.

2 INSULIN THERAPY

Newly-diagnosed cats should be treated with twice daily insulin injections (unless DKA is present) for best regulation and diabetic remission rate. Glargine (Lantus®), PZI (ProZinc®) and lente (Vetsulin®) insulins are all viable options. Glargine and PZI insulins appear to result in slightly higher remission rates than lente insulin. However, given the significant price differences, lente insulin is a practical option for owners with financial limitations. NPH is not recommended in cats due to short duration of action. Compounded PZI insulin is also not recommended. The starting insulin dose in cats is 1-2U twice daily.

Dogs should also be treated with twice daily insulin injections, using a moderate acting insulin. Lente (Vetsulin®) and NPH (Neutral protamine Hagedorn, either Humulin N® or Novolin N®) are most frequently used for first-line therapy (0.25 – 0.5U/kg BID). Most of my diabetic dogs are started on lente insulin. Glargine,

detemir, and PZI have also been evaluated in dogs, and detemir is useful when the duration of lente or NPH is too short. **Detemir is more potent in dogs than in cats or people, so a starting dose of 0.1 U/kg BID is recommended.**

3 MONITORING

There are several methods available for monitoring diabetes, including assessment of clinical signs, BG curves (BGCs in clinic and at home), continuous glucose monitoring (specifically the FreeStyle Libre), fructosamine concentrations, and urine glucose.

(continued)

TREATMENT AND MONITORING OF DIABETES IN DOGS AND CATS

PATTY A. LATHAN, VMD, MS, DACVIM
Associate Professor, Mississippi State University

(cont)

This section will focus on the clinical signs and glucose monitoring.

CLINICAL SIGNS

Since the primary goal of treating a diabetic patient is to control clinical signs, clinical signs should always be considered when assessing diabetic control. A stable diabetic patient should have normal water intake (<60 mL/kg/day) and urination, "normal" energy level, and a stable weight. Although weight loss is recommended in obese animals, it is preferably delayed until at least moderate diabetic control is achieved. Water intake directly correlates to BG concentrations, and having the owner measure (and log) daily water intake gives them a way to be active in the management of their pet. Additionally, owners can assess urination by recording how many urine clumps are in a cat's litterbox, or how many times a dog asks to go out during the day (and the middle of the night!). Phone apps are now available to help owners log daily water intake, food consumption, signs of illness, and at home BGC measurements, including Merck's PetDiabetes Tracker App and the RVC Pet Diabetes App. Both apps allow the owner to email information directly to the veterinarian. The patient's weight should be recorded and assessed at each veterinary visit. Note that all other monitoring modalities should be interpreted in light of the patient's clinical signs and weight.

GLUCOSE MEASUREMENTS

Blood Glucose Curves

Traditionally, BGCs have been used to help identify clinically-undetectable hypoglycemia, and can help determine an insulin's duration of action. If the duration of activity is too short, that patient may benefit from a longer-acting insulin. BGCs are also helpful in determining whether it is safe to increase the patient's insulin dose when clinical signs are present. They are particularly important when initially arriving at an insulin dose and when clinical signs return. Curves MUST be interpreted in light of clinical signs, such as PU/PD, polyphagia and weight loss. Disadvantages of BGCs include the inability to identify hypoglycemia during the hours or days in which a curve is not performed (ie, in the middle of the night, when more hypoglycemic events occur), inconsistent correlation with clinical signs, and the effects of stress hyperglycemia in cats.

At-home Glucose Curves

A much less stressful alternative to in-hospital BGCs is at-home glucose curves. These are ideal because they give us a more realistic idea of normal daily BGs in cats that experience SH, and are often less stressful for the pet and the owner (especially when the patient hates going to the clinic, resulting in owner guilt). Additionally, even if the owners don't routinely perform full BGCs on their pets, knowing how to obtain BG readings at home can help them identify hypoglycemia when suspected. Sites for obtaining BG samples in cats include the marginal ear vein or inner pinna, and the edge of a non-weightbearing paw pad. In dogs, the inner pinna, gums, and elbow callus may be used.

Continuous Glucose Monitoring System (CGMS); FreeStyle Libre

The FreeStyle Libre (FSL) is a CGMS that measures interstitial glucose (IG) every 15 minutes for up to 14 days. Sensors are easily placed, even in less agreeable patients, and generally as affordable as a BGC (late 2019 with GoodRX: reusable reader--$65-$85; 14-day sensor--$65). The FSL can be purchased from a human pharmacy, with a prescription; vets may also obtain them from a distributer, usually at a higher cost. A 2016 paper (Corradini et al, JVIM) reported successful use of the FSL in dogs. We have been using them instead of traditional BGCs and also in hospitalized DKA patients (following rehydration). They appear to be accurate for the most part, but we have identified discrepancies in some patients. In particular, sometimes the FSL will read as hypoglycemic when the BG is actually 120 mg/dL or more. There is no study in cats yet, but our experience is that they are particularly helpful in "stressed" cats in which a BGC is impossible. More studies are needed to assess the accuracy of the FSL. However, we use the FSL extensively, with positive results. A video for placement of the sensor on a dog can be found here: https://www.youtube.com/watch?v=ytkcjpdxtKY

Note that the sensor used in this video is different than the 14 day sensor that we currently use. The 14 day sensor starts reading 1 hour after placement.

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LEPTOSPIROSIS

GEORGE E. MOORE, DVM, MS, PHD, DACVPM, DACVIM
College of Veterinary Medicine, Purdue University, West Lafayette, IN

In this VETgirl-Zoetis webinar entitled "Canine Leptospirosis," Dr. George Moore, DVM, MS, PhD, DACVPM, DACVIM reviewed all you need to know about canine leptospirosis. If you aren't testing your AKI injury patients for it, you're missing the diagnosis. If you missed the free webinar, you can view it HERE for a limited time.

KEY HIGHLIGHTS

Leptospirosis is found in more than 150 mammalian species, and therefore the risk of this disease to dogs or cats must be dependent on the prevalence of leptospirosis in these species and subsequent environmental exposure risk to dogs. With this information, the pertinent patient history question is not "Does your dog have potential exposure to rats or livestock?" but rather "Does your dog have potential exposure to raccoons, deer, or skunks (or specifically their urine) in your neighborhood or backyard?"

1 Approximately 10 years ago research at Purdue University found that leptospirosis cases were more likely to be dogs from suburban, or recently urbanized, areas than from rural settings. Wildlife studies at other universities indicate that population densities of peri-urban wildlife may be 8-12 times greater than in their rural counterparts due to increased availability of food and lack of predators, thus increasing disease exposure risk. A recent review of leptospirosis cases from the VMDB (Veterinary Medical Database) from university teaching hospitals over the last 40 years documents a change in the signalment in diagnosed cases, with dogs less than 15 pounds proportionately more likely to be diagnosed with the disease than dogs in other weight groups. These small dogs in our experience have not been vaccinated against leptospirosis, leaving them susceptible to infection.

2 Which serovars are important? The veterinary literature from the 1950s and 60s documented serosurveys of stray unvaccinated dogs in the US, and antibodies against *Leptospira* serovars Canicola and Icterohaemorrhagiae were most common in these dogs. Maintenance hosts for these two serovars are dogs and rats/rodents, respectively. Vaccines were therefore developed in the 1960s to protect dogs against these two serovars. From the mid-1970s to early 1990s, there were few published reports, in peer-reviewed literature, of canine leptospirosis in the US. Through the 1990s, case series reports of canine leptospirosis began to document (usually based on serology) canine infections caused by nonvaccinal serovars. Thus, in the face of possible protection against serovars Canicola and Icterohaemorrhagiae, clinical cases were increasingly attributed to serovars Pomona, Grippotyphosa, Bratislava, and Autumnalis. Serovars Pomona and Grippotyphosa have been recognized pathogens in livestock (cattle and pigs) although until the 1990s they were not pathogens of concern to dogs. They now appear to be established within reservoir wildlife species, e.g. raccoons. The other two serovars (Bratislava and Autumnalis) are documented pathogens on other continents.

(continued)

LEPTOSPIROSIS

GEORGE E. MOORE, DVM, MS, PHD, DACVPM, DACVIM
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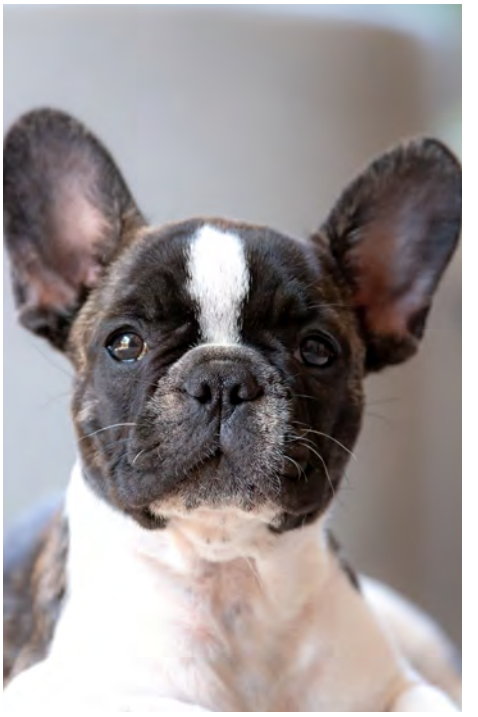
(cont)

Bratislava has been associated with clinical disease in pigs (in the US and Europe) and in horses (in Europe), but Autumnalis has not been isolated from livestock or companion animals in the US. Positive titers to Autumnalis should be interpreted as a cross-reaction from another serovar.

3 Clinical signs in dogs are usually attributable to localization of infection to the renal, hepatic, or vascular system. Clinical findings can be quite varied in severity, ranging from acute oliguric renal failure, renal and hepatic disease, fever of unknown origin (FUO), or even no clinical signs (asymptomatic). A general classification of the frequency of organ involvement in canine leptospirosis, based on clinical and diagnostic findings, is: renal only: 30-50%, renal and hepatic: 25-35%, hepatic only: 10-20%, and other (uveitis, myalgia, FUO): 5-10%. A recently published report also documented fatal septicemia-like disease in dogs less than 1 year old; these dogs died before a positive-MAT response but were positive for *Leptospira* on special stains of kidney tissue. Some serovars may be more likely to cause disease in certain organs, but there is not consistent evidence to support this perception.

4 Determination of the infective serovar and even clinical diagnosis is hindered by lack of a sensitive, specific, low-cost, rapid and widely available diagnostic test for leptospirosis. Most cases of leptospirosis are diagnosed by serology, and the reference method is the microscopic agglutination test (MAT). The MAT is difficult to standardize and requires live organisms for antigens. Cross-agglutination is also common. Despite these drawbacks, the MAT is still the diagnostic norm for many laboratories. Clinicians must presume that the serovar with the greatest antibody titer is the infective serovar, although paradoxical reactions to un-infective serovars have been noted. This is believed to occur most commonly early in infection, due to a non-specific IgM response; the MAT primarily measures IgM rather than IgG. Likewise, clinicians are in a quandary when 2 serovars have equal titers as dual infection is probably unlikely. The use of paired sera (2-4 weeks apart) is often required to confirm the diagnosis and clarify the infective serovar. Problematic however is the capability of leptospiral serovars to alter their outer membrane proteins. This is done in the natural host environment in order to reduce the host immune response to the invader. This transformational ability in laboratory-maintained serovars also could reduce the MAT correlation between laboratories and compared to the infective serovar.

5 Newer antibody-directed tests have been developed, including ELISA, immunoblot assay, a dipstick method, and a lateral flow assay. A new lateral flow assay (WITNESS® Lepto Antibody Test Kit by Zoetis), like some other new tests, is a semi-quantitative test using a color-change indicator for detecting a titer. These newer tests generally have higher sensitivity in detecting IgM in the first week of infection, but probably no difference by day 14. Advantage to the newer tests compared to MAT may be lower cost, more rapid test



results, and improved sensitivity early in infection; the disadvantages may include no numerical titer, no indication of infective serovar, and an increased risk of false-positive test results due to previous *Leptospira* exposures from environment or recent vaccination.

6 PCR of urine and/or blood is also used to diagnose leptospirosis before antibiotic administration (early in infection or hospitalization!), but its use and impact have raised new questions. Although PCR is increasingly available through many laboratories, controlled studies have not defined the correlation between PCR and MAT, using a true “gold standard” in a large number of cases.

(continued)

LEPTOSPIROSIS

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(cont)

One limitation of PCR-based diagnosis is the inability of most PCR assays to identify the infecting serovar. While this may not be important for individual patient management, serovar identify has important epidemiological and public health value. Not all PCR tests are performed with the same methodology, and sensitivity and specificity may vary. Generally PCR tests are highly sensitive. False negatives are considered uncommon, but can occur with low/zero levels of leptospiruria or leptospiremia. Certain methodologies however may be more prone to reductions in specificity, causing false positive test results. A comparison study of two PCR methods reported there were 0% false-positives in one method but the same samples had 13% false-positives via an alternative methodology. PCR positive results however do not necessarily mean there is viable organism.

7 Serological evidence in the US clearly supports the use of 4-serovar (Icterohaemorrhagiae, Canicola, Grippotyphosa, and Pomona) vaccines, rather than 2-serovar vaccines; and the 2017 AAHA Canine Vaccination Guidelines do not recommend the use of 2-serovar products. Leptospiral vaccines are generally considered serovar-specific, and cross-protection between serovars is not believed to occur. This concept is being challenged in some research, however, and cross-protection may occur between selected serovars. Recent research suggests that MAT seropositivity for serovars Autumnalis, Grippotyphosa, Bratislava, and Pomona are strongly correlated. Thus, there appears to be some molecular mimicry between these serovars. At Purdue, we have not documented a case of leptospirosis attributable to serovar Bratislava or Autumnalis in a dog properly vaccinated with a 4-serovar product, again suggesting some cross-protection may occur between some serovars.

8 All leptospiral vaccines are similar in that they are bacterins. Recombinant leptospirosis vaccines do not exist. Bacterins can vary in the quantity of whole inactivated bacteria or cell wall antigens present, or in quantity of vaccine excipients (such as bovine serum albumin) remaining from vaccine production. This variation in exogenous protein/antigen most likely explains the occurrence – or lack of occurrence – of allergic reactions following leptospirosis vaccination and observed differences in the rate of these reactions among vaccines by different manufacturers. Nevertheless, current vaccines are much improved in safety compared to the biologicals produced more than a decade ago.

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MONITORING THE IV FLUID THERAPY PATIENT

AMY NEWFIELD, CVT, VTS (ECC)

In the VETgirl veterinary technician learning track webinar, "Monitoring the IV Fluid Patient," Amy Newfield, CVT, VTS (ECC) reviewed appropriate monitoring of the IV fluid therapy patient.

KEY HIGHLIGHTS

Fluid therapy is perhaps one of the most common drugs we give in veterinary medicine. We often don't think about how it's not benign. We have to remember that any intravenous fluid is a drug and drugs, no matter the kind, are not benign. Being aware of common complications and how to monitor a patient on fluid therapy is the difference between life threatening complications and not.

Fluid therapy is generally indicated in most hospitalized patients, even those that are healthy and undergoing small minor procedures, like a laceration repair. There are certain conditions where aggressive fluid therapy or perhaps even no fluid therapy may be indicated. Contradictions for aggressive/no fluid therapy include: heart disease, pulmonary contusions/edema and brain injuries. In these patients if fluid therapy is necessary then it must be done so cautiously and patients must be monitored very closely.

1 FLUID OVERLOAD & DEHYDRATION

Patients should be constantly monitored for both fluid under-hydration and fluid over-hydration (dehydration and overload). While the later is more common, it is equally important to watch for excessive fluid losses or signs that dehydration may not be corrected in a timely fashion. It is important to alert the veterinarian in changes of a patient's status that result in fluid loss such as vomiting, diarrhea or reluctance to eat/drink. Dehydration signs include: tachycardia/bradycardia, dry mucous membranes, increase skin turgor, depressed mentation, sunken in eyes, hypotension. Fluid overload signs include: increased lung sounds, increased blood pressure, serous nasal discharge, pitting edema, chemosis (edema of the ocular conjunctiva). Using the below metrics to monitor how the patient is handling the fluids is key.

2 USE FLUID PUMPS

Because the calculation of fluid volume is somewhat subjective, potential inaccuracies can occur. Gravity fed systems are not ideal and should only be used if there is no fluid pump. This is because every time a patient moves the drip rate changes. Since it is generally impossible to get patients to stay completely still, the drip rate you initially calculated out will change, causing the patient to receive more or less fluids then the desired rate. Fluid administrative pumps should always be used to help avoid mistakes in fluid flow rates.

3 WEIGH YOUR PATIENT

Patients should be weighed at the beginning of treatment and then at least two times a day to determine fluid gains and losses. Rapid changes in body weight are usually a result of fluid gains or losses. A 0.5 kg weight gain is equivalent to a 0.5 liter fluid gain.

(continued)

MONITORING THE IV FLUID THERAPY PATIENT

AMY NEWFIELD, CVT, VTS (ECC)

(cont)

4 IS YOUR PATIENT URINATING?

Urine output should be monitored. In patients where kidney disease is suspected or patients that are down, urinary catheters should be placed to accurately account for urine production as well as to keep animals clean. In both dogs and cats 1-2ml/kg/hr of urine should be produced if the patient is not on fluids. If the patient is on fluids then the total volume you are giving into the patient should ideally be urinated out. If a cat is on 20ml/hr of fluids, it should urinate out about 20ml/hr. You can place non-absorbent litter boxes in cages with cats and quantify the urine; you can catch the urinations of canine patients in a bowl for quantification.

5 PHYSICAL EXAM

Patients receiving fluid therapy should be minimally given a full physical exam ever 4-6 hours. Mucous membrane color should be assessed. A pale or white color to the mucous membranes may indicate vasoconstriction and decrease perfusion, which generally indicates increasing fluid rates. This same color could also mean anemia where an increase in fluid rate is not necessarily indicated. Dark red or injected mucous membranes may indicate fever or sepsis, but may also indicate high blood pressure which can occur from fluid overload. Normally, blood will refill the capillary bed in 1-2 seconds. A slow return to color (>2 seconds) supports vasoconstriction which often occurs because of a decrease in effective circulating volume.

Increased heart rates (greater than 160bpm in the dog and greater than 220 bpm in the cat) generally occur from a compensatory response due to a decrease in cardiac output. In some cases, however, increase in heart rate can occur from fluid overload. Increases in heart rate can also occur from pain, fear, excitement, and tachyarrhythmias.

Palpating a pulse is not just to get a heart rate. It is important to feel a pulse to feel the overall stroke volume of the circulatory system. Feeling a moderate to strong pulse would be normal. Feeling a weak to thready pulse supports decreased stroke volume and peripheral vasoconstriction. Feeling a bounding and fast pulse supports circulatory overload, but may also occur during times of severe dehydration, hyperdynamic shock, anemia, etc.

The patient's temperature is also important. A decrease in temperature indicates peripheral vasoconstriction as is often the response to a decrease in circulating effective volume. Increases in temperature generally cause the fluid requirements for the patient to increase simply because more fluid loss is expected.

6 BLOODWORK

Packed cell volume (PCV) and total solids (TS) should be monitored once daily for patients receiving fluid therapy. In general, total solids that remain above 8.0 g/dl, dehydration should be suspected. Dehydration can also be suspected in patients with PCV about 45% in cats and 55% in dogs. Aggressive fluid therapy dilution can be seen in both the PCV and TS readings. A patient that came in with a PCV of 45% and a TS of 8.5 g/dl could have a PCV of 33% and a TS of 4.8 g/dl once hemodilute.

Lactate builds up the tissues and blood as a result of inadequate oxygen available to tissue which can be caused by tissue hypoperfusion somewhere in the patient. Increases in lactate can be seen because of shock, sepsis, renal failure, liver disease and even toxins. Lactate can be measured using a simple hand-held device similar to a blood glucose machine. Under a value of 2.5 mmol/L is normal. It is important to normalize lactate concentrations. In some cases, increases in lactate may be the only indication that hypoperfusion still exists. In several human studies, decreasing serum lactate levels during resuscitation was associated with improved survival. If lactate levels are elevated more aggressive fluid therapy is likely warranted.

7 BLOOD PRESSURE

Generally speaking, arterial hypotension, ideally assessed by the mean arterial pressure less than 60 mmHg or by a Doppler with a systolic less than 80 mmHg usually warrants more aggressive fluid therapy. Normalization of blood pressure (MAP 80-100 mmHg or systolic between 110-140 mmHg) is usually the goal of fluid therapy. If blood pressure is high then fluid overload may be considered.

8 CONCLUSION

It is important to understand how to appropriately monitor your patient. Monitoring all parameters provides a better picture of the patient's fluid therapy needs.

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STEVE MEHLER, DVM, DACVS
Chief Medical Officer Veterinarian Recommended Solutions

In this VETgirl webinar "The use and abuse of wound drains," Dr. Steve Mehler, DVM, DACVS reviewed all you need to know about surgical wound drains.

KEY HIGHLIGHTS

Surgical drains of various types have been used, with the best intentions, in different operations for many years and it is controversial whether they achieve their intended purpose. There is very little scientific evidence in human and veterinary surgery that demonstrates an absolute benefit of surgical drains but many veterinarians, the author included, continue to use drains in surgery. This lack of definitive evidence has not helped to resolve most of the controversial issues surrounding the use of surgical drainage.

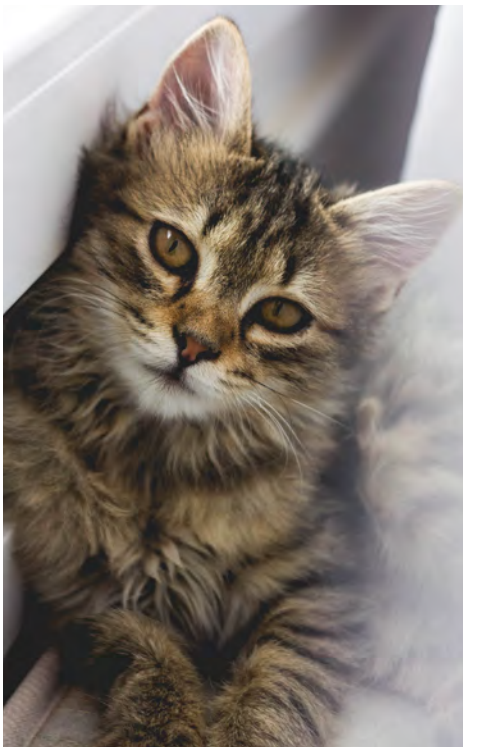
1 INDICATIONS FOR SURGICAL DRAINAGE

Surgical drains are used in a wide variety of procedures and the intention should be to decompress or drain fluid from the area of surgery. The single most important indication for surgical drain placement is to control dead space. Fluid accumulation in a wound or body cavity can lead to failure of the incision or repair, provides a nutrient source for bacteria and rapid colonization of tissues, prevents the ability of neutrophils to migrate into an infected area, can be a source of discomfort, and delays wound healing. The ultimate form of wound drainage is open wound management; however, it may not be the most practical, safe, and cost effective in some cases. Drains are not indicated to remove infected, devitalized and contaminated tissue and in fact, cannot do so. Drain materials of all types are considered a foreign body. Foreign body reaction in all tissues will decrease the amount of bacteria required to establish an infection and simultaneously induce regional tissue inflammation. This fact coincides with a contraindication of drain use in patients; drains should not be used in place of aggressive surgical debridement and lavage. Drains are to be used to control dead space and fluid accumulation in a wound or cavity after appropriate surgical management. Drains are also used in some cases as a diagnostic tool in order to assess local wound fluid production, record fluid volume and consistency, and perform cytology. The diagnostic utilization of drains is controversial because the presence of the drain alone will cause fluid production, inflammation to regional tissues, and failure of healing of the surgical site secondary to inflammation.

Drains should never be placed directly under an incision as the inherent inflammation they induce may negatively impact incisional healing. Drains should never exit or be in contact with haired skin and all drains should be protected by a bandage at all times.

2 CHARACTERIZATION OF A DRAIN

Drains can be characterized as open or closed. Open drains (corrugated and noncorrugated rubber, silicone, or plastic) ideally drain fluid on to a gauze pad or into a wound dressing, a



collection bag, or are left unprotected and exposed to the environment. They increase the risk of infection, especially when left exposed to the environment. Closed drains are formed by tubes draining into a bag or bottle helping to reduce the risk of infection.

Drains can also be classified as active or passive. Active drains are maintained under suction (low or high pressure). The drain can be attached to a suction source.

(continued)

THE USE AND ABUSE OF SURGICAL WOUND DRAINS

STEVE MEHLER, DVM, DACVS

(cont)

Some suction sources apply a fixed amount of pressure (grenades, bulbs, vacuum containers) or to a suction device in which a prescribed pressure can be selected. Active drain collection canisters usually lose their suction when are about 50% full. Drainage lines, if possible, and collection canisters should be completely replaced every 48-72 hours to reduce drain related infections. Active drains can be open or closed. Open active drains have an air vent into the wound (sump) but there is significant danger of retrograde contamination of the wounds through the vent. Passive drains have no suction and work according to the differential pressure between body cavities and the exterior environment or rely partially or exclusively on gravity to remove fluid from a wound or body cavity. The most commonly used passive drain in veterinary medicine is the Penrose drain and it should only be utilized to drain the subcutaneous space. Penrose drains are used exclusively in clean wounds and only when the exposed end can be covered at all times by a bandage. They should exit the skin at least 1 cm from the incision and be place at the most gravity dependant location.

Most commercial drains are made from silastic or rubber. Silastic drains are relatively inert and induce a less severe tissue reaction compared to rubber drains. Some forms of rubber, like red rubber drains, can induce an intense tissue reaction, and should be avoided.

3 REMOVAL

Generally, drains should be removed once the drainage has significantly decreased, ceased completely due to malfunction or blockage of the drain, or becomes less than about 1-2 mls/kg/day. Consider sedating the patient or providing analgesia as there may be some discomfort when the drain is pulled out. Place a dry dressing over the site where the drain was removed as temporary continued drainage is expected.

4 EVIDENCE AND CONTROVERSY

Despite the paucity of clinical evidence demonstrating any benefit supporting their use, drains continue to be placed frequently in wounds in dogs and cats. Drains must not be used as a substitute for aggressive surgical debridement. The only proven benefit of surgical drains is to remove fluid from a wound that otherwise would lead to complications associated with healing. In regards to active drains, a recent study concluded that closed active suction drains can be used with low risk of major complications, but they lead to a high rate of infection in clean surgeries in dogs. It is recommended that such drains are kept in place for the shortest time possible and that strict asepsis is adhered to both during placement and management.

In a recent study evaluating different types of active drains, the drainage systems varied widely in their initial suction and rate of loss of suction during filling. However, grenade-type compressible suction drains appear to perform in a safe, predictable, and consistent manner and operate with a lower amount of suction. An increased rate of wound infection or inflammation in association with the use of surgical drains has been documented in a prospective study of surgical site infection in dogs and cats. The use of active suction drains reduces surgical site infection, compared with the use of open passive drains. The constant negative pressure generated by the system minimizes the potential for retrograde flow of bacteria and fluid.

5 DISADVANTAGES OF DRAINS

Drains serve as a retrograde conduit for skin and environmental contaminants to enter the wound. All drain materials impair the local tissue environments resistance to bacterial colonization and infection by 10,000 fold. Drains made from latex or rubber incite more inflammation than those made of silicone.

6 NEGATIVE PRESSURE WOUND THERAPY (NPWT)

Vacuum assisted closure has been shown to be effective in the treatment of traumatic and chronic wounds. The therapy decreases interstitial edema, increase perfusion to the wound and periwound, and the mechanical strain on the fibroblasts appears to increase proliferation and collagen synthesis. Its use in veterinary medicine is extremely promising, with one of the advantages being prolonged time between dressing changes (up to 72 hours). This modality was evaluated in a controlled, experimental setting on open wounds as well as free skin grafts and demonstrating the beneficial and potentially negative effects of vacuum assisted closure.

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WITH VETGIRL COO, DR. GARRET PACHTINGER, DACVECC

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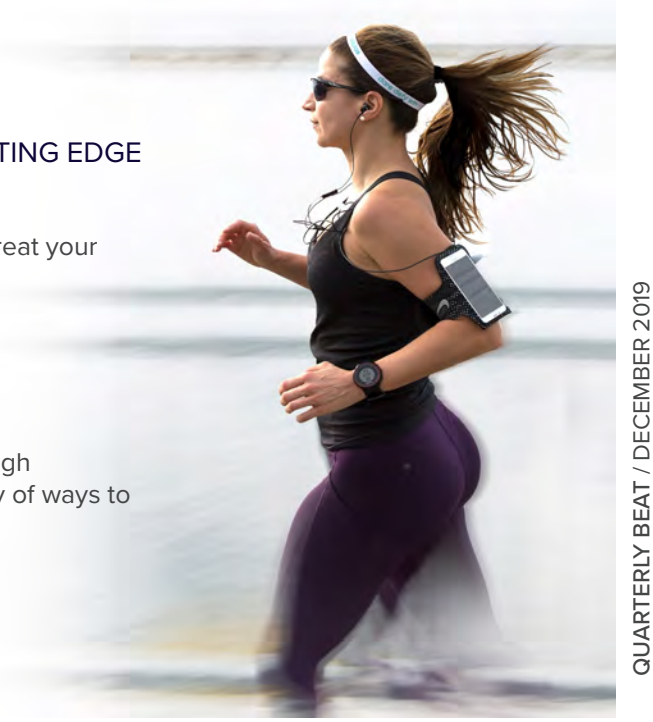

PROVIDER SPOTLIGHT //

AMY NEWFIELD, CVT, VTS (ECC)

VETGIRL'S TECHNICIAN CE COORDINATOR

Amy is currently employed with BluePearl Veterinary Partners as a Project Manager for Training and Team Development. After working in general practice for many years, Amy found her passion in emergency medicine. In 2003 she became a Veterinary Technician Specialist in Emergency and Critical Care. She has held several board positions in the Academy of Veterinary Emergency & Critical Care Technicians & Nurses including president. Amy is well published in over 15 subjects, is an international speaker, has received numerous awards including two speaker of the year awards and is highly involved in her community. She lives in Massachusetts with her wonderful furry kids where you can find her eating chocolate, running in the woods, competing in agility and diving in the ocean.

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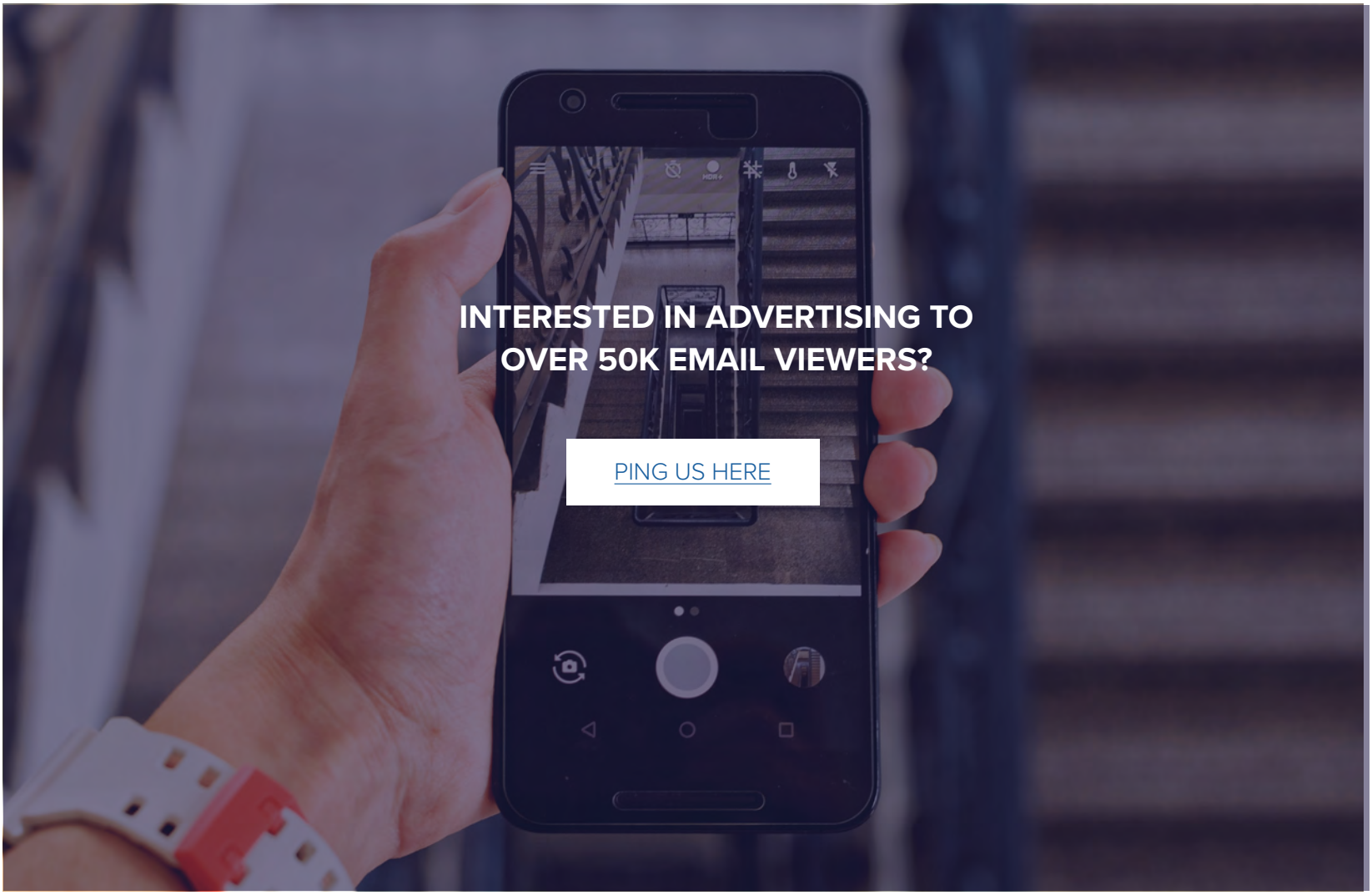

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NOTE: When in doubt, all drug dosages should be confirmed and cross-referenced with a reference guide such as Plumb's Veterinary Drug Handbook.