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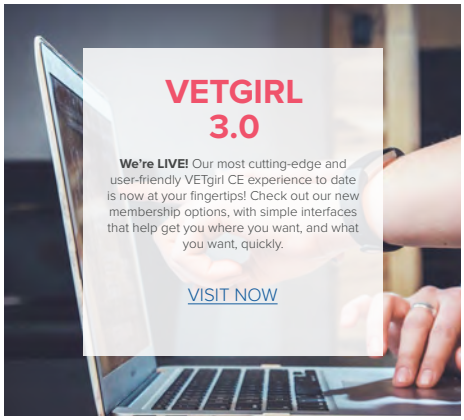

Because you deserve to eat a meal using silverware instead of tongue depressors.

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basic beef brisket

ingredients

Approximately 3 pounds 2nd cut brisket
salt, pepper and paprika, to taste
3 carrots, chopped
3 parsnips, peeled and chopped
1 rutabaga, peeled and chopped
A few mushrooms
  cleaned and left whole (more if you like them but don't skip if you don't!)
2 onions, quartered
6 cloves garlic
  peeled and lightly crushed
cooking oil

directions

1 Preheat oven to 300 °F.

2 Heat oil in a large pan and season both sides of brisket with salt, pepper and paprika. Sear until a nice crust forms.

3 Meanwhile, arrange ¾ of veggies in the bottom of a lidded roaster to form a bed for the brisket.

4 Transfer browned brisket to lidded roaster over the vegetables. Top with remaining ¼ of veggies. Deglaze pan and pour in with meat.

5 Bake, covered, in oven for 4-8 hours, checking occasionally to be sure there's still some liquid in the pan. Always better the next day, flipped and reheated. Should pull apart with just a fork.
Serve with your favorite potatoes and applesauce.

Submitted by Jessica Greenberg

INS AND OUTS OF FOAL FLUID THERAPY

PAMELA WILKINS, DVM, MS, PHD, DACVIM-LA, DACVECC
University of Illinois, Champaign-Urbana IL USA

In this VETgirl online large animal veterinary CE webinar, Dr. Pamela Wilkins, DVM, MS, PhD, DACVIM (Large Animal), DACVECC, reviewed fluid therapy in foals – what's new and should we still be reaching for crystalloids?

KEY HIGHLIGHTS

The clinician managing critically ill neonates must recognize that intravenous fluid therapy simply cannot be scaled down from adult management approaches. Fluid management of the ill neonate, particularly over the first few days of life, must take into consideration that the neonate is undergoing a large transition from the fetal to the neonatal state and that important physiologic changes are taking place. These transitions include shifts in renal handling of free water and sodium and increased insensible losses because of evaporation from the body surface area and the respiratory tract. The newborn kidney has a limited ability to excrete excess free water and sodium, and the barrier between the vascular and interstitial space is more porous than that of adults. Water and sodium overload, particularly in the first few days of life, can have disastrous long-term consequences for the neonate.

1 EXCESS FLUID ADMINSTRATION

In the ill equine neonate, excess fluid administration frequently manifests as generalized edema formation and excessive weight gain, frequently equivalent to the volume of excess fluid administered intravenously. In cases in which antidiuretic hormone secretion is inappropriate, as in some foals with PAS, generalized edema may not form, but the excess free water is maintained in the vascular space. This syndrome of inappropriate anti diuretic hormone secretion is recognized in the foal that gains excessive weight not manifested as edema generally, with decreased urine output and electrolyte abnormalities such as hyponatremia and hypochloremia. The foal manifests neurologic abnormalities associated with hyponatremia. The plasma or serum creatinine concentration varies in these cases, but urine always is concentrated compared with the normally dilute, copious amounts of urine produced by foals more than 24 hours of age on a milk diet. If measured, serum osmolarity is less than urine osmolarity. The treatment for this disorder is fluid restriction until weight loss occurs, electrolyte abnormalities normalize, and urine concentration decreases. If the clinician is unaware of this differential diagnosis, the neonate can be assumed mistakenly to be in renal failure, and the condition can be exacerbated by excessive intravenous fluid administration in an attempt to produce diuresis.

(continued)

INS AND OUTS OF FOAL FLUID THERAPY

PAMELA WILKINS, DVM, MS, PHD, DACVIM-LA, DACVECC
University of Illinois, Champaign-Urbana IL USA

(cont)

2 APPROPRIATE FLUID MANAGEMENT

The problem of appropriate fluid management in critically ill neonates has been recognized by medical physicians for years and has resulted in changes in fluid management of these patients. The approach taken has been one of fluid restriction, in particular sodium restriction but also free water restriction, and has resulted in improved outcome and fewer complications, such as patent ductus arteriosus and necrotizing enterocolitis. The calculations used for maintenance intravenous fluid support in these patients takes into consideration the ratio of surface area to volume and partially compensates for insensible water losses. Maintenance fluids are provided as 5% dextrose to limit sodium overload and provide sufficient free water to restore intracellular and interstitial requirements. The calculation for maintenance fluid administration is as follows:

First 10 kg body mass
100 ml/kg/day

Second 10 kg body mass
50 ml/kg/day

All additional kilograms of body mass
25 ml/kg/day

As an example, the average 50-kg foal would receive 1000 ml/day for the first 10 kg of body mass, 500 ml/day for the next 10 kg of body mass, and 750 ml/day for the remaining 30 kg of body mass for a total of 2250 ml/day. This translates to an hourly fluid rate of about 94 ml/hr.

3 ADJUSTMENT OF FLUIDS FOR ONGOING LOSSES

One should adjust the fluid and sodium requirements for ongoing losses exceeding the maintenance requirements. These losses can take the form of diarrheal losses and excessive urine output, such as those with glucose diuresis and renal damage resulting in an increased fractional excretion of sodium. The normal fractional excretion of sodium in neonatal foals is less than that of adult horses, usually less than 1% (J.E. Palmer, unpublished data). In the critically ill foal the sodium requirement can be met with as little as 140 mEq of sodium per day, less than administered in a single liter of normal equine plasma. One can address sodium deficits by separate infusion of sodium-containing fluids, although this may not be necessary if one considers the sodium being administered in other forms, including drugs administered as sodium salts and any constant rate infusions (pressors, inotropes, etc.) that are being provided as solutions made with 0.9% sodium chloride.

4 MONITORING DURING FLUID THERAPY

The author has used this approach to fluid therapy for the last few years and believes that the percentage of foals suffering from generalized edema - and related problems - has decreased. If one takes this approach to fluid therapy, one should take the weight of the patient once daily, or even twice daily, and monitor the fluid intake and output as closely as practical. One should evaluate any larger than anticipated weight gains or losses.

One should not expect urine output to approach the reported normal of 300 ml/hr for a 50-kg foal because the free water administered is limited, unless the patient is experiencing diuresis (glucosuria, resolution of the syndrome of inappropriate antidiuretic hormone secretion, resolution of previous edematous state, renal disease). One should obtain the urine specific gravity several times daily and should determine fractional excretion of sodium at regular intervals. If the volume of urine produced by the patient is measured accurately, one can determine sodium losses accurately and can obtain creatinine clearance values.

(continued)

INS AND OUTS OF FOAL FLUID THERAPY

PAMELA WILKINS, DVM, MS, PHD, DACVIM-LA, DACVECC
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(cont)

One should obtain blood pressure measurements at regular intervals throughout the day because hypotension can be a problem in these patients, particularly in septic foals and foals suffering from PAS, and one may need to increase fluid therapy to maintain adequate vascular volume. Patients with hypotension may need inotrope and pressor support.

5 PRESSOR AND INOTROPE THERAPY IN NEONATES

Inotrope and pressor therapy generally is restricted to referral centers where these drugs can be administered as constant rate infusions and blood pressure can be monitored closely. Blood pressure can be monitored directly or indirectly by the use of cuffs placed on the base of the tail. Both techniques have advantages and disadvantages. Although direct blood pressure measurements are considered the gold standard and are generally more accurate, the difficulty in placing and maintaining arterial catheters and lines in these patients severely restricts the utility of this method. Indirect techniques can be inaccurate and are affected by cuff size and placement. However, indirect techniques are easier to use in the NICU and can be useful if trained staff are using the equipment. Once the appropriate cuff size has been identified, that cuff should be dedicated to that patient for the duration of the hospitalization to decrease variability caused by using different cuffs. One should monitor the blood pressure of all recumbent patients at regular intervals, and trends upward or downward should prompt the clinician to make necessary adjustments.

Foals suffering from PAS and sepsis are the patients most at risk for significant hypotension and perfusion abnormalities. Perfusion is maintained by supporting cardiac output and blood pressure with judicious use of intravenous fluid support and inotrope/pressor support. The author does not aim for any specific target systolic, mean, or diastolic pressure. Instead the author monitors urine output, mentation, limb perfusion, gastrointestinal function, and respiratory function as indicators that perfusion is acceptable. For NICU patients to require inotrope and pressor therapy is not unusual, but in some cases hypoxic and septic damage is sufficiently severe to blunt the response of the patient to the drugs. One must approach each patient as an individual, and no single inotrope/pressor protocol will suffice for all patients.

DOBUTAMINE

Dobutamine is an adrenergic inotrope that is frequently used as first choice therapy in NICU patients. Its effects are best used in the foal at the lower dose range. Neonates have a limited ability to increase stroke volume in an effort to maintain cardiac output, and one may observe tachycardia in these patients as heart rate increases to maintain cardiac output and vascular pressure.

(continued)

INS AND OUTS OF FOAL FLUID THERAPY

PAMELA WILKINS, DVM, MS, PHD, DACVIM-LA, DACVECC
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(cont)

Dobutamine is useful after patients are volume replete for support of cardiac output. The dose range is between 2 to 20 ug/kg/min, provided as a constant rate infusion, with best results generally obtained between 2 and 5 ug/kg/min. If larger doses are needed, a better approach might be to add a pressor to the treatment plan.

DOPAMINE

Dopamine has dopaminergic activity at low doses, β1 and β2 activity at moderate doses, and β1 activity at high doses. Dopamine causes norepinephrine release, which has led to the suggestion that this is its major mode of action at higher doses. At doses greater than 20 ug/kg/min, intrapulmonary shunting, pulmonary venous vasoconstriction, and reduced splanchic perfusion may occur. Dopamine also produces natriuresis at lower doses through a direct effect on renal tubules. For these reasons, dopamine has fallen out of favor in human critical care and at many veterinary referral institutions.

NOREPINEPHRINE

Norepinephrine has α1 and β1 activity but variable β2 activity, resulting in potent vasopressor effects; it has inotropic and chronotropic effects, but its chronotropic effect usually is blunted by vagal reflexes slowing the heart rate induced by the increase in blood pressure. In many critical care units, norepinephrine has become a pressor of choice and frequently is used along with dobutamine. Evidence suggests that splanchic perfusion is maintained better with norepinephrine than with some other pressors and norepinephrine is frequently paired with dobutamine. The dose range is 0.2 to 2.0 ug/kg/min, although larger doses have been used when necessary in certain patients.

EPINEPHRINE

Epinephrine has α1, α2, β1, and β2 activity; activity predominates and results in increased cardiac output and decreased peripheral resistance at low doses. Epinephrine has been associated with hyperglycemia, hypokalemia, lipolysis, increased lactate concentration, and increased platelet aggregation. The effect on renal function is controversial. Use of epinephrine usually is limited to those patients not responding to other pressors.

VASOPRESSIN

Vasopressin (antidiuretic hormone) is a pressor gaining a great deal of attention in the critical care literature. Vasopressin appears to be depleted from the neurohypophysis in septic shock, and short-term administration of vasopressin spares conventional vasopressor use, in addition to improving some measures of renal function. Low-dose vasopressin infusion (0.5-2.0 mU/kg/min) increases mean arterial pressure, systemic vascular resistance, and urine output in patients with vasodilatory septic shock that are hyporesponsive to catecholamines. These data indicate that low-dose vasopressin infusions may be useful in treating hypotension in patients with septic shock.

LEARN MORE

TOP 10 TIPS TO EVALUATE ANEMIA IN SMALL ANIMAL PATIENTS

GARRET PACHTINGER, VMD, DACVECC
Chief Operating Officer, Co-Founder VETgirl

KEY HIGHLIGHTS

1 As simple as it gets, anemia can be classified into three categories:

- Blood loss
- Hemolysis (destruction)
- Decreased production

Classification into one of these three categories is not simply academic, rather it allows the clinician to form a more targeted differential list for both the diagnostic workup and communication with the client.

2 Although fancy and more expensive diagnostics exist, one cannot ignore the cost-effective practicality of a simple packed cell volume (PCV) and total solids (TS) to evaluate anemia.

For example, if the PCV and TS are both low, acute blood loss should be suspected. In contrast, a low PCV with normal total solids would be consistent with hemolysis or decreased red blood cell production. Here is a chart with a few examples of how PCV and TP together can help direct your diagnosis and treatment plan:

PACKED CELL VOLUME AND TOTAL SOLIDS

⬆PCV / ⬆TP	⬇ PCV / Normal TP	⬇ PCV / ⬇ TP	Normal PCV / ⬇ TP

Hemoconcentration	• Hemolytic anemia
	• Anemia of chronic disease
	• Pure red blood cell aplasia
		• Blood loss
		  • GI
		  • Body cavity (abdominal, thoracic, etc.)
			• Protein-losing enteropathy (PLE)
			• Protein-losing nephropathy (PLN)
			• Acute blood loss
			• Liver disease / failure

3 Don't forget a blood smear! If the blood smear shows polychromasia and anisocytosis, this often indicates a regenerative response. Conversely, the lack of those cells may indicate a non-regenerative response. A blood smear can also help evaluate WBC morphology and an estimated platelet count.

(continued)

TOP 10 TIPS TO EVALUATE ANEMIA IN SMALL ANIMAL PATIENTS

GARRET PACHTINGER, VMD, DACVECC
Chief Operating Officer, Co-Founder VETgirl

(cont)

4 A slide agglutination test is another cost-effective test you should have in your anemia "toolbox." Especially if hemolysis is suspected (low PCV, normal TP, icteric serum/patient). To perform a slide agglutination, a drop of anticoagulated blood from a purple top tube or capillary tube is mixed with a drop of 0.9% NaCl.

5 Don't forget to simply look at your patient! Ask yourself, "does the patient look way better than you would expect with a PCV that low?" Simply put, clinical signs vary depending on severity and acute or chronic occurrence of the anemia. If the patient has a PCV of 12 and is happy, BAR, grooming, eating...then you are likely dealing with a more chronic and non-regenerative anemia!

6 A regenerative response is not immediate. It takes up to 3 days after the anemia develops for the bone marrow to respond. A reticulocyte count > 80 × 10^9/l is indicative of regeneration.

7 Heinz-body anemia commonly occurs secondary to toxin exposure including zinc, garlic, onion, or acetaminophen. Zinc is the main metal component of pennies, not copper and any patient showing a Heinz-body anemia should be evaluated for penny ingestion.

8 There is no specific number in which every patient should receive a red blood cell transfusion for anemia. Simply put, there is no "transfusion trigger." Each patient must be assessed individually for factors that would warrant a transfusion including hemoglobin concentration, hematocrit, CvO2, lactate concentration, lactate, blood pressure, heart rate, pulse quality, etc.

9 Blood transfusion therapy is not without risk. Although most are familiar with more subtle transfusion reactions (e.g. transient pyrexia, hemolysis, transfusion-associated circulatory overload (TACO), facial edema, vomiting), TRALI, defined as transfusion-related acute lung injury, is another concern. TRALI is defined as new acute lung injury that occurs within 6 hours of transfusion of one or more blood products resulting in hypoxemia and non-cardiogenic pulmonary edema.

10 Don't forget the importance of fluid therapy. Intravenous fluid support will provide improved circulation of the red blood cells that remain. If fluid therapy alone does not improve tissue oxygenation and clinical signs, a blood transfusion should be considered.

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REGISTRATION OPEN NOW

ORAL EXAMINATION AND CHARTING

MARY L. BERG, BS, LATG, RVT, VTS (DENTISTRY)
Beyond the Crown Veterinary Education

In the VETgirl veterinary technician learning track webinar, Mary Berg, BS, LATG, RVT, VTS (Dentistry) reviewed oral examination and charting.

KEY HIGHLIGHTS

Why is dental charting important? A dental chart is a diagrammatic representation of the dentition where information can be entered in a pictorial and/or notation format. It allows you to keep a record of the patient's oral health, track changes in oral health and record treatment. A dental chart is also a legal document.

In order to ensure efficient record keeping, the dental chart should include a chart with a key, brief descriptions to clarify disease and treatments, the procedure performed, therapeutic plan, prognosis and photographs. These can be in either fill in or check off format. The chart needs to have basic vital information that is similar to the items needed in all veterinary records. There are commercially available dental charts but you can develop your own.

IMPORTANT TERMS

Occlusion
the way teeth fit together

Furcation
area where roots join

Recession
loss of gingival tissue

Inflammation
swelling, redness, infection

Pocket
the pathological area between gingiva and tooth surface

Hyperplasia
excessive gingival tissue

Supernumerary
too many teeth

Mobility
tooth moves

1 ORAL EXAMINATION

An oral examination on a conscious patient is important but often limited to a visual inspection and digital palpation. The examination involves more than just the oral cavity. Palpation of the facial bones and zygomatic arch, temporomandibular joint, salivary glands, and lymph nodes are also important. Dental occlusion should also be evaluated. This can be done by gently retracting the lips to look at the soft tissue, the bite and the buccal aspects of the teeth.

Once the animal is anesthetized, a thorough oral examination can be completed. All the structures of the oral cavity must be evaluated to include the oropharynx, lips, and cheeks, mucous membranes, hard palate, the floor of the mouth and tongue as well as the teeth. The periodontium (gingiva, periodontal ligament, cementum, and alveolar bone) of each tooth needs to be evaluated. In animals with large amounts of calculus on the teeth, it may be necessary to remove these deposits to access the periodontium accurately. The use of a calculus removal forceps is a recommended method to remove supragingival calculus. Use care when using this instrument to ensure that the gingiva and tooth crown are not damaged.

When evaluating the periodontium, a periodontal probe, a dental explorer and a dental mirror are used. The following indices should be evaluated for each tooth; gingivitis, periodontal probe depth, gingival recession, furcation involvement, mobility and periodontal attachment levels.

The amount of plaque observed on the teeth prior to cleaning should be recorded.

(continued)

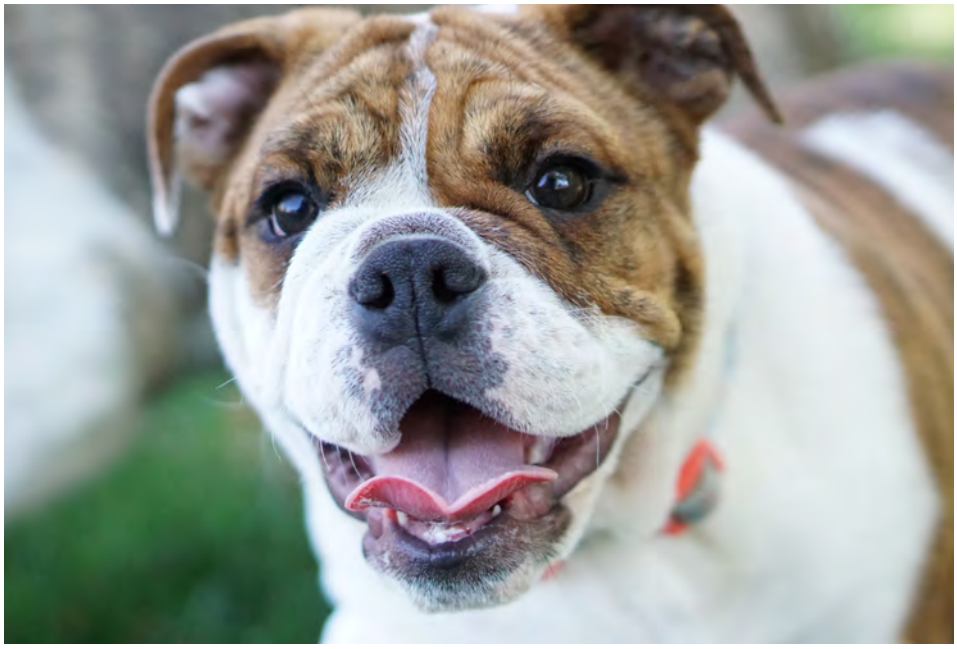
ORAL EXAMINATION AND CHARTING

MARY L. BERG, BS, LATG, RVT, VTS (DENTISTRY)
Beyond the Crown Veterinary Education

(cont)

Because plaque is the soft, gelatinous matrix of bacteria and bacterial by-products that lead to gingival irritation and gingivitis, it may be necessary to use a disclosing agent to visualize.

Calculus (tartar) is calcified plaque. The amount of calculus should be recorded as light, moderate, or heavy. Calculus can only be removed by either hand scaling or power scalers.



2 GINGIVITIS INDEX (GI)

The gingival index (GI) is a measurement of gingival health. The assessments of gingival changes are scored using the following criteria with each tooth given the most severe score.

0 **normal healthy gingiva**

1 **moderate inflammation**
moderate redness, not bleeding on probing, edema

2 **moderate inflammation**
moderate to severe redness, edema, bleeding upon probing

3 **severe inflammation**
severe redness, edema, ulceration, spontaneous bleeding

3 PROBE DEPTH (PD)

Probe depth (PD) is a measure of the depth the periodontal pockets often found in periodontal disease. The probe depth is measured at multiple sites of the tooth. A periodontal probe with millimeter markings is gently placed between the free gingiva and the tooth surface and carefully advanced until soft tissue resistance is felt. The tip of the probe should be parallel to the long axis of the tooth. The pocket depth is recorded as the distance in mm from the free gingival margin to the bottom of the pocket. The probe may be glided or walked along the tooth to measure the varying pocket depths. A normal gingival sulcus depth is 1-3 mm in dogs and 0.5 to 1mm in cats. Measurements in excess of these values should be recorded in the appropriate location on the dental chart.

4 GINGIVAL RECESSION (GR)

Gingival recession is also measured with the periodontal probe. It is the distance from the cementoenamel junction to the margin of the free gingiva. At sites with gingival recession, the probe depth may be normal despite the loss of alveolar bone.

5 FURCATION INDEX (FI)

The furcation index (FI) measures the loss of bone support in multi-rooted teeth. A periodontal probe is placed perpendicular to the long axis of the tooth and slid along the free marginal groove to the furcation site. The following criteria are used to assign a numerical score.

1 no loss of bone support

2 horizontal loss of supporting tissues not exceeding one-third of the width of the tooth

3 horizontal loss of supporting tissues exceeding one-third of the width of the tooth but not encompassing the total width of the furcation area.

4 horizontal through and through loss of supporting tissue.

(continued)

ORAL EXAMINATION AND CHARTING

MARY L. BERG, BS, LATG, RVT, VTS (DENTISTRY)
Beyond the Crown Veterinary Education

(cont)

6 MOBILITY INDEX (MI)

The mobility index (MI) measures the loss of bone support by indicating the amount of movement of the tooth. The length of the periodontal probe is placed on the buccal surface of the crown of the tooth and gentle pressure is applied to the tooth. The following criteria are used to assign a numerical score.

1	no mobility
2	perceptible mobility but less than 1 mm buccolingually
3	definite mobility between 1-2 mm
4	gross mobility exceeding 2 mm buccolingually and/or vertical mobility

7 PERIODONTAL ATTACHMENT LEVEL (PAL)

In the PAL, the pocket depth is measured from the base of the pocket to the cementoenamel junction. This is a more accurate assessment of bone loss in periodontitis. PAL can be directly measured, or it can be calculated as the sum of PD plus GR.

8 FURCATION EXPOSURE

In multi-rooted teeth, the area where the roots meet is referred to as the furcation. The bone loss caused by the periodontal disease often affects this area early in the disease process. The presence of furcation involvement should be evaluated and recorded as Grade 0 – 3 depending upon the amount of involvement.

9 STAGE OF PERIODONTAL DISEASE

The stages of periodontal disease can be used to help price your periodontal therapies but also need to be recorded so that the progression of the disease can be determined. These stages are determined by either measuring clinical attachment level or radiographically.

Stage 1 - Gingivitis only with attachment loss.

Stage 2 - Less than 25% attachment loss. Grade 1 furcations present.

Stage 3 - 25 to 50% attachment loss. Grade 2 furcations present

Stage 4 - Over 50% attachment loss. Grade 3 furcations present.

10 ORAL MASSES

Oral masses need to be drawn onto the chart and noted. This includes epuli and gingival hyperplasia. This is important to note these in order to have a record of the mass and be able to note changes in future examinations as well as gingivectomies (the removal of excess gingival tissues).

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MANAGEMENT OF NON-HEALING CORNEAL ULCERS

DR. SHELBY REINSTEIN, DACVO
Veterinary Specialty & Emergency Center, Levittown, PA

In the VETgirl Real-Life Rounds webinar, "What's the deal, it just won't heal: Management of non-healing corneal ulcers," Dr. Shelby Reinstein, DVM, DACVO reviewed non-healing corneal ulcers.

KEY HIGHLIGHTS

Refractory Corneal Ulcers
Refractory corneal ulcers are superficial ulcerations that are not progressive but yet, also fail to heal within 5-7 days. The most common type of refractory corneal ulcers in dogs is a chronic corneal epithelial defect (CCED), otherwise known as an indolent ulcer. CCEDs are due to a failure of the epithelial cells to develop normal attachments to the underlying basement membrane. Any condition that interferes with normal epithelialization or epithelial cell adhesion can result in a CCED.

1 CAUSES OF REFRACTORY CORNEAL ULCERS

The first step in the management of a refractory corneal ulcer is to determine the underlying etiology. A thorough physical and ophthalmic examination is essential to identify factors that could be contributing to the refractive healing state. Refractory corneal ulcers can be caused by primary corneal disease or secondary to other processes. Eyelid abnormalities are quite common and may lead to a non-healing corneal ulcer. Specifically, persistent corneal trauma from distichia, ectopic cilia, entropion, or eyelid masses will interfere with normal cellular healing. Abnormalities that preclude normal blinking can predispose to refractory ulceration; lagophthalmos (incomplete blinking) may be associated with poor eyelid conformation, buphthalmos, exophthalmos, or cranial nerve deficits. Keratoconjunctivitis sicca (KCS, dry eye) is exceedingly common in dogs, and both quantitative and qualitative tear film abnormalities will interfere with normal corneal healing and result in a refractory corneal ulcer. A variety of primary corneal diseases will prevent or delay normal cell healing. Lipid, cholesterol, or calcium deposition in the cornea will inhibit the formation of strong cellular attachments. Corneal edema can lead to the formation of bullae, or fluid pockets, in the anterior corneal stroma. These areas are predisposed to ulceration that is often refractory in nature. The excessive stromal fluid inhibits normal epithelial cell attachment to the underlying stroma. Finally, superficial refractory ulceration that has no discernable underlying cause is known as spontaneous chronic corneal epithelial defects, or SCCEDs ("Boxer ulcers", indolent ulcers).

2 SUPERFICIAL CHRONIC CORNEAL EPITHELIAL DEFECTS (SCCEDS)

The boxer is the most common breed to develop SCCEDs, comprising approximately 25% of cases. Other breeds that have been reported to have an increased incidence of SCCEDs include poodle and poodle crosses, Welsh Corgis, Labrador retrievers, and German Shepherds and their crosses. The average age of dogs affected with SCCEDs is 7-9 years with no dramatic sex predilection.

SCCEDs are often easily diagnosed by recognizing the typical clinical appearance of a superficial ulcer with a non-adherent epithelial border. Fluorescein stain can be classically seen diffusing under this loose lip of epithelial cells and appears as a less intense ring of stain uptake. SCCEDs are most often located in the axial or paraxial cornea and are vascularized approximately 60% of the time. Without proper treatment, SCCEDs may persist for months to even years with an average time to referral of 7.5 weeks.

(continued)

MANAGEMENT OF NON-HEALING CORNEAL ULCERS

DR. SHELBY REINSTEIN, DACVO
Veterinary Specialty & Emergency Center, Levittown, PA

(cont)

Normal corneal wound healing is accomplished via epithelial cell migration to cover the exposed stroma, followed by epithelial cell proliferation to restore the normal thickness of the epithelial layer. The epithelial cells develop firm attachments to the anterior corneal stroma via adhesion complexes. SCCEDs develop when the formation of these epithelial-stromal adhesions is inhibited. Thus, SCCEDs ulcers are often noted to epithelialize normally, however this newly formed epithelium is easily denuded contributing to the refractory nature of healing. SCCEDs have been studied histologically and multiple hallmark alterations in the normal healing process have been described. In almost all SCCEDs samples, the epithelial cells adjacent to the ulcer are poorly attached to the underlying stroma. Finally, there is formation of an acellular, hyalinized zone, which covers the exposed corneal stroma. This abnormal zone is now considered to contribute significantly to the pathophysiology of SCCEDs, as it interferes with the formation of strong epithelial-stromal adhesion complexes.

3 TREATMENT OF REFRACTORY CORNEAL ULCERS

Superficial corneal ulcerations are quite painful, as the corneal nerve density is greatest in this region. Despite the underlying cause, refractory corneal ulcers should be treated with topical prophylactic antibiotic therapy (every 8-12 hours), and a topical cycloplegic (e.g. atropine). Oral non-steroidal anti-inflammatories or additional pain medications are beneficial in controlling the discomfort, and a hard, plastic E-collar is necessary to prevent self-trauma. As previously discussed, refractory corneal ulcers have a variety of causes, and all efforts should be made to identify and treat any predisposing conditions.

4 TREATMENT OF SUPERFICIAL CHRONIC CORNEAL EPITHELIAL DEFECTS

Both medical and surgical methods for the treatment SCCEDs have been described. The foundation and crucial first step in all successful SCCEDs treatment modalities is epithelial debridement. Using a sterile cotton-tipped applicator to remove the loose epithelium can be safely performed after application of topical anesthetic. Normal epithelium is quite firmly adhered, and thus will not be removed with gentle debridement. Epithelial debridement on its own has a reported success rate of about 50%. Techniques that aim to remove or disrupt the acellular, hyalinized superficial stromal zone have improved published success rates over epithelial debridement alone.

The most recently reported therapy for SCCEDs is diamond burr debridement (DBD). DBD is performed using a handheld, battery powered polishing burr and has been described in human ophthalmology for the treatment of superficial, refractory ulcerations. The DBD technique was investigated histologically in dogs and shown to safely remove the epithelial basement membrane (and presumably the stromal hyalinized zone) without penetrating deeper into the corneal stroma. Recently, the DBD technique in conjunction with bandage contact lens (BCL) placement was evaluated in a clinical setting in dogs with a success rate of 92.5% after a single treatment. Minimal complications were noted, and 95% of dogs retained the contact lens during the study. The BCL is thought to improve healing by protecting the migrating epithelial cells, as well as improve patient comfort by covering the exposed corneal nerves. Overall, DBD is considered advantageous due to the minimal cost, lack of specialized equipment needed, ease of the procedure, and little adverse effects.

In clinical practice, the author treats SCCEDs in dogs with epithelial debridement, DBD, BCL placement, and oral doxycycline in addition to the standard topical antibiotic, and often oral NSAIDs therapy as for any corneal ulcer. Tetracyclines are known to modulate the expression of certain growth factors involved in corneal wound healing, and dogs that were treated with either topical oxytetracycline ophthalmic ointment or oral doxycycline healed faster than the control group. Anecdotally, a success rate of 90-95% is seen in the author's practice, with an approximate 30% BCL retention rate.

LEARN MORE

MEDICAL CANNABINOIDS: A REVIEW

STEPHEN CITAL RVT, SRA, RLAT, VCC, CVPP, VTS-LAM
Director of Education and Development, ElleVet Sciences, Portland ME

In the VETgirl Real-Life Rounds webinar, "Medical Cannabinoids: A Review," Stephen Cital RVT, reviewed the use of cannabinoids in veterinary medicine. What do practitioners need to know?

KEY HIGHLIGHTS

The endocannabinoid system (ECS) has been evolving since the beginning of vertebrate species, but why did veterinary practitioners never learn about it in school? Just like our human counterparts', veterinary practitioners have no or only a cursory understanding of the ECS and cannabis therapy. Veterinary practitioners have also been echoing that there "is no evidence" in animals. To the contrary, we have numerous studies utilizing cannabinoids and other cannabis molecules for therapeutic relief and translational studies that could be considered for any vertebrate creature. We have hundreds, if not thousands, of articles in laboratory animal species, which technically includes dogs and cats, verifying the safety of cannabinoids at extremely high doses and therapeutic potential for numerous conditions. Here we review the current and pertinent literature in utilizing cannabis derivatives in animals and discuss the future forecast of cannabis in veterinary medicine.

1 THC TOXICITY

The use and demand for cannabis products in veterinary medicine is growing rapidly, mainly by pet owner demand. Unfortunately, it is growing faster than most practitioners have the time to educate themselves about it. Another confounding factor feeding a negative bias in veterinary medicine is the all too often tetrahydrocannabinol (THC) toxicity in companion animals. Since the legalization of medical marijuana in the United States began, Animal Poison Control Centers have seen a 330% increase in THC toxicities. It should be noted there are no reported deaths that can be definitively attributed to THC or other phytocannabinoids without other factoring chemicals also present in the system. The suspected lethal dose of THC in dogs is >9 g/kg, a nearly impossible dose to achieve. The most common route of exposure to THC in companion animals is via ingestion. Approximately 66% of exposures involve pets ingesting homemade or commercial edible goods. The second most common source of cannabis exposures involves ingestion of plant material, followed by cannabis oils or tinctures. Symptoms of THC toxicity include lethargy, central nervous system depression, ataxia, vomiting, urinary incontinence or dribbling, increased sensitivity to motion or sound, dilated pupils, hypersalivation, and bradycardia. Less common symptoms include aggression, agitation, low blood pressure, low respiratory rates, elevated heart rates, and nystagmus (continuous abnormal movements of the eyes). Rare signs include seizures or comatose conditions. A 2018 study investigating the susceptibility of cannabis-induced convulsions in rats and dogs, reported no seizures in dogs.

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But central nervous system signs including ataxia, tremors, and hypoactivity were observed when dogs were given chronic daily oral doses of cannabis extracts containing concentrations as high as 27 mg/kg THC combined with 25 mg/kg cannabidiol (CBD) (1.08:1 ratio of THC to CBD) for 56 weeks. Interestingly, GW also did a long-term study in dogs for 39 weeks with a CBD isolate at 100mg/mg with some minor concern of liver distress. While 100mg/kg is an unrealistic dose we'd ever give our patients, it does highlight the potential of adverse effects. More recently, we have a 12-week study published showing the safety of using a hemp CBD product from ElleVet Sciences in healthy dogs and cats. The study concluded that at a dose of 2mg/kg, PO, BID animals can safely tolerate longer term dosing with minimal to no side-effects.

2 MARIJUANA VS. HEMP PLANTS

There are some fundamental distinctions one must make on the topic of medical cannabis, and even specific terminology used when approaching medical cannabis as a valid medical therapy. The first distinction is between a "marijuana" plant versus a "hemp" plant. The hemp plant has much lower levels of THC (less than 0.3% by dry weight) and has found favor among veterinary professionals since there is a reduced risk of THC toxicity. This distinction is particularly important for recommendations made by veterinary professionals. At the time this article was written there were no states that allow for medical marijuana prescriptions for veterinary use, with many states also denying veterinarians the ability to even "recommend" an over the counter hemp-based product. California was the first state to pass legislation at the end of 2018 with AB2215 that allows veterinarians to discuss cannabis (Marijuana specifically) as a therapeutic option, but the legislation still prohibits veterinarians from prescribing, dispensing, or recommending marijuana to animals. Currently hemp remains a legal OTC product for consumers to purchase without the recommendation of a DVM in a majority of states.

3 VETERINARY CANNABIS STUDIES

To date, we have an ever-growing list of relevant studies for practical use of cannabis in companion animals. Most notably, we now have the results from four studies, two conducted at Colorado State University (CSU) and two from Cornell University, to help shed light on effective and safe dosing of CBD dominant cannabis products in dogs. In the Colorado State University study, conducted by Dr. Stephanie McGrath, we see dogs given three different dosing strategies. A group of 30 healthy beagle dogs were randomly assigned to receive a cannabidiol dominant product in the form of a capsule, oil, and CBD transdermal cream at a dose of 10 mg/kg/day or 20 mg/kg/day for 6 weeks. In the study, the dogs had complete blood counts, chemistry panels, urinalysis, and bile acids performed at 0, 2, 4, and 6 weeks. The most notable effect was elevations in serum alkaline phosphatase (ALP) that occurred in some dogs. All of the dogs in the study also experienced diarrhea, while the dogs that received the transdermal formula had reddened skin after application that was not of clinical concern. Because the products used in the study were plant-based, the variability between batches were measured. The study concluded that this particular CBD dominant product, with limited terpenes, appeared to be well tolerated in dogs.

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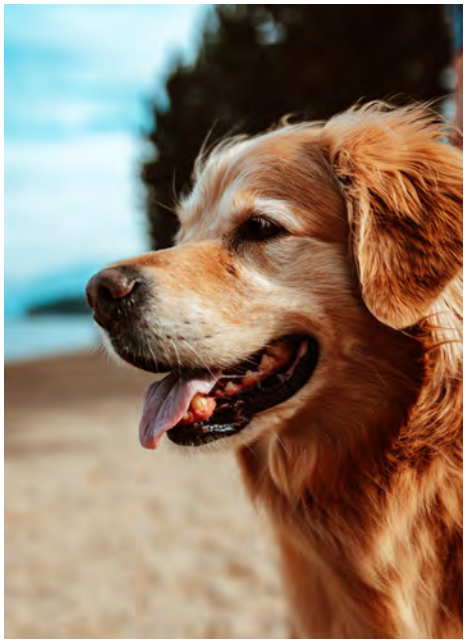
4 CBD STUDIES FOR OSTEOARTHRITIS (OA) AND CANINE EPILEPSY

Also, at CSU there are two continuing studies: one on osteoarthritis (OA) and the other with a longer-term study focused on the utility for canine epilepsy. The pilot study for epilepsy published in the summer of 2019 used a 5 mg/kg daily dose for 6 weeks. More subjective clinical differences were seen between the placebo group and treatment group using a product form Applied Basic Sciences. However, these differences were not of statistical difference from the placebo group in the conclusion. The author suspects the dose in this study is too low compared to human extrapolation of dosing. A long-term study over three years will follow with higher dosing. A similar study is also being conducted at the University of Florida with ElleVet Sciences product.

In a canine study conducted at Cornell University under the direction of Dr. Joseph Wakshlag, we see similar, yet more favorable results with no diarrhea, utilizing a product made by ElleVet Sciences. A single dose pharmacokinetic study was performed using two different doses of CBD enriched oil. The industrial hemp used in this study has ~10 mg/mL CBD and an equal mix of ~10 mg/mL cannabidiolic acid (CBDA), 0.24 mg/mL THC, 0.27 mg/mL cannabichromene (CBC), and 0.11 mg/mL cannabigerol (CBG). All other cannabinoids were less than 0.01 mg/mL with a robust terpene profile. The initial investigation into single-dose oral pharmacokinetics was performed with four beagles. Each dog received a 2 mg/kg and an 8 mg/kg oral dosage of CBD oil. The dogs were fed 2 h after dosing. Blood was collected at 0, 0.5, 1, 2, 4, 8, 12, and 24 h after oil administration. Pharmacokinetics demonstrated that CBD half-life of elimination median was 4.2 h (3.8–6.8 h) for the 2 mg/kg dose, and 4.2 h (3.8–4.8 h) for the 8 mg/kg dose. These results led to dosing during the clinical trial at 2 mg/kg body weight every 12 h. For the clinical efficacy study, which assessed the use for dogs with radiographically confirmed OA, a randomized placebo-controlled, veterinarian and owner blinded, cross-over study was used. Dogs received CBD oil (2 mg/kg) or placebo oil every 12 h. Hematology, serum chemistry, and physical examinations were performed on every visit. A canine brief pain inventory and Hudson activity scores showed a significant decrease in pain and an increase in activity with CBD oil. Veterinary assessment showed decreased pain during CBD treatment. Owners reported no adverse side effects; however, serum chemistry showed an increase in alkaline phosphatase (ALP) similarly to the CSU study during CBD treatment which normalized over time. Conclusions of the clinical study suggest that 2 mg/kg of ElleVet Sciences CBD product twice daily can help increase comfort and activity in dogs with OA. It should also be noted that some dogs in the study were also on traditional nonsteroidal anti-inflammatory drugs with no adverse effects.

Data has shown in both studies that the other nonpsychotropic cannabinoids, primarily CBD, has a wide safety margin with only minimal side effects.



In both studies, the elevated ALP was notable. Interestingly, the increase in liver values was not associated with any other elevated liver values (gamma-glutamyl transferase, bile acids, or alanine aminotransferase) and may be a response to cannabinoid metabolism through the cytochrome P450 (CYP450) pathway.

5 CBD STUDIES FOR ANXIETY/PANIC ATTACKS

Animal models of CBD utility for anxiety or panic attacks are supported by studies placing a prey species in front of a predator species and conditioned escape responses in mice and rats. According to these studies, anxiety or panic attacks would be related to the flight and freezing defensive responses elicited by threats which expression was decreased in both models.

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Canopy Growth has announced the completion of their anxiety study in companion animals that is currently awaiting publication. The author is aware of other anxiety-related research being conducted in dogs, cats and birds with hopeful publication in the next year. Levels of stress markers such as oxytocin, vasopressin and cortisol will be measured alongside a behavioral survey.

6 CBD STUDIES IN PRODUCTION ANIMALS

Besides the alleviation of disease processes, veterinary scientists are exploring hemp for its anxiety-reducing effects and nutritional content increases in production animals. Stress on food-producing animals is directly correlated to poorer production of eggs, milk, down, wool, or muscle growth for meat producing animals. By exploring the use of naturally occurring cannabinoids in biomass from hemp production for other uses, we are beginning to see the utility for this welfare and economic challenge. The nutritional content of cannabis biomass is also being studied as feed for production animals, since seeds are particularly full of beneficial fatty acids.

7 CBD STUDIES FOR ALLERGIC DERMATITIS

Aside from pharmacokinetic, pain, seizure, and anxiety studies, we have seen scientific articles looking at cannabinoid receptor proliferation in feline and canine epidermal tissues suggesting the efficacy of topical and systemic applications for atopic dermatitis in dogs and hypersensitivity dermatitis in cats.

8 CBD STUDIES FOR GASTROINTESTINAL DISORDERS

Other studies looking at ECS distribution in various tissues are those interested in gastrointestinal function. One study published by Glaiazzo and colleagues looked at CB1, CB2, GPR55, and PPARa in canine gastrointestinal tissue, giving us deeper insight to the anatomical basis of supporting therapeutic cannabis in relieving motility disorders and visceral hypersensitivity in canine acute or chronic enteropathies. We have also seen studies looking at protective effects, specifically for gastrointestinal mucosal lesions secondary to acute pancreatitis in rat models. This is of particular interest in companion animals because pancreatitis is a common occurrence.

9 ANTICANCER EFFECTS OF CBD

Anticancer effects are one of the more common interests with owners. The scientific literature (in rodent models) is promising in several different cancer types, and certainly for the alleviation of symptoms related to chemotherapy or radiation therapy. A canine cancer study at the University of Florida has some exciting preliminary in-vitro results for three different types of canine cancer cells. Hopefully, we will see similar results in the on-going in-vivo study.

10 CONCLUSION

While the legal status of cannabis and hemp products continues to play out, it is critical that we continue to push for quality scientific data to support therapeutic evidence. Just like in human medical cannabis circles, the veterinary side of things will continue to evolve, looking for specific cannabinoid and terpene profiles for various ailments or ECS support. As scientists, consumers, and animal lovers, we must pressure cannabis manufacturers to produce products following good manufacturing guidelines, use safe ingredients for animals, and be transparent with what is in their products. To that end, manufacturers should suggest dosing regiments based on science instead of anecdotes. It is critical to note dose extrapolation from one tested product to the next would not necessarily provide the same efficacy or have the same safety profile as mentioned in the conclusions of a specific study based on the wide array of cannabinoid and terpene profiles on the market. We must also pressure local governments, mainly state veterinary and pharmacy boards, to adopt legislative language to allow veterinary professionals to discuss, recommend, and, in some cases, prescribe cannabis product for our pets. Lastly, we must encourage the veterinary profession to educate themselves on this topic.

References available upon request.

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WITH VETGIRL COO, DR. GARRET PACHTINGER, DACVECC

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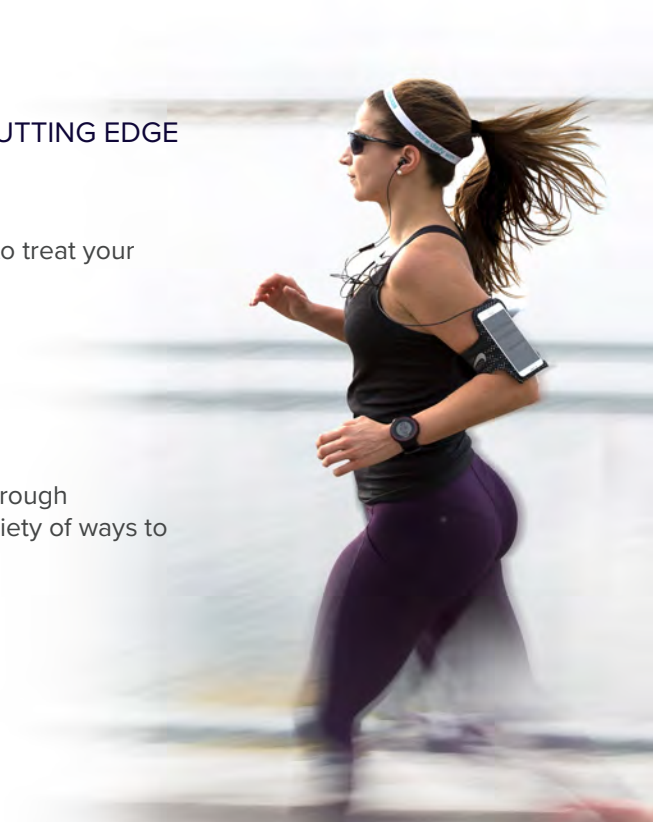

PROVIDER SPOTLIGHT //

JEANNINE MOGA, MA, MSW, LCSW

CHIEF HAPPINESS OFFICER, VETGIRL, LLC

Jeannine Moga is a licensed clinical social worker and VETgirl's Chief Happiness Officer. She received her undergraduate degree in Psychology/Law & Society from Purdue University and thought she wanted to be a Criminology professor – so she pursued graduate work in Sociology at Washington State University. After finishing her Master's, she decided she preferred "boots on the ground" work with people and communities. She worked in multiple human services settings – domestic violence intervention, juvenile corrections, and program development & evaluation – before pursuing her Master of Social Work degree at the University of Minnesota with an emphasis on human-animal relationships.

During her graduate training, Jeannine worked with an animal-assisted therapy program and also developed her own clinical internship at the University of Minnesota Veterinary Medical Center – where she first worked with VETgirl's Dr. Justine Lee. She was hooked on veterinary work and founded the VMC's Family & Community Services program shortly after graduation. A number of years later, Jeannine was asked to start a similar program for the NC State University Veterinary Hospital, where she also pioneered a veterinary clinical ethics consultation program to help veterinary staff, faculty, and students build solutions to complex ethical dilemmas.

Jeannine left academic medicine in 2018 with the goal of better serving the mental health needs of animal care professionals. She now maintains a small private practice in the Hampton Roads area of Virginia, specializing in anxiety, depression, grief, and stress-related syndromes. Jeannine is also a "work-life wellbeing advocate" who provides continuing education and program consultation to veterinary and social services organizations across the country.

When she isn't working, Jeannine can be found riding her horse (Georgia), baking, playing in the dirt, or biting off some sort of home improvement project involving power tools. She and her husband share their home with four dogs (Ronan, Bridget, Exo, and Pip), an ancient canary (Rupert), and a teenage Fortnite wizard who calls himself The Tooting Squid.

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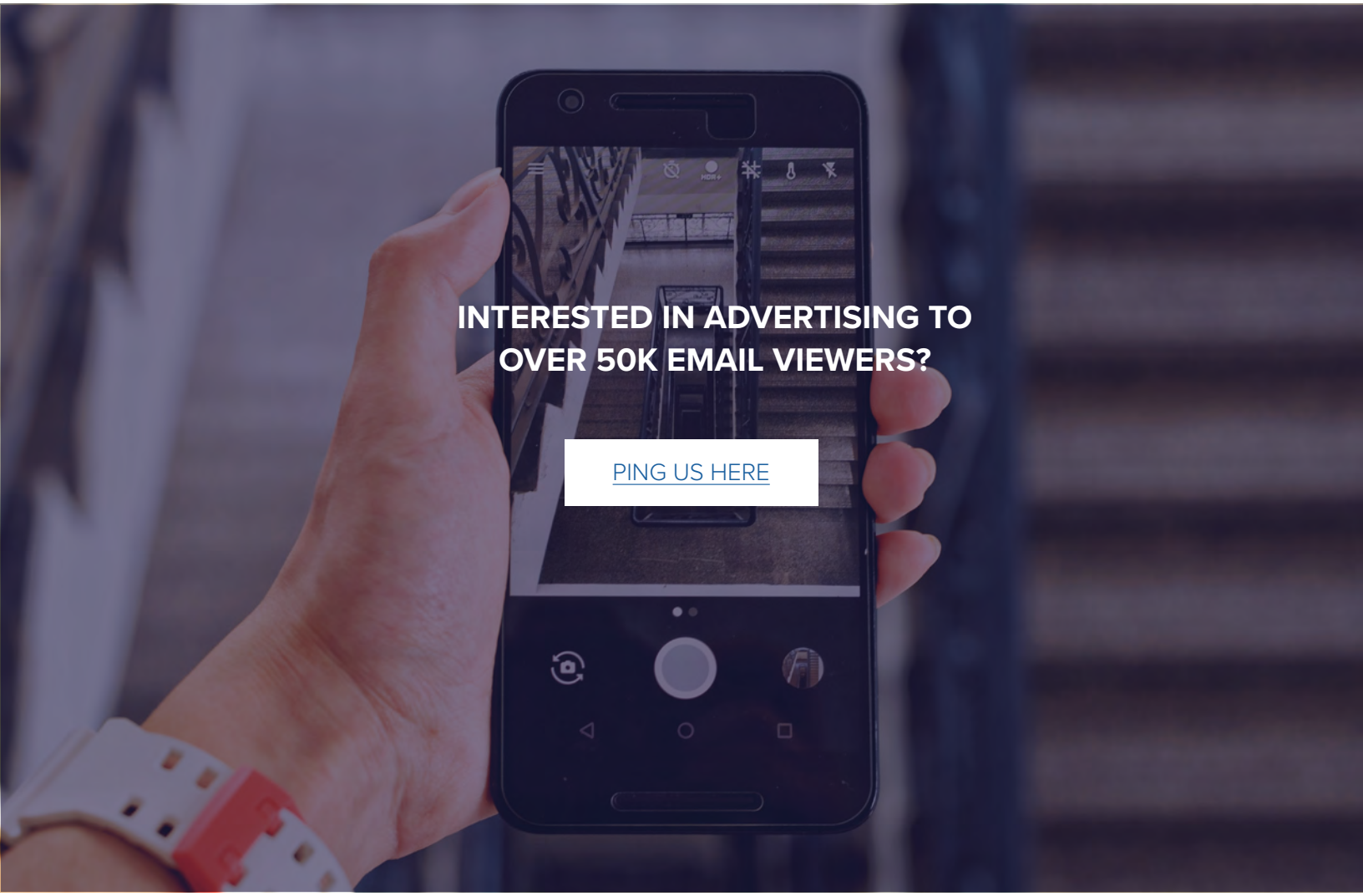

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NOTE: When in doubt, all drug dosages should be confirmed and cross-referenced with a reference guide such as Plumb's Veterinary Drug Handbook.