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ÍNDICE

Bill Saxon, DVM, DACVIM, DACVECC

1.1.1. THE ABCs OF DIAGNOSING INFECTIOUS DISEASES

Bill Saxon, DVM, DACVIM, DACVECC

Accurate diagnosis of infectious disease is increasingly important given the expanding geographical distribution of many, particularly vector-borne, diseases. Though some pets with infectious disease present with clinical signs many do not. This is especially true with vector-borne disease in dogs in which the majority are subclinical. Thus, screening for VBD in healthy patients is important especially given that many of these diseases can also affect humans and dogs may act as sentinels of emerging disease in a specific region.

Serology assesses humoral immunity and is the mainstay of screening for infectious disease as it is relatively easy to perform and can be done pet side. High sensitivity is important in screening tests to minimize false negatives. Serology can detect antibody or antigen. A positive antibody result indicates exposure to the pathogen (or cross-reaction from vaccine). To determine if active disease is present a combination of clinical signs, laboratory findings, magnitude of antibody titer, or additional testing, e.g., polymerase chain reaction may be required. A negative antibody result indicates lack of exposure or acute exposure (there is lag time to seroconversion). A positive antigen result confirms infection. A negative antigen results usually excludes the diagnosis. The cellular immune system is mediated primarily by T cells (CD4 and CD8) and plays a major role in defense against intracellular organism (e.g, Rickettsia spp., viruses). Serology may be negative in infections in which cellular immunity predominates.

All positive screening tests should be confirmed by follow-up testing. An ideal confirmatory test is highly specific thereby minimizing false positive results. As an example, a positive result or 'blue dot' on a SNAP test for VBD in a clinically normal dog should be followed by assessing for laboratory changes consistent with VBD (thrombocytopenia, hyperglobulinemia, proteinuria) and possibly PCR testing or obtaining a titer (amount of antibody, below). As another example, a positive FeLV antigen test should be followed by a second antigen test and quantitative PCR to confirm and stage the infection.

A titer is a quantitative measure of antibody. It is obtained by performing serial 1:1 dilutions with the 'endpoint' titer reported as the highest dilution at which antibody is detected. Comparing Leptospira canicola titers 1:100 and 1:1600, 1:1600 ('one to sixteen hundred') is the higher titer indicating more antibody. For most infectious disease 10-14 days are required for seroconversion after exposure. Hence the recommendation to obtain repeat or 'convalescent' titers 2 weeks after an initial low or negative result in an acutely ill patient. A 4-fold or greater increase in titer confirms disease. Titers to many VBD persist for months to years (lifelong in some) and therefore are not useful in monitoring response to treatment.

PCR is a molecular diagnostic tool the identifies DNA (or RNA) of a pathogen and is highly sensitive and specific for confirming infectious disease. Quantitative or real-time PCR allows determining the number of DNA copies which can be useful in differentiating vaccine from infection and in staging disease, e.g., leishmania, FeLV. Whole blood is the most common sample for diagnosing infectious disease, but PCR can also be run on urine (with whole blood for leptospirosis), aspirates of bone marrow, lymph nodes, spleen, and other tissues. A positive result indicates the organism is present and may be causing disease. A negative result usually excludes the diagnosis. However, prior treatment with antibiotics and/or organism in tissue not sampled can lead to 'false' negative results.

Serology and PCR testing are complementary, and it has been shown that performing both, sometimes more than once, maximizes diagnosis compared to performing one or the other. Co-

infections are common with VBD and PCR panels that include multiple infectious agents are useful in this setting, especially in pets that present with severe or atypical clinical signs or that fail to improve within 3-5 days of therapy.

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1. Creevy KE, Grady J, Little SE, et al. 2019 AAHA canine life stage guidelines. J Am Anim Hosp Assoc 2019;55:267-290.

2. Little SE, Levy JK, Hartmann K, et al. 2020 AAFP feline retrovirus testing and management guidelines. J Fel Med Surg 2020;22:5-30.

1.1.2. THE BLEEDING PATIENT: A PRACTICAL APPROACH TO DIAGNOSIS AND TREATMENT

Bill Saxon, DVM, ACVIM, ACVECC

Patients with bleeding disorders represent a true veterinary emergency. Rapid diagnosis and treatment are necessary for a successful outcome. An understanding of normal hemostasis, the difference in clinical signs between primary and secondary hemostatic disorders, the point of care and remote laboratory testing necessary to confirm a diagnosis, and the rational use of blood products and other therapy will optimize management of these often critical patients.

Normal blood clotting involves primary and secondary hemostasis. Platelets, von Willebrand factor, and the vessel wall are involved in primary hemostasis which culminates in formation of a platelet plug and is the first line of defense following vascular injury. Soluble clotting factors mediate secondary hemostasis leading to formation of a cross-linked stable fibrin clot. Tertiary hemostasis involves fibrinolysis, or clot breakdown.

Of the current models of coagulation (cascade, cell-based, and clot lifespan) the traditional cascade model remains the most clinically useful tool for practicing veterinarians. This model dates to the 1960's and describes a sequence of reactions in which each clotting factor becomes activated and in turn activates a 'downstream' factor eventually leading to thrombin formation which cleaves fibrinogen to form a stable fibrin clot. This cascade is divided into an intrinsic and extrinsic pathway which join in a final common pathway. The intrinsic pathway is localized within the vascular system and is initiated by contact activation of factor XII. The extrinsic pathway occurs outside vessels and is initiated by activation of factor VII by tissue factor (TF). The final common pathway involves activation of factor X with subsequent conversion of prothrombin to thrombin and eventual fibrin formation. This cascade model of coagulation is useful primarily in localizing a coagulation abnormality to the intrinsic or extrinsic pathway.

In clinical patients bleeding disorders can be successfully diagnosed and treated using clues from the history and physical examination, laboratory tests of coagulation, and blood products as well as other medications, e.g., vincristine in patients with severe thrombocytopenia. Physical examination findings in patients with disorders of primary hemostasis, e.g., immune-mediated thrombocytopenia, von Willebrand disease, include mucosal hemorrhage (e.g., epistaxis, hematuria, GI bleeding), petechiae, ecchymoses, and immediate bleeding after venipuncture. Petechiae are rare in von Willebrand disease. Physical examination findings in patients with disorders of secondary hemostasis, eg, anticoagulant rodenticide toxicity, hemophilia, include hematoma formation, body cavity hemorrhage, hemarthrosis, and delayed bleeding after venipuncture.

Laboratory evaluation of bleeding patients can include platelet count, APTT/PT, activated clotting time, and buccal mucosal bleeding time (BMBT). Using these tests most patients can be classified as having either a primary or secondary hemostatic disorder. Definitive diagnosis may require additional evaluation such as imaging, serologic or PCR testing for infectious disease, von Willebrand factor testing, clotting factor quantification, thromboelastography, and others.

Therapy will depend on the specific bleeding disorder but all severely anemic patients receive the same initial supportive care aimed at optimizing oxygen delivery by providing blood, usually in the form of typed crossmatched packed red blood cells (pRBCs), intravenous fluids, and supplemental oxygen. Once the coagulation abnormality has been defined as primary or secondary more definitive therapy can be given. Anemic patients with severe thrombocytopenia, <50,000 platelets/uL are treated with pRBCs or fresh whole blood, immunosuppressive prednisone therapy, and possibly vincristine and/or human intravenous immunoglobulin. Platelet transfusions are not readily available and are ineffective in immune-mediated thrombocytopenia due to rapid destruction, within minutes to hours, of transfused platelets. Blood products containing clotting factors such as fresh whole blood but more commonly fresh frozen plasma or cryoprecipitate are used to control hemorrhage in animals with prolonged APTT, PT (eg, anticoagulant rodenticide toxicity, congenital factor deficiency) or low von Willebrand factor concentrations (APTT/PT normal, BMBT prolonged).

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1.1.3. CARDIAC DISEASE: HOW TO MANAGE CARDIAC PATIENTS THAT PRESENT AS EMERGENCIES.

Bill Saxon, DVM, DACVIM, DACVECC

A useful approach to cardiac disease in dogs and cats is to recognize that myxomatous mitral valve disease predominates in small dogs and is the most common heart disease overall, dilated cardiomyopathy predominates in large dogs, and hypertrophic cardiomyopathy predominates in cats. Each of these etiologies is associated with a preclinical phase in which structural cardiac changes and/or arrhythmia are present. Identifying cardiac disease in the preclinical phase allows more frequent monitoring, earlier intervention, and better outcomes. The various cardiac diseases can progress to congestive heart failure in some (but not all) patients and emergency treatment is largely similar regardless of etiology.

Degenerative mitral valve disease is the most common cardiac disease in dogs affecting mostly middle-aged to older small breeds (<15-20 kg) and is characterized by a holosystolic murmur over the mitral (and in 30% tricuspid) valve. Many dogs with MMVD do not progress to CHF (6 yr mortality 10%) and those that do often have a 4-5 preclinical course after first detection of a murmur. Staging of MMVD is important in determining when to initiate therapy in preclinical dogs (Stage B2) to delay first onset of CHF. When echocardiography is not available a combination of radiographic assessment of cardiac size using vertebral heart scale (>12) and NT-proBNP (>1500 pmol/L) can fulfill criteria for stage 2B. Beginning pimobendan at 0.25-0.3 mg/kg PO bid in dogs with MMVD Stage B2 has been shown to delay onset of CHF by 15 months (60% prolongation of preclinical phase).

Dilated cardiomyopathy in Doberman Pinschers is an inherited disease with reported prevalence of 58.8%, 45%, and 63% in Europe, US, and Canada, respectively. It is a slowly progressive disease with an occult stage in which ventricular arrhythmias may be present leading to sudden death in 25-30% of affected dogs. Left ventricular enlargement is the classic morphologic abnormality. Current recommendations are to begin annual screening Doberman Pinschers for occult DCM beginning at 3-4 years of age with echocardiography and 24-hour Holter monitoring. Increased left ventricular volume or dimensions and/or frequent VPCs (>300 VPC/24 hr or 50-300 VPCs/24 hr on two recordings within 12 months) confirm occult DCM. The combination of auscultation abnormalities (left apical murmur, gallop sound, arrhythmia), weak pulse, and/or pulse deficits are strong indications to pursue further testing. In clinic ECG with >1 VPC/5 min and/or atrial fibrillation, NT-proBNP >500 pmol/L and/or ultra-sensitive TnI >0.139 nmol/L are all suggestive of DCM and should prompt further evaluation. Pimobendan (0.453 mg/kg/day divided, median oral dose) administered to Doberman Pinschers in the preclinical phase of DCM was shown to delay onset of congestive heart failure by 9 months and improve survival without an increase in severity of ventricular arrhythmia or incidence of sudden death.

Feline cardiomyopathy (CM) is a heterogeneous group of myocardial diseases of which hypertrophic cardiomyopathy (HCM) is the most common (prevalence 15% in general population, up to 29% in older cats). Most cats with HCM are nonpedigree though several breeds are at increased risk and distinct sarcomeric gene mutations are present in Maine Coon can Ragdoll cats. Most cats with CM are subclinical and many first present with congestive heart failure or aortic thromboembolism. Echocardiography is the gold standard for screening cats for CM (beginning at breeding age in Maine Coons) but is not always available or affordable. Clinical findings suggestive of CM that should prompt further evaluation include gallop sound, arrhythmia, at risk breed, and a prominent (grade 3-4) murmur especially in males. An increase in NT-proBNP and/or TnI indicate moderate to severe CM and echocardiography should be pursued. No treatment has been shown to delay onset of CHF in preclinical HCM in cats though atenolol is indicated if significant tachycardia, ventricular arrhythmia,

and possibly severe left ventricular outflow tract obstruction are detected. Clopidogrel can be considered to prevent clotting if marked atrial enlargement is present.

Initial stabilization of CHF consists of minimizing further patient stress, sedation (butorphanol or buprenorphine if needed), supplemental oxygen, furosemide (2-4 mg/kg IV initial dose), pimobendan (dogs, 0.25-0.3 mg/kg TID in acute CHF, then BID), thoracocentesis if pleural effusion is present, and possibly topical nitroglycerin ointment in patients with fulminant pulmonary edema.

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1.1.4. KIDNEY DISEASE: ACUTE OR CHRONIC?

Bill Saxon, DVM, DACVIM, DACVECC

Acute kidney injury is an abrupt decline in kidney function and is potentially reversible. Chronic kidney disease can be defined as abnormal kidney function that persists for 3 months or longer or structural changes in kidneys suggestive of chronic disease (e.g., small kidneys) and is irreversible. The International Renal Interest Society has published criteria for grading AKI in addition to guidelines for staging and treating CKD. These two processes can be thought of as a continuum whereby a kidney insult (infection, ischemia, toxin) may result in acute, reversible damage or sustained, progressive renal failure. Further, AKI and CKD are risk factors for each other; repetitive bouts of AKI may lead to CKD, and CKD predisposes to AKI. These factors underscore the importance of lifelong monitoring of renal function and early detection of kidney insult or injury.

Traditional biomarkers of kidney function lack sensitivity and specificity making early detection of decreased kidney function difficult. Symmetric dimethylarginine is a sensitive and specific biomarker of GFR. It is produced at a constant rate in all nucleated cells as a byproduct of protein turnover and is eliminated by glomerular filtration (>90%). An increased SDMA therefore indicates impaired GFR and the need for a thorough investigation of prerenal, renal, and post renal causes. SDMA increases when GFR decreases by 25-40% (versus 75% with creatinine) and has been incorporated in the IRIS guidelines for both AKI and CKD.

AKI may damage renal tubules as they are the most metabolically active portion of the nephron hence most vulnerable to ischemic, toxic or other insults. A complete urinalysis including cytology may reveal casts, normoglycemic glucosuria, proteinuria, bacteriuria, etc. Novel biomarkers of tubular damage including urine cystatin B, neutrophil gelatinase-associated lipocalin (NGAL), retinol binding protein (RBP) and others are being actively investigated in veterinary medicine.

AKI is dynamic and is graded on a daily basis using changes in creatinine and urine production as well as SMDA and urinalysis findings to determine progression or resolution of disease and guide therapy. CKD has a more stable, slowly progressive course and is staged periodically using creatinine and IDEXX SDMA (current guidelines) and sub-staged using proteinuria and systolic blood pressure.

Treatment of AKI and CKD differ. The goal of CKD treatment is to delay progression of disease and ameliorate complications (e.g., hypertension, anemia). This is accomplished by feeding a renal diet and, based on patient needs, use of phosphate binders, antihypertensive drugs, darbepoetin, angiotensin converting enzyme inhibitors/angiotensin receptor blockers for proteinuria, etc. The goal of treating AKI is to rapidly restore renal perfusion with appropriate fluid therapy, minimize further damage by removing known toxins or nephrotoxic drugs, identify and treat a specific underlying cause when possible, treat oliguria/anuria if present, and provide renal replacement therapy (dialysis) when necessary. Long term monitoring is important to determine if AKI has resulted in CKD, i.e., kidney dysfunction persisting more than 3 months post AKI.

Reference: iris-kidney.com

IRIS CKD Staging Guidelines

IRIS AKI Grading Criteria

	Stage 1 No azotemia (Normal creatinine)	Stage 2 Mild azotemia (Normal or mildly elevated creatinine)	Stage 3 Moderate azotemia	Stage 4 Severe azotemia
Creatinine in mg/dL Stage based on stable creatinine — Canine	Less than 1.4 (125 µmol/L)	1.4–2.8 (125–250 µmol/L)	2.9–5.0 (251–440 µmol/L)	Greater than 5.0 (440 µmol/L)
Feline	Less than 1.6 (140 µmol/L)	1.6–2.8 (140–250 µmol/L)	2.9–5.0 (251–440 µmol/L)	Greater than 5.0 (440 µmol/L)
SDMA* in µg/dL Stage based on stable SDMA — Canine	Less than 18	18–35	36–54	Greater than 54
Feline	Less than 18	18–25	26–38	Greater than 38
UPC ratio Substage based on proteinuria — Canine	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.5**	Proteinuric **>0.5**	
Feline	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.4**	Proteinuric **>0.4**	
Systolic blood pressure in mm Hg Substage based on blood pressure	Normotensive **<140**	Prehypertensive **140–159**	Hypertensive **160–179**	Severely hypertensive **≥180**

Table 1: IRIS AKI Grading Criteria

AKI Grade	Blood Creatinine	Clinical Description
Grade I	<1.6 mg/dl (<140 µmol/l)	Nonazotemic AKI: a. Documented AKI: (historical, clinical, laboratory, or imaging evidence of AKI, clinical oliguria/anuria, volume responsiveness‡) and/or b. Progressive nonazotemic increase in blood creatinine: ≥ 0.3 mg/dl (≥ 26.4 µmol/l) within 48 h c. Measured oliguria (<1 ml/kg/h)# or anuria over 6 h
Grade II	1.7 – 2.5 mg/dl (141 – 220 µmol/l)	Mild AKI: a. Documented AKI and static or progressive azotemia b. Progressive azotemic: increase in blood creatinine; ≥ 0.3 mg/dl ≥ 26.4 µmol/l) within 48 h),or volume responsiveness‡ c. Measured oliguria (<1 ml/kg/h)# or anuria over 6 h
Grade III	2.6 – 5.0 mg/dl (221 – 439µmol/l)	Moderate to Severe AKI: a. Documented AKI and increasing severities of azotemia and functional renal failure
Grade IV	5.1 – 10.0 mg/dl (440 – 880 µmol/l)	
Grade V	>10.0 mg/dl (>880 µmol/l)	

(‡Volume responsive is an increase in urine production to >1 ml/kg/h over 6 h; and/or decrease in serum creatinine to baseline over 48 h)

1.1.5. MY PATIENT HAS INCREASED SDMA. NOW WHAT?

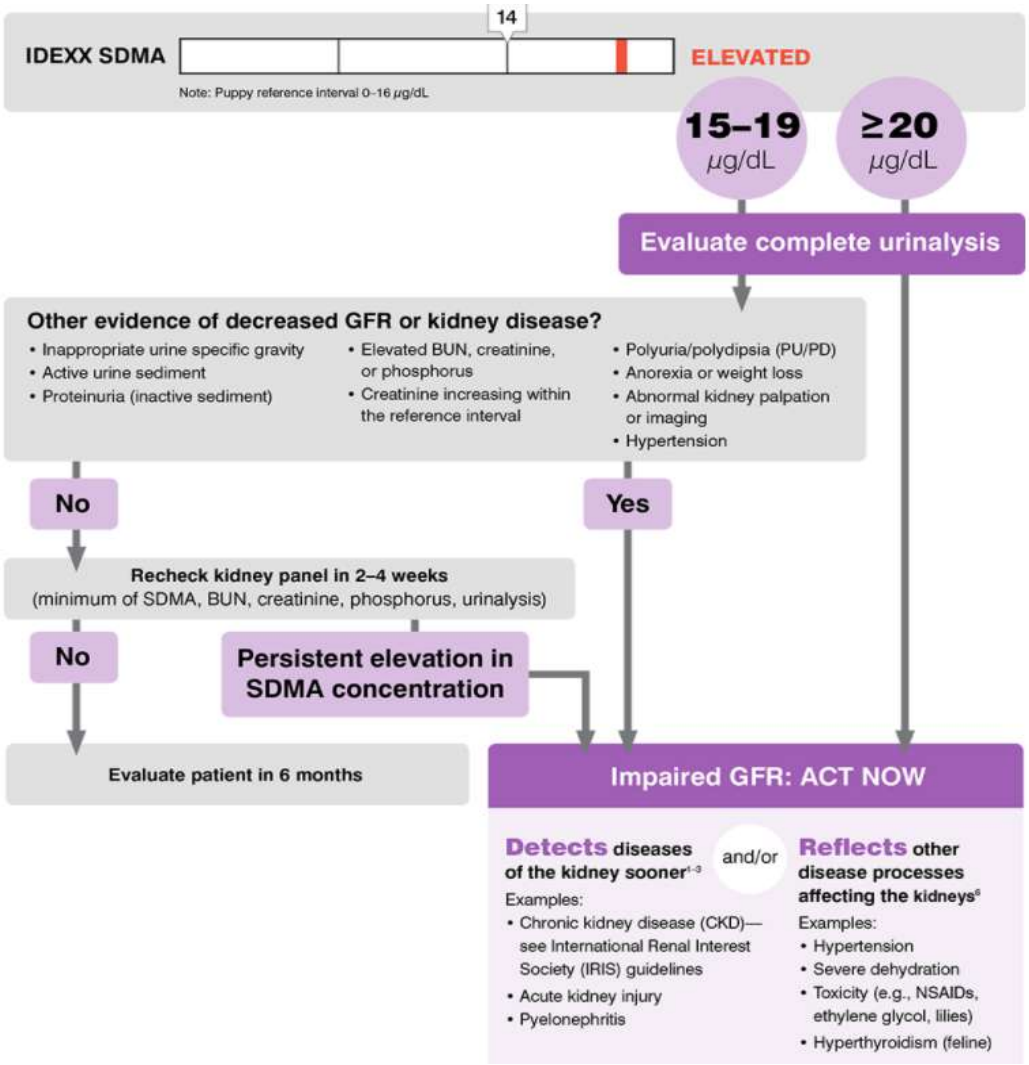
Bill Saxon, DVM, DACVIM, DACVECC

Symmetric dimethylarginine (SDMA) is a sensitive and specific biomarker for glomerular filtration rate in people, dogs, cats and other species. It fulfills many of the criteria of an ideal GFR biomarker as it is produced at a constant rate, primarily (>90%) filtered by the glomerulus, undergoes no tubular secretion or reabsorption, and is physiologically inert. It is highly correlated with GFR in dogs and cats and, when compared to creatinine, increases with on average 40% functional nephron loss (75% with creatinine), allows earlier detection of CKD in dogs and cats, and is unaffected by lean muscle mass, diet, or exercise. Any cause of prerenal, renal, or postrenal decrease in GFR may increase SDMA and if GFR is restored by treatment, e.g., fluid therapy for shock or dehydration, SDMA may return to normal. SDMA is best interpreted in conjunction with traditional GFR biomarkers BUN and creatinine and, importantly, with urinalysis.

In 2019 the International Renal Interest Society published modified guidelines for staging CKD in dogs and cats. This update stipulates using both creatinine and IDEXX SDMA for primary staging of CKD as SDMA 'may be a more sensitive marker that is less impacted by loss of lean body mass' than creatinine. When there is a discrepancy between creatinine and SDMA the patient is staged based on SDMA. For example, if SDMA is persistently >25 ug/dl in a cat whose creatinine is between 140-250 umol/L (IRIS CKD Stage 2 based on creatinine), the cat should be staged and treated as IRIS CKD Stage 3.

Mild increases in SDMA, i.e., 15-19 ug/dL, commonly are seen in apparently healthy dogs and cats. Recent publications show that a majority of these animals had a persistent increase in SDMA 1 year after an initial mild increase, that SDMA was the first indicator of decreased GFR in 80% of pets, and that in 50% of dogs and cats increased creatinine was not seen until 1 year. These findings highlight the importance of mild increases in SDMA as a potential early marker of persistence decrease in kidney function.

A recommended diagnostic approach when increased SDMA is identified is first to evaluate the urinalysis for evidence of kidney dysfunction (decreased urine specific gravity, renal proteinuria). If the urinalysis is abnormal a thorough investigation of causes of decreased kidney function is performed including but not limited to imaging, urine culture/susceptibility, evaluating for infectious (e.g., vector-borne), endocrine (e.g., feline hyperthyroidism), and other systemic disorders that may affect kidney function (e.g., pancreatitis, systemic hypertension). Any underlying disease, e.g., pyelonephritis, should be managed and the pet should be monitored for resolution or progression. If urinalysis is normal re-evaluating SDMA within one month is suggested.



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1.1.6. THE ANEMIC PATIENT: UPDATE ON DIAGNOSIS AND TREATMENT

Bill Saxon, DVM, DACVIM, DACVECC

Anemia, defined as low numbers of red blood cells or hemoglobin, is common in veterinary medicine. Practitioners should be aware of common causes and develop a consistent approach to diagnosing and treating these patients to improve outcomes. The diagnosis of anemia is straightforward and is made by evaluating the CBC. Developing anemia can be identified in an individual patient when normal values have been established during health and trended over time.

Once anemia is confirmed the next step is to characterize it as regenerative or nonregenerative since differential diagnosis, additional workup, and treatment differ. The absolute reticulocyte count is the most sensitive indicator of regeneration. An increased reticulocyte count indicates regenerative anemia. Changes in RBC indices, i.e., increased MCV, decreased MCHC, are neither sensitive or specific for regeneration and are normal in ≈90% of dogs with regenerative anemia. In nonregenerative anemia the reticulocyte count is normal.

Regenerative anemia is due to hemorrhage or hemolysis. Differentiation involves evaluation of evidence of internal/external bleeding, plasma proteins (usually decreased with hemorrhage), changes in RBC morphology (spherocytes, ghost cells with hemolysis), serum color (may be red/pink with hemolysis), and bilirubin (may be increased with hemolysis). The magnitude of reticulocytosis can aid in differentiation with counts >200K-250K/ml indicating likely hemolysis. Coagulation assessment (platelet count, APTT/PT, vWF) is considered when there is no identifiable vascular/organ injury to explain hemorrhage. Further evaluation when hemolysis is suspected could include direct Coombs' test, slide agglutination test, peripheral blood film review, abdominal imaging (zinc foreign body, e.g.), PCR testing for blood parasites (Mycoplasma haemofelis, Babesia gibsoni) and others.

Nonregenerative anemia is most common and is secondary to chronic disease or inflammation. The anemia is usually mild and diagnostic efforts are aimed at identifying and treating underlying disease, e.g., chronic kidney disease. In cats with CKD and hematocrit <20, darbepoetin (1 U/kg/wk SC, iron dextran 50 mg/cat IM as starting doses) can be given. Acute blood loss or hemolysis may initially be nonregenerative or 'pre-regenerative' because of the 3-5 day lag time between stimulus (anemia) and increased production/release of reticulocytes from the bone marrow.

Iron deficiency anemia is caused by external blood loss due to endoparasites (hookworm), ectoparasites (fleas), or gastrointestinal or urinary tract hemorrhage. Reticulocyte hemoglobin (Retic-HB) concentration is a newly available CBC parameter that is an early (within days) indicator of decreased bone marrow iron availability for hemoglobin production. A decrease in Retic-HB indicates true iron deficiency from external blood loss or relative iron deficiency due to inflammation causing sequestration of iron in bone marrow macrophages. Changes in RBC indices, i.e., decreased MCV, decreased MCHC, may also occur but require weeks to months of iron deficiency (compared to several days with Retic-HB).

Treatment of anemic patients involves maintaining adequate hemoglobin concentration for oxygen delivery to tissues. Transfusion of packed RBCs or whole blood to achieve hematocrit of minimum 20 (cats) and 30 (dogs) is indicated in critical patients. Patients with coagulopathy may also benefit from transfusion of fresh frozen plasma (warfarin, hemophilia A or B) or cryoprecipitate (von Willebrand disease). Once stabilized additional therapy is based on underlying disease and may involve surgery to stop active hemorrhage or remove zinc foreign body, immunosuppressive therapy (prednisone 2 mg/kg/day) for IMHA or ITP, vitamin K1 (2.5 mg/kg PO BID) for anticoagulant rodenticide toxicity, doxycycline (10 mg/kg/day for 14 days) for Mycoplasma haemofelis, etc.

References:

Garden OA, Kidd L, Mexas AM, et al. ACVIM consensus statement on the diagnosis of immune-mediated hemolytic anemia in dogs and cats. J Vet Intern Med 2019;33:313-334.

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1.1.7. THE ANEMIC PATIENT: UPDATE ON DIAGNOSIS AND TREATMENT

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Douglas R. Mader, MS, DVM, DABVP

2.1.1. LASER SURGERY IN SMALL ANIMAL PRACTICE:

Laser History and Physics, Tissue Response, Surgical Procedures and Applications in Small Animal Practice

Douglas R. Mader, MS, DVM, DABVP (Canine/Feline, Reptile/Amphibian), DECZM (Herpetology)

Tropical Veterinary Services, Florida, USA

As with most anything in life, even in veterinary medicine ever-changing technology is rapidly pulling us into the 21st century. No longer are the cool "toys" limited to the veterinary institutions and the multimillion-dollar referral practices. Recent graduates are entering the work force with advanced training. Printed media, animal programs on cable TV and the INTERNET are educating clients on the advances in veterinary medicine. The result – practitioners need to keep up!

Traditional medicine has taught the use of the scalpel, or cold steel. The scalpel is still the gold standard for surgical incisions, but, as with anything, it has its limitations.

Cold steel was replaced by the "electroscalpel." For many years this radiosurgery was the standard in exotic animal medicine. Now, in the dawn of the 21st century, the laser (Light Amplification by the Stimulated Emission of Radiation) has emerged as a viable alternative to surgical intervention.

INTRODUCTION

Cold steel surgery, even with the best technique, has the risk of excessive hemorrhage. This problem was somewhat controlled when the electroscalpel was introduced.

Radiosurgery, the successor to the standard scalpel, offered many options and solutions to hemorrhaging problem seen in the small exotic patients. Radiosurgery involves the passage of fully filtered, fully rectified, high-frequency radio waves through tissue. This technique causes cutting of the tissue with minimal coagulation.

Electrosurgery, by definition, involves the removal or destruction of tissue by conversion of energy into heat through tissue resistance to the passage of high-frequency alternating current. The radio waves here are fully rectified but not filtered. As a result, the unit effectively cuts and coagulates.

Electrocoagulation involves the use of a partially rectified, intermittent flow of high-frequency current to seal blood vessels. It is not intended for incisions.

Electrocautery involves the heating of a needle tip or scalpel using low frequency, high amperage current. This is not a form of electrosurgery since no radiowaves pass through the patient. This term is often erroneously interchanged with the aforementioned elecrocoagulation.

A big concern with Radiosurgery techniques is the problem with lateral transfer of heat to surrounding tissue. Lateral heat damages tissue and ultimately delays healing and encourages dehiscence.

Since the operator has the ability to control laser's output and focus the laser's beam, these problems can be circumvented. There is no contact between the laser and the patient's tissue. All of these factors contribute to making the laser ideal for surgical cases in exotic animal medicine.

LASER PHYSICS

The idea of Lasers has been around since the early 1900's when Einstein proposed the concept of stimulated light emission. Theodore Maiman developed the first laser in 1960. Weapons research, communications and manufacturing technologies provided the impetus to further laser research. After the end of the Cold War the laser manufacturers, looking for additional applications of their product, began the push for laser involvement in industry and medicine.

A standard light bulb and a laser share one thing in common - they both generate electromagnetic energy – commonly called light. The electromagnetic spectrum extends from very short wavelengths (gamma radiation at 10 -11 m) to radio waves (10 -1 m). The laser wavelengths fall between infrared and ultraviolet, which include the invisible and visible (400 – 700 nm) light spectrum.

The power behind a laser comes from its ability to store energy in atoms, concentrating the energy and releasing it in the form of powerful waves of light energy. Specifically, an atom in its resting ground state in a given medium (e.g. solid crystal, liquid or gas) becomes excited to a higher energy state by absorbing thermal, electrical or optical energy. After the energy is absorbed, the atom spontaneously returns to its resting state by releasing that energy as a photon – this is called Stimulated Emission.

This released photon resonates between mirrored ends of the laser chamber, further exciting other atoms in the laser medium. The momentum of the particles grows until finally a highly concentrated beam of light passes through a partially transmissive mirror at one end of the laser chamber.

Just as sound passes through air, or a ripple in the water, light travels in waves. Frequency is the term for the number of waves that pass a point in time. The frequency of light (known as the number of oscillations per second) combined with its wavelength (the distance between one peak to the next) determine the color of light. Normal white light is INCOHERENT, which means it contains many wavelengths radiating in all directions. If you shine a flashlight into a prism the beam is broken down into its different colors.

Laser light, in comparison to normal light, is COHERENT, and consists of only one color, known as MONOCHROMATIC. The last distinguishing feature of laser light, is that it is COLLIMATED, or non-radiating as is white light. Laser light travels in parallel beams, each reinforcing the beam next to it.

The wavelengths of medical lasers range form 193 nm (UV-excimer lasers) to 10,600 nm (far-infrared lasers). Only lasers in the wavelengths of 400 – 700 nm are visible to the naked eye.

The laser in science fiction is always red in color. Medical lasers that are visible to the eye are the Argon laser (blue – 488 nm), the YAG or KTP laser (green – 532 nm), the Dye laser (yellow/orange/red – 577 – 665 nm) and the Ruby laser (deep red – 694 nm). The Carbon dioxide laser, the most commonly used laser in veterinary medicine, is in the non-visible range (10,600 nm).

Laser light must be converted to another form of energy to produce its therapeutic effects. Laser interactions are categorized according to whether laser energy is converted into heat (photothermal), chemical energy (photochemical) or acoustic (mechanical-photodisruptive) energy.

When laser light is absorbed by a cell, the water within the cell is boiled and the cell essentially explodes. The cell denatures into smoke and the cell remnant, called char. This smoke, which has been documented to contain DNA, bacteria and viruses, should always be evacuated with a filtered vacuum.

When utilizing a small laser tip. The cellular destruction is limited to a region only three to four cells away from the target area, thus minimizing tissue devitalization, thus making laser incision far less destructive than either cryosurgery or electrosurgery.

TYPES OF LASERS IN SMALL ANIMAL PRACTICE

There are many different types of lasers used in the medical field. The two most commonly used in Veterinary Medicine are the Diode laser and the Carbon Dioxide Laser. Either of these instruments is usually chosen for a specific purpose in mind, such as dermatological or endoscopic applications.

Carbon Dioxide (CO_2) Laser

This laser type has long been used for its ability in tissue ablation. The 10,600 nm wavelength is highly absorbed by water, making it ideal for cutting (with a focused beam) and vaporizing (using a defocused beam) tissue.

Cutting with the CO_2 laser is virtually bloodless in most capillary beds as it seals vessels less than 0.6 mm in diameter. Lymphatics are also sealed, reducing post-operative edema. Smaller nerves are sealed as well, and perhaps even spared, resulting in less pain for the patient. Since the tip of the laser does not contact the skin or tissue being incised (as does the tip of a radioscalpel), microorganisms are destroyed in the process of photothermal ablation. Most importantly, the thermal insult from a given amount of energy is superficial, only 50 – 100 um in depth.

Diode Laser

Diode lasers can vary in wavelength from 635 – 980 nm. These lasers have been used for photocoagulation of retinal and other ocular tissues since 1984.

A big advantage of diode lasers is their ability to be used in conjunction with the fiberoptic delivery systems (i.e. through an endoscope). Additional uses of diode lasers include chromophore enhanced tissue ablation or coagulation, laser welding (tissue fusion) and photodynamic therapy.

The diode laser has deeper penetration than the CO_2 laser, and thus is less precise for delicate procedures such as debriding a cornea and ablating a right adrenal gland.

All lasers cut with a high intensity beam of light. These light beams can be focused at a specific distance. This allows the surgeon to use this intensified light beam to "cut" tissue when focused, or, “ablate” the tissue, when defocused.

A simple analogy can be made with using a magnifying glass in the sunlight. The convex glass collects the sun's beams or rays and focuses them to a pinpoint. The light rays can be focused to a fine point by moving the magnifying glass closer or further away from the surface being imaged. The beam is at its peak intensity when the point of light is at its smallest diameter. This correspondingly is also when the beam of light is at its maximum cutting power - which can be easily demonstrated by focusing the sun beam on a piece of paper and watching it burn with exacting precision.

The laser works in a similar fashion. It actually cuts tissue by searing through it with a highly intense focused beam of generated light. Just like the magnifying glass, the laser has to be positioned so that it is focused on the target tissue (the growth or tumor, for instance).

“Ablation" is especially useful for removing small growths or tumors (such as a ferret adrenal gland). In some situations it is preferable to "ablate" the tumor rather than cut it off. What this means is that the laser beam is defocused on the tumor, and instead of cutting it away, the laser literally disintegrates it.

MAKING THE CUT

There are three factors that determine the impact of the delivered laser beam: spot size, power and exposure.

Spot size refers to the diameter of the aperture that contains 86% of the laser’s beam. The tip size of the handpiece (commonly 0.4 or 0.8 mm) and the distance of the tip from the target tissue determine the actual spot size at the target. For most applications this is typically 1 mm.

Power is measured in watts, which is defined by the amount of energy applied over time (defined as Joules/second). Power is adjusted on the laser by adjusting the wattage. The greater the wattage, the higher the power.

Power density is affected by the size of the target area. If the spot size is small, the power is concentrated. If the spot size is large, the power is spread out over a larger area, and the power density is decreased, thus producing a lessor tissue effect.

Exposure is also a user controlled variable. Exposure is determined by the duration of the applied laser. The greater the exposure, the greater the tissue impact. Exposure can be delivered as continuous, repeat or single pulse. Surgical precision is increased respectively.

2.1.2. ULTRASOUND IN COMPANION ANIMALS

Douglas R. Mader, MS, DVM, DABVP (Canine/Feline, Reptile/Amphibian), DECZM (Herpetology)

Tropical Veterinary Services, Florida, USA

Introduction

The objective of this presentation is to present a very basic introduction and overview of small animal ultrasonography. Ultrasonography is rapidly becoming one of the most readily utilized imaging techniques in small animal medicine. The cost of the equipment has gone down, and the quality and ease of use of the equipment has gone up over the last decade. Where owning an ultrasound was once a specialty item, now, many small animal hospitals have ultrasound machines in their practice.

Ultrasound is a non-invasive modality to image soft tissues. It uses sound waves to generate images that are projected onto a screen which gives real time representation of the anatomy of the patient, in all three dimension, unlike radiography, which only generates a two dimensional image of a three dimensional object.

A radiograph allows the doctor to appreciate size, shape, position, contour and opacity of internal organs. An ultrasound allows the operator to evaluate size, shape, position, contour, echogenicity and composition of the tissue being evaluated. The most common imaging is called B-mode that produces a two dimensional cross sectional image.

Physics of Ultrasound

A piezoelectric crystal housed in a hand held transducer produces sound waves that are propagated through soft tissues of the body. The piezoelectric crystal spends 1% of its action transmitting sound waves, and 99% of the time receiving back the reflected waves. The frequencies produced by the crystals range from 1.0 MHz to greater than 20 MHz. The higher the MHz for the probe the greater the detail of the image (high resolution), but the shallower the depth of field. Conversely, the lower the MHz, the greater the depth of field, but, there is a lesser quality and a lack of detail (poor resolution) compared to the higher frequency transducers.

Examples of tissue types and frequency recommendations:

Tissue	Frequency
Eyes, testicles, superficial tissues	10 MHz
Cats/Small dogs/Small Exotic pets	7.5-8.0
Medium sized dog	5.0
Large dogs (large animals)	3.0-3.5
Giant breed dogs (large animals)	2.5

The sound waves are stopped by bone and gas. The sound wave, as it passes through different tissue densities (called acoustic impedance), is reflected back to the transducer, which then acts as a

receiver. The echos are converted to electric impulses and displayed on the ultrasound screen. The more sound that reflects back from the tissue, the brighter the image on the screen.

When a sound wave crosses a tissue interface only a portion of that wave is reflected back to the receiver. The amount reflected depends on the amount of difference in the acoustic impedance between the two tissues. Acoustic impedance refers to the density of the tissue and the speed that the sound wave travels within that tissue. This determines the echogenicity of the selected tissue.

Echogenicity refers to the amount of sound returned (attenuation) to the transducer from an object or a tissue interface. Low echogenicity refers to a minimal amount of returned sound. High echogenicity refers to a maximum amount of returned sound. When referring to the images generated by the ultrasound wave, there are four main categories: Anechoic (no image – screen is black), hypoechoic (less reflection than other tissues), isoechoic (the same reflection as other tissues) and hyperechoic (more reflection than other tissues). These will be described in more detail later.

For B mode ultrasonography the standard convention is to have the screen black and the image various shades of grey.

When comparing ultrasound images to radiographic images, the following applies:

Object	Ultrasound	Radiograph
Fluid (urine, bile)	black	white
Bone	white	white
Gas (bowel, lung)	white	black
Fat	Blotchy white	gray

The echogenic scale of tissues on an ultrasonic image range as follows:

0	Black	Fluid
2		Kidney medulla
4		Kidney cortex
5		Liver
6		Spleen
8		Fat/Fibrous tissue
10	White	Gas (air)/Bone

Mastering ultrasonography does take time. There is an initial "easy" phase where the operator can utilize an ultrasound and readily generate an image. Since most of what is needed in a clinical practice is generally concentrated around the "big five" structures – Liver, Kidneys, Spleen, Bladder, Intestines – this is a relatively easy task to master. However, there is a steep learning curve that is encountered when more detailed studies are pursued. For instance, when imaging adrenals, pancreas, lymph nodes and other smaller objects.

One of the biggest learning obstacles is understanding the concept of artifacts. To help with this, a few definitions may prove useful:

Reflection – Redirection of the ultrasound beam back to the source. This gives rise to the diagnostic ultrasound images.

Absorption – when the sound wave is absorbed in the target tissue it gets converted to heat, and not reflected back to the receiver.

Scatter – When the ultrasound beam encounters an interface that is irregular or tangential, or smaller than the sound beam, and the sound reflects off in different directions and not necessarily back to the receiver.

Shadow – This is a major source of artifacts. The pulse is unable to reach deep tissues due to highly reflective tissue interfaces, reflecting sound waves back to the receiver, thus casting a black shadow over the tissues beyond the interface. A classic example here is bone or a urinary calculi inside a fluid filled bladder.

Enhancement – This is the opposite of shadowing where the echoes from deeper tissues reflect louder (brighter) than superficial tissues (tissue on the backside of the urinary bladder or ball bladder are two good examples).

Refraction – This is where the sound wave is displaced alongside the walls of a fluid filled structure, and produces a negative artifact (black lines).

Reverberation – Sound waves resonating and reflecting back and forth between two tissue planes multiple times before it finally returns to the receiver. Air/fluid and soft tissue/gas interfaces are common sources of reverberation. On the ultrasound screen this appears as highly echoic parallel lines that recur at regular intervals. This is also seen when trying to image the lungs.

The Ultrasound Machine

The ultrasound machine has two different types of transducers (probes). The convex probe has a smaller curved face (referred to as the footprint) is preferred for smaller contact surfaces and smaller subjects, such as feline/canine abdomens, eyes, and hearts.

The linear probe is best for superficial structures such as cat intestines, tendons, etc.

Probes are regulated by the actual machine to which they are attached. There are multiple settings on the ultrasound machine. Generally, once a study has been started (e.g. abdomen, heart, eye, etc.) and the settings are determined, they don't need to be changed frequently. A probe can be either a single frequency probe (e.g. 5 MHz) or a variable frequency probe (e.g. 3-5-8 MHz) that has multi-purpose usage.

"Power" refers to the intensity of the sound output that is emitted by the transducer.

"Gain" regulates the amplification of the returning echos, regardless of the depth or origin of the reflection. The higher the gain, the brighter the image. Time-Gain Compensation (TGC) refers to selective areas of amplification of the returning echos.

Uses of Ultrasonography

As mentioned, ultrasonography allows visualization of the soft tissues in real time, in multi-dimensions. It also allows both distinction between tissue types as well as the ability for virtual objective assessment of internal structures, such as measurements of intestinal wall thickness.

Positioning

Whereas patient positioning is operator preference, most ultrasonograhers prefer to have the patient in dorsal recumbency for abdominal scans. Some prefer to have the patient in either right or left lateral recumbency. Regardless, the patient's abdomen should be shaved to bare skin from just cranial to the xiphoid caudally to the pubis and laterally to at least the costo-chondral junctions.

For cardiac examinations, most basic studies can be accomplished using a window between the ribs with the patient in RIGHT lateral recumbency, although left lateral and ventral, sub xiphoid approaches are also used.

For the purpose of this lecture, the major structures that general veterinary practitioners should be readily able to evaluate are considered to be the "big five." That is, the Liver, Kidneys, Spleen, Bladder and Intestines. In addition, we will make a few brief remarks regarding evaluating the heart in dogs and cats.

Abdominal cavity

The ultrasound is ideal for detecting abdominal fluid, soft tissue masses, urinary calculi and more. Ultrasound is ideal for detecting even small amounts of peritoneal fluid. In addition, the presence of free fluid acts as an acoustic window, thus enhancing visualization of other abdominal structures. Where it can be difficult to ascertain distinct abdominal masses using conventional radiography, an ultrasound can readily differentiate between the different acoustic densities between liver, spleen and masses.

The liver is the larges organ in the abdomen, and is generally the place where the ultrasound study should begin. It is evaluated for architecture and contour and general echogenicity. Focal lesions, metastasis, nodular hyperplasia, abscesses, cysts, neoplasia, vascular congestion, shunts, fistulas and cirrhosis can all be evaluated.

With practice ultrasound guided fine needle aspirates and Tru-cut biopsies are easily accomplished with accuracy and safety.

Between the right medial and lateral lobes of the liver can be found the hepatobiliary system – specifically the Gall Bladder and Bile Duct. Cholelithiasis, biliary obstruction, bile duct dilation, sludging and Gall Bladder mucocoeles are all identified. Secondary obstruction of the biliary duct due to pancreatic disease or duodenal pathology, or foreign body presence, is also possible.

The spleen is a dynamic organ and readily moves around in the peritoneal cavity. It sized can be influenced by disease and or certain drug administration. For instance, the phenothiazine tranquilizer acepromazine causes splenomegaly, and generally should not be used prior to abdominal ultrasound evaluations.

Splenic neoplasia is probably the most common finding using the ultrasound. Since approximately 50% of all splenic masses are benign, the finding of splenic disease with ultrasound certainly makes splenectomy a viable next step.

Splenic torsions, infections, infarctions, cysts, hematomas and nodular hyperplasia are all readily imaged with the ultrasound. With practice differentiation between the different pathologies will be more apparent.

Kidneys and Bladder are readily seen with the ultrasounds. Evaluation of the kidneys, measurements of their size, renal blood flow and overall appearance is accomplished with ultrasound. For kidneys, neoplasia (e.g. lymphoma), cysts, abscesses, hydronephrosis, glomerulonephrosis/nephritis, mineral deposition, fibrosis, hypoplasia, dysplasia and toxicosis (e.g. ethylene glycol) can all be determines.

Investigation into the urinary bladder is commonplace, with evaluation of wall thickness, presence of masses, urinary sediment or calculi and number of stones, dilation of ureters, and position of the ureteral openings (an advanced procedure) can all be performed. In addition, using ultrasound-guided cystocentesis allows for more thorough urinary evaluation in even the most obese patients or those with small bladders.

In intact males the prostate and testicles can be scanned for presence of pathology such as neoplasia or abscessation.

In the bitch ultrasound can be used for pregnancy diagnosis as early as 20 – 25 days post breeding. Fetal viability is easily determined by looking for fetal movement and individual fetal heartbeats.

Ovarian activity, uterine pathology, pyometra can all be assessed.

The intestines are readily moveable, but, the duodenum and large colon are fairly stationary. The ileum and jejunum will move about with positioning and probe pressure, but, once learned, can be readily identified. This is important as it allows intestinal wall thickness to be measured. This is imperative when evaluating intestinal lymphoma or inflammatory bowel disease. In addition, ultrasonography is useful in determining the presence of foreign bodies such as string and plastic, items that may be radiolucent on x-ray studies.

Imaging the pancreas takes some practice, but once learned, evaluation for the presence of cysts, masses, neoplasia or pancreatitis is readily accomplished.

Measurements and evaluations of the abdominal lymph nodes are done with the ultrasound where these structures may not be visualized using standard radiography.

Thorax

While evaluating the thorax is beyond the scope of this lecture, learning how to look for fluid lines in the pleural space is relatively easy to master. In addition, one does not need to be a cardiologist to evaluate cardiac wall thickness to determine the predominant pathology in a cat with cardiac signs. If the ultrasound equipment has the ability, Doppler technology allows visualization of valvular regurgitation such as is seen with myxomatous degeneration of the A-V valves. Also, identifying adult heartworms in the right ventricle and pulmonary artery of a dog is generally not difficult once a person gains some experience.

Summary –

Ultrasound diagnostics is no longer something confined to universities and specialty hospitals. The technology is getting better and the cost of the equipment has been steadily decreasing over the past decade. The machines are user friendly and affordable. The learning curve is initially quick and the diagnostic benefits are great.

References

There are many good ultrasound references available, both in book form and on line. In addition, there are many telemedicine services that offer help with evaluating both radiographs and ultrasound images. Two textbooks that I find useful:

Mattoon J, Nyland T. Small Animal Diagnostic Ultrasound (3rd edition). Elsevier, St. Louis. 2015.

Chetboul V, Bussabori C, de Madron E. Clinical Echocardiography of the Dog and Cat. Elsevier, St. Louis. 2015

Elizabeth Colleran DVM, MS DABVP

3. Elizabeth ColleranCAT FRIENDLY PRACTICE

Elizabeth Colleran DVM, MS DABVP feline specialist

Despite the popularity of cats, small animal practices have historically had many fewer cat visits than dogs. Disturbing trends in cat ownership and care have been shown in past pet population and demographic studies. There are millions more owned cats than dogs in the US, for example, according to recent data . However, almost twice as many cats than dogs never visit the veterinarian. Of the cats that visit the veterinarian, they averaged 26 percent fewer visits and dogs. There are 2 major concerns that have been suggested reasons for this fact.

First is a lack of appreciation for the value and need for veterinary care for cats. Second is the concern over the stress resulting from a visit to the veterinarian. In many small animal practices, more effort goes into educating clients about the value and services that can be given to canine patients than their feline patients. Clients are often unaware how many veterinary services can improve the quality of life and life expectancy of their cat. Clients are also reluctant to put themselves and their cats through the struggle of going to the veterinarian, especially if they do not understand why going to the veterinarian is such an important part of a healthy life.

Most clients demonstrate willingness to pursue good veterinary care if the veterinary team overcome these 2 giant hurdles. Many clients who have both dogs and cats choose a different practice for their cat because they experience a difference in the level of care delivered.

You can help clients ensure a longer better quality of life for their beloved cat by improving Wellness care, education, and being proactive about diagnosing diseases early. This builds a strong and more productive practice relationship with the clients and improves care for the cat. There are so many ways for veterinarians to improve client visits, especially with our aging cat population. Learning strategies to lessen the stress of the veterinary visit can encourage more frequent usage of the services a veterinarian offers. As we improve our understanding of feline patients' needs our clients will see our greater interest and knowledge. On client relationships build loyalty and trust and open the door for client referrals recommending your practice to their friends and family as being cat-friendly.

Cats evolved have physical and behavioral characteristics that make them specialized hunters of rodents and other small prey. They are developed to be solitary hunters, and are motivated to hunt by The sight and sound of prey. In order to be a successful hunter the cat will search its hunting range during times when its main prey are active and vulnerable which is usually at dawn and dusk. The cat is an obligate carnivore or hyper carnivore unable to survive or thrive without nutrients found in meat such as taurine.

Cats are a mesopredator they are also prey as both predator and prey they have unique reactions to unfamiliar environments and stimulation. They have evolved ability to hide disease a strength when worried about potential predators. This can make healthcare and observation challenging.

As cats are solitary hunters they are naturally Neo-phobic that is fearful in unfamiliar environments and highly efficient at defending themselves against perceived threats. Any change can be frightening. Cats are highly motivated to flee as well as attack any sudden movement. Team members should move slowly and develop distraction techniques that can diffuse escalating stress in the cat. The risk of potential infection from bites and scratches can be high. Learning strategies that help avoid stress will help keep people and animals safer. Recent data has demonstrated that workers' injury are lower in cat friendly practices. Finding ways to minimize fear and defensive aggression are important. Understanding that many cats will be compelled to fight if not given an opportunity to hide can keep staff and clients safer.

We often use the term territory quite loosely, but in behavioral terms it is the area that a cat is prepared to defend. In the wild, the cat's survival and hunting success depends on the Integrity of its individual home range and territory and resting area. Consequently cats are usually cautious and concerned about any intrusions into their territory, especially at certain times such as dawn and dusk. As household pets, cats are fed by their owners and they don't need to hunt to survive, however they still have a strong drive to hunt and establish territories and ranges.

Cats use scent as a means of social communication usually to keep other cats at a distance except when looking for mates or scent-marking members of their feline group. Cats have scent glands on their lips and chin, the top of the head, along the top of the tail, in between the digits of their paws, and around their anal region. When a cat rubs around its owners it is these areas that leave its unique scent. Similarly cats mark in the same way on Twigs branches and other objects in their territory. They will also climb trees and fences leaving both a visual and scent mark from glands between their paw pads. All cats regardless of sex or reproductive status scent mark in some way. Scent is the first sense used for feeding. Food doesn't smell palatable the cat won't even attempt to taste. Diseases such as upper respiratory infection compromise the sense of smell and cats may not wish to eat . Releasing odors by warming up food may make it more tempting.

There are no familiar scents in the veterinary practice so anxiety maybe high. Bringing familiar items from home to veterinary visits can help alleviate some of the stress . Similarly, stay in the hospital may be less stressful If an item from home with a familiar scent can be left with the cat. Washing hands and surface wiping is essential for hygiene, but also to remove the scent of other animals. Strong disinfectants can be overwhelming. Rinse and let dry before introducing a cat to a cage. Avoid alcohol due to the strong smell. Use an appropriately dilute chlorhexidine solution or another safe agent instead of alcohol for cleaning skin prior to sample collection or intravenous injection. Use of synthetic pheromones can help comfort cats and be useful in the practice.

Cats are excellent at hiding signs of illness and pain so as not to attract attention. As solitary hunters, this is an important mechanism to prevent predators from recognizing their weakness. Owners may not be aware that the cat is suffering because the signs are so subtle.

The cat that survives on its own outside does not need feline company. He can hunt by himself find his own den, and defend territory. He can keep himself clean, claws sharp, and protect himdself by being highly aware of using his agility, speed, and strength to get out of trouble . Hiding or fleeing is preferred over fighting if a cat faces danger. Where they do live together, cats do not form structure packs like dogs and there is no dominance hierarchy among a group of cats. The assumption that cats need the company of their own species is based on human perceptions of sociability. Cats may react quickly if disturbed or frightened in the veterinary practice. Since they are not allowed a means by which to hide or flea to lessen their anxiety in the practice environment they may result in defense of aggression. Hiding is an important feline coping strategy in an unfamiliar environment. A cat can feel more safe hidden in the bottom half of a carrier, under a towel, or in a cat bed and it can also be safer to work with for the veterinary team. Slow quiet approach and avoiding eye contact will minimize threat. Avoid sharp or loud noises when working with cats as they can be very alarming to an already hyper-vigilant animal. Scruffing or intrusive handling can cause fear and panic. Bring all necessary equipment into the examination room and avoid going in and out of the room. You can also be beneficial to conduct many procedures in the examination room to avoid increased stress to the cat by bringing them into a different room. A single unpleasant event at the practice can affect future visits for this patient. Cats are excellent at hiding signs of pain or vulnerability. Owners may have noticed behavior changes but are not aware of their significance.

Becoming a practice that is genuinely cat-friendly involves our attention to 3 distinct acts aspects of the day :

- It is important the practice has a proactive approach to client communication and education. The entire practice culture should reflect a passion for ensuring the best possible experience for feline patients and increasing the quality of care provided

- Measure should also be in place to ensure practice outcomes are being monitored, new staff are trained and feline friendly tactics and improvements are being made where necessary

- Practices need to ensure that they have appropriate equipment facilities and instruments to ensure feline patients are cared for in the best and safest possible way

Effective communication between the practice and the client is vitally important in delivering comprehensive care to the feline patient. It is important that communications are done in an empathetic and understanding way, and that clients are given the opportunity to contribute to any discussions and voice any concerns. The central goal is for clients to be involved in all treatment plan decisions and that those decisions are individualized for each patient and the owner as well. Effective communication not only applies to clinical investigations and treatments, but to all aspects of client communication and education. For example, client should be informed about procedures, how best to transport the cat to the practice, what to expect when they arrive, what will happen during the exam as it is narrated to them, and respectfully asked about their cat's past behaviors in the veterinary practice when booking an appointment.

Patience, gentleness, and empathy are important in the exam room. Even with the best environment and approach, some cats will remain very anxious and a full physical examination may be challenging. Remember that each cat deserves a comprehensive physical exam. Be prepared to take additional time, schedule another appointment if needed, or hospitalize the cat if necessary. Again, remember that attitude and approach taken by staff in the exam room may determine whether or not the client will ever bring the cat back to the practice. As with history taking a standardized form for physical examination will make sure that all the activities that need to be done are completed.

There is a checklist in manual that completely describes all of the techniques and discipline needed to create a cat-friendly practice . There is a checklist that can be used to summarize the larger manual to make sure that everything is complete . The techniques and strategies are easy to implement and well described in the manual. More help is available by contacting the cat-friendly practice team . The most important step is to recognize that there is a need to make the adaptations in the first place. By incorporating these recommendations into your practice you will provide better care for cats and develop more lasting and productive bonds with your client.

RESOURCES

Catvets.com

Catfriendly.com

American Association of Feline Practitioners

3.1.2. MANAGING THE FELINE DIABETIC

Elizabeth J. Colleran DVM, MS, Diplomate ABVP Feline

Diabetes Mellitus (DM) is a common disease in cats, with some estimates suggesting prevalence in first opinion practices of around 1 in 100 to 1 in 500. There is also evidence that the prevalence of feline DM has been increasing, possibly at least partly due to the rise in prevalence of obesity .

Managing DM in cats represents a challenge for both owners and the veterinary health care team, and considerable support is needed for owners as they continue to care for cats in the home environment. Studies have shown median survival times in cats with DM of between thirteen and 29 months, with longer survival times in better stabilized cats, and with many cats dying of diseases other than DM . Prognosis for cats with DM is this good when the disease is well managed .

The majority of cats with BM appear to have a disease bearing similarities to human type 2 DM, resulting from beta cell dysfunction and insulin resistance . Type 1 DM is rare in cats . In cats with DM, beta cell dysfunction usually results in insulin deficiency and is likely to be caused by a number of factors including islet amyloid deposition , glucose toxicity, and possibly damage from reactive oxygen species and/or inflammatory cytokines. Many factors May contribute to insulin resistance, obesity is a common cause, but others including concomitant endocrinopathies like acromegaly or hyperadrenocorticism, drug-induced diabetes and pancreatitis . Importantly, if insulin resistance can be reduced and beta cell function improved, in some cats diabetic remission may be achieved. In other words, exogenous insulin therapy may no longer be needed, although the remission may only be temporary in some cases.

Classic clinical signs of DM include polyuria and polydipsia , lethargy, weight loss, and polyphagia . Less commonly, weakness, plantigrade stance Palma depression, and anorexia may be seen . The last more commonly with ketoacidosis.

Numerous Studies have identified risk factors for the development of feline DM, although the presence of unidentified concomitant disease , for example acromegaly, they have influence the results obtained. Major reported risk factors include:

- Obesity – this reduces insulin sensitivity and obese cats are up to 4 times more likely to develop DM an Optimal weight cats .
- Increasing age - Cats over 7 years old are at greatest risk
- Breed – Burmese cats have been reported to have a higher risk in studies from Australia, New Zealand, and Europe.
- Physical inactivity - indoor and inactive cats are at increased risk.
- Gender - male cats and neutered cats are at higher risk.
- Drug treatment - glucocorticoids and progestogens may cause insulin resistance and predispose cats to DM .

Diagnosis

Diabetes is usually diagnosed by documenting persistent hyperglycemia and glucosuria , with consistent clinical signs. Stress hyperglycemia and glucosuria must be excluded prior to initiating therapy. Press on commonly causes hyperglycemia greater than 288 milligrams per deciliter or

greater than 16 mmol per liter and generally it resolves within a few hours. Repeat blood and urine monitoring will confirm persistent hyperglycemia with DM and home monitoring of these parameters may be useful where the diagnosis is in doubt.

Serum fructosamine is indicative of the average blood glucose during approximately the preceding week, and may not be affected by short-term stress hyperglycemia AMA depending on its magnitude and duration. It's measurement can be helpful in confirming a diagnosis of DM and in monitoring glycemic control although it may not be increased in cats with recent onset and/or mild DM.

Evaluation

Evaluation of a cat with suspected DM should include:

- Thorough history and physical examination
- Routine serum biochemistry
- Complete urinalysis ideally with culture
- Complete blood count
- Serum fructosamine - although not always required for diagnosis and monitoring
- Serum thyroxine in older cats to exclude hyperthyroidism

Because of the high prevalence of concurrent diseases, including pancreatitis, abdominal ultra-sonography and or determination of serum pancreatic lipase immune reactivity may be indicated AMA especially in cats that are depressed or not eating well, although interpretation of these tests may not be straightforward .

Diabetic ketoacidosis Philip Center proportion of untreated diabetic cats, and should be suspected when cats are depressed, anorexic, vomiting, weak, collapsed or moribund. Diagnosis requires these clinical signs + confirmation of high blood or urine ketone concentrations and metabolic acidosis, in conjunction with persistent hyperglycemia.

Clinicians should be vigilant and monitor patients for the development of diabetic complications or the presence of concomitant disease, particularly if treatment response is poor or erratic.

Overall goals in managing diabetic cats

Despite the favorable prognosis for well-managed cats, euthanasia is sometimes an outcome due to unmet owner expectations or the impact of disease management on owners' lives. Thus the main goals of management are twofold:

- To limit or eliminate the cats clinical signs using a treatment regimen that fits into the owners' daily routines
- While avoiding insulin induced hypoglycemia and preventing other complications

On occasion, achieving both of these goals can be difficult. Even the negative impact hypoglycemia can have on cats and the concern this causes owners, it is preferable to prioritize avoiding hypoglycemia at the expense of allowing periods of hyperglycemia . That said, in many cats, it may be possible to achieve good glycemic control safely, particularly with good home monitoring by owners, and this in turn may also improve the prospects of diabetic remission.

Maintaining blood glucose below the renal threshold in most cats avoids osmotic diuresis, May reduce the risk of glucose toxicity, and should help minimize metabolic derangements associated with DM , including the risk of DKA. Further, exogenous insulin therapy and good control of glycemia may result in reduced endogenous insulin requirements and recovery of beta cells which may increase their capacity to regain insulin-secreting ability and ameliorate the effects of glucose toxicity.

Diabetic remission may occur in a proportion of treated cats appears more common in cats with better glycemic control . Early diagnosis, good management and home monitoring of blood glucose may all potentially help improve glycemic control and the long-term outcome.

Hypoglycemia is defined as blood glucose < 3.0-5.0 mmol/ L or 54-63 mg/dl. The lower cutoff should be reserved for use when the accuracy and precision of the equipment being used to measure BG is good . Mild hypoglycemia may be tolerated by the cat and may go unnoticed by the owner, but severe hypoglycemia can be life-threatening and/or result in reactive hyperglycemia.

Role of Diet

Arresting BM Associated pathological weight loss is the first goal of nutritional management . Press, initially diabetic cats should be fed ad-lib or multiple meals per day. However, obesity is associated with insulin resistance and, in the face of obesity, managed weight loss is likely to improve glycemic control and increase the prospects of diabetic remission.

Body weight and body condition should be monitored regularly - preferably every 1 to 2 weeks - in all diabetic cats, by owners at home, or in the clinic if required . Calorie restriction is used to encourage weight loss if the cat is overweight, once moderately good glycemic control has been achieved. Feeding exclusively wet Foods may help with weight loss, as wet food consumption tends to reduce calorie consumption compared with dry Foods. Additionally, using what foods may increase total water intake, which may be a value in diabetic cats. close monitoring of BG and Insulin requirements is recommended during any of weight-loss.

Improved management of cats with DM is likely with restricted dietary carbohydrate. 2 randomized controlled studies suggest a potential benefit of lower carbohydrate diets, higher diabetic remission rates and improve glycemic control being reported. Note, however, that it is impossible to adjust only 1 element of a diet. Although the optimal dietary carbohydrate content has not been determined, diets with restricted carbohydrate (less than or equal to 12 percent metabolizable energy or 3 grams per hundred kcals has been suggested) most wet cat foods and therapeutic dry cat foods formulated for management of DM are low in carbohydrate. Other cat foods with a higher carbohydrate concentration, including most dry Foods, are not recommended as first choice diets for diabetic cats.

Studies suggest that both the amount and type of carbohydrate in the diet are important determinants of postprandial insulin and glucose concentration in cats; and when it occurs, postprandial hyperglycemia may also be prolonged . Although low-carbohydrate diets designed to manage DM or therefore the preferred option, good control of DM . Although low-carbohydrate diets designed to manage DM are there for the preferred option, would control of DM can still be achieved with insulin therapy and higher carbohydrate diet, so alternative diets may be used if clinically indicated. (do for example to comorbidities)

The optimal feeding regimen for cats with DM has been poorly investigated. However, based mainly on studies in healthy cats, when feeding a low-carbohydrate diets and 1 with complex carbohydrates, it appears that the timing of meals does not need to be matched to insulin injections, as clinically relevant postprandial increases in BG are unlikely. In practice, as postprandial changes ain glucose may be uncertain, and to reduce possible diet-related increases in glucose, some clinicians prefer to

ensure cats are fed at the same time as they receive insulin injections for some owners, injecting the cat while it is eating may also be easier.

Frequency of feeding is likewise not critical, continuing the normal frequency for the individual cat is generally advised. (Assuming a minimum of 2 meals a day) ad lib feeding may be acceptable for some cats, but especially with obese cats daily food allowances should be accurately measured .

Where food is withheld and depending upon the diet consumed, there may be no significant effect on the morning BG concentration . Nevertheless, it is safer to administer 50% of the normal insulin dose and then monitor BG, supplementing with additional insulin or glucose as required.

Oral hypoglycemic agents

While oral hypoglycemics are often used in type 2 diabetics in human medicine, there is no good evidence to support their use in preference to insulin therapy in cats. The main indication for using an oral hypoglycemic is when owners initially refused insulin treatment. Currently, glipizide is the only agent with sufficient evidence to support its use as sole therapy in cats. Owners frequently change to insulin treatment when Glipizide is found to be ineffective. This transition can often be achieved within a few weeks; earlier being valuable to avoid missing the window of opportunity for reversal of glucose toxicity and achieving diabetic remission .

Insulin

There are many insulin formulation available worldwide some specifically licensing cats, which can be used to manage feline DM safely and effectively, especially when combined with an appropriate diet. The choice of insulin used by a clinician will depend upon availability, familiarity, and the properties of the insulin itself. Additionally, in some countries, regulations May limit the first line choice to certain Veterinary registered products.

Insulin preparations available worldwide and suitable for long-term use and cats with DM fall into 3 main groups:

- Medium acting insulins - Lente or insulin zinc suspension , for example Veterinary licensed Caninsulin/Vetsulin. Typical Peak activity in cats is 2 to 8 hours post injection. Typical duration of effect in cats is 8 to 10 hours

- Longer acting insulins - protamine zinc insulin PZI or Veterinary licensed ProZinc have a typical Peak activity in cats 2 to 6 hours post injection. Typical duration of effect and cats is 13 to 24 hours although few Studies have specifically evaluated the veterinary licensed recombinant human product ProZinc

- Longer-acting insulin analogs - insulin glargine (Lantus) and Insulin detemir have typical Peak activity in cats at 12 to 14 hours . Typical duration of effect in cats is 12 to greater than 24 hours.

The pharmacokinetics of these insulin preparations varies between insulin type, individual cats, and between different formulations of the same type. Additionally, the pharmacokinetics are influenced by the methodology used in different studies. While no available insulin shares the same amino acid sequence as feline insulin, production of anti-insulin antibodies does not appear to be a significant clinical problem in cats.

Although in many pharmacodynamic studies of healthy cats , insulin glargine and detemir I’ve been want to have a duration of activity of over 24 hours. There is evidence from alternative studies that

they're true clinical duration of activity may be closer to from 10 to 16 hours. While comparative studies for PZI have not been done. Additionally, while a clear BG nadir is seen in some cats with these longer acting insulin analogs, a much smoother curve is seen in others. Insulin glargine, insulin Detemir and PZI last longer in cats than lente insulin . Us the former are likely to provide better control of diabetes when used twice daily. Additionally, longer-acting insulin preparations May produce a more gradual decline in BG following injection in many cats .

Recommendations for insulin

Although good control of DM can be achieved in cats with both intermediate and long acting insulin preparations, and definitive comparative studies and diabetic cats are lacking, given current knowledge of the pharmacodynamics of insulin preparations in cats , it is recommended whenever possible to use longer-acting insulin preparations (glargine, detemir, PZI) injected twice daily, for optimal diabetic control.

Rigid adherence to a 12-hour Lee injection schedule, although ideal, will be unachievable for many owners. Allowing flexibility with dosing and/or simply missing an insulin injection when work or social commitments preclude dosing at the correct time are acceptable compromises.

The primary goal of therapy is to minimize clinical signs associated with DM . For specific aims of insulin therapy can be defined as:

- To control blood glucose 2 less than 14 millimoles per liter or 252 milligrams per deciliter or as much of a 24-hour period as possible and
- To avoid clinically significant hypoglycemia at all times

If control with twice-daily administration of insulin is proving difficult, the possibility of more frequent insulin dosing and/or use of different preparation should be considered.

Many insulin preparations contain 100 units per ml, while others such as Vetsulin and ProZinc are formulated to 40 units per ml which can be helpful for accuracy of dosing with the syringes and cats . It is essential to ensure that insulin syringes or pens are used that are appropriate for the insulin concentration being used.

And you factors often state that, once opened, insulin vial should be discarded after 4 to 6 weeks. With careful handling and refrigerated storage, it has been suggested that at least some insulin preparations can be safely used for between 3 and 6 months. However, any deviation from manufacturer's recommendations should be undertaken cautiously. If insulin is ever stored and used for longer than recommended, considerable care is needed as repeated needle puncture renders the vials vulnerable to contamination and owners must be advised to discard insulin if it becomes discolored or more cloudy than usual .

Initial management

Starting dose of an intermediate or longer-acting :insulin preparation in a nonketotic cat is generally:

- 0.25 to 0.5 units per kg every 12 hours
- The dose is rounded down to the nearest unit and is generally around 2 units per Cat every 12 hours
- The higher dose of 0.5 U/kg may be appropriate if BG is > 20mmol/l or 360 ml/dl

- Obese and underweight cats should be dosed according to their estimated ideal weight and not their current weight

Because hyperglycemia itself causes insulin resistance and beta cell dysfunction, successful treatment May reduce insulin requirements after a variable period of time . Early monitoring of BG is thus aimed mainly at identifying hypoglycemia which might require a reduction in insulin goes. Increases in insulin doses, if required, should be made on the basis of persistent clinical signs supported by assessment of glycemia.

Doses should generally not be increased more frequently than every 5 to 7 days. Rapid escalation in dose is a common cause of hypoglycemia, rebound hyperglycemia , and poor control.

Most cats with uncomplicated DM (clinically well with no DKA or other major complications) are best initially managed at home with insulin and dietary therapy. Some veterinarians and owners prefer to manage the cat in the clinic for the first few days, to help ensure severe hypoglycemia does not develop and to assess the initial response to insulin. However, owners should be made aware that stabilization would not be achieved within these first few days .

In preparation for the cats discharge from the clinic, the owner should be educated in the technical aspects of treating a diabetic cat. This should include detailed instructions and demonstrations about:

- Transition to optimal diet and feeding
- Using insulin syringes and/or insulin pens
- Correct handling, storage, and injection of insulin
- Clinical signs of hypoglycemia and how to treat low glucose concentrations

Written instructions for the owner are invaluable. Additional web-based owner resources are also available.

5 to 10 days post discharge

Cat should be re-examined in the clinic, either after it has received food and insulin at home, or before the insulin doses do if the cat eats well 1 hospitalized. A thorough physical examination should be performed, the history of clinical response at home, including home records of daily water intake, urine glucose testing, and so on, reviewed and laboratory parameters re-evaluated as needed. A blood glucose curve should be performed where possible and appropriate. Ideally PG is measured every 1 to 2 hours for Lente insulin and every 3 to 4 hours for longer-acting preparations for at least 12 hours , bearing in mind that Bg can vary from day-to-day with individuals. As cats are prone to stress hyperglycemia, the accuracy of data generated from in-hospital curves is questionable. Serum fructosamine measurement and/ or reuse of home measured blood glucose can therefore be helpful. Some clinics use a continuous glucose monitoring system to evaluate the response to insulin. This can reduce the risk of stress hyperglycemia induced by repeat sampling for Bg Palma allow detection of brief periods of hypoglycemia and facilitate overnight BG monitoring. Continuous glucose monitoring systems can also be used in the home, but owners must be able to take blood from the cat for calibration of the machine. The dorsal neck may be the most appropriate site for sensor placement. Insulin adjustments are made according to results of clinical monitoring, BG concentrations and clinical signs .

3 weeks post discharge

Hat is re-evaluated as previous with a blood glucose curve performed at home or in the clinic. Home monitoring of blood glucose should where possible and appropriate be discussed with the owner and support materials provided.

The use of home monitoring of blood glucose helps provide more control over the disease, aids in the identification of hypoglycemia and may provide better glycemic control. Although not all owners are able to perform this task, it can be successfully undertaken by most, with sufficient support, and should ideally be introduced early in the management of DM .

An experienced technician or veterinarian should teach capillary or marginal are vein blood sampling using a lancing device and a portable glucose meter validated for use in cats, during an extended consultation. Blood may be obtained interchangeably from the pinnae, the metacarpal or metatarsal pads and the procedure is well tolerated by most cats. Printed and web-based resources should be made available to owners. A home blood glucose curve can be obtained by measuring BG before the morning insulin injection, and every 2 to 3 hours for 12 hours or hourly if hypoglycemia is suspected. However, owners must be counseled not to make decisions regarding insulin dosage without discussion with the veterinarian.

Intensive management of DM

Intensive management of BM has been described using regular home monitoring blood glucose , generally a minimum of 3 and on average 5 blood glucose samples daily, and appropriate adjustments of insulin . The aim is to maintain tight control of blood glucose concentrations and thus keep BG closer to the physiological range.

There is some evidence from 2 small studies using twice-daily glargine injections in diabetic cats that tighter control of BG may be more likely to result in remission of DM. there is also some evidence that the longer-acting insulin analogs, glargine and detemir, maybe less likely to produce clinical hypoglycemia when aiming for tighter control of Bg although good comparative studies are lacking.

Studies involving intensive management of DM I’ve often recommended aiming for a B g concentration between a low of 2.8-3.0 mmol/l (50-54 mg/dl) and a high of 5.5-11.1 mmol/l (99-200 mg/dl) throughout a 24-hour period. Every day may not be suitable for many owners of diabetic cats. Newer technology using wearable blood glucose monitoring systems , especially those connected to smartphones may provide a reasonable pathway to tighter control .

Long term management of the diabetic cat

Monitoring at home

Information provided by the cat owner is highly valuable in the assessment of diabetic control and is especially important if repeated BG monitoring is unavailable, financial limitations may make monitoring infeasible . Owners should be encouraged you keep a diary and record the cat’s :

- Daily overall well-being in particular demeanor and activity
- Daily water intake average BG corresponds with 24 hour water intake and reductions in water intake are a useful clinical marker of response to insulin therapy. Dietary and environmental factors, in addition to any disease state. In general, cat’s fed a wet diet will have a higher total water intake than those fed a dry diet, although the volume of water consumed voluntarily maybe lower. For these reasons it is impossible set a target daily voluntary water intake in diabetic cats. Owners can be asked to subjectively assess water intake, but accurate monitoring a daily water consumption is helpful .

Using a measuring advice with 10 ml increments can more accurately record consumption. If the water bowl is shared between cats, the total volume consumed by all cats can be measured. If water consumption fails to decrease, or increases after being reduced, then re-evaluation of glycemic control is indicated.

- Daily urine production. Assessment may be subjective , amount of urine in the litter tray, size/number of urine-soaked clumps of litter or objective by weight of the litter tray before and after urination .

- Daily feeding. Amount and type of food offered and amount of food eaten.

- Daily insulin administration with time and dose

- Weekly body weight and body condition score ideally using a baby scale or similar accurate device

- Urine glucose monitoring may be particularly helpful if owners are unable to perform home monitoring BG. Urine can be collected throughout 1 day per week and owners can use a urine dipstick with pooled urine or with wet urine soaked litter. Results should be interpreted cautiously and owners advised not to alter the dose of insulin based on results without prior discussion with their veterinarian . Nevertheless, persistent glucose urea suggest inadequate control, while persistent lack of glucose can reflect variously excellent glycemic control, diabetic remission, or insulin overdose, and further evaluation is required . Urine ketone should also be evaluated suggesting poor glycemic control.

- Blood glucose Where good home monitoring of BG is possible, ideally the following should be performed and recorded in the diary :

o Blood glucose curve weekly until stable and then every 3 to 4 weeks

o Blood glucose spot checks if the owner is concerned. If intensive management of DM is attempted several daily BG checks may be performed

o Where less frequent home monitoring of BG is possible, following may be performed and recorded in the diary :

- Less frequent blood glucose curves , for example every 2 to 6 weeks and / or
- Spot BG check anytime the owner is concerned and/or
- BG measurement prior to insulin dosing as frequently as it’s practical

Together, some or all of these measures may be useful for owners who find performing repeat blood glucose curves difficult or stressful. If blood glucose is measured prior to insulin dosing, insulin can be withheld or a lower dose administered whenever a low reading is obtained, helping to avoid hypoglycemia. Again, owners must be advised not to adjust your insulin dosage without discussion with their veterinarian

Monitoring in the clinic

Frequent re-evaluations are required initially to slowly titrate the insulin dose, to detect diabetic remission, and to identify “difficult to stabilize” cats that require further workup. The frequency of clinic visits will depend mainly on the response to treatment and the owners ability to perform home monitoring Bg .

For in clinic monitoring a guide would be assessment at 1 , 2-3, 6-8,10-12 and 14-16 weeks after initiating treatment. Frequency of clinic reexaminations can then generally be reduced to approximately every 1 to 4 months depending upon how stable the cat is and the

conscientiousness/ability of the owner with regard to home monitoring . If diabetic remission seems likely, more frequent checks may be appropriate.

Each re-evaluation will vary according to clinic needs from may include:

- Review of Owners Diary
- Body weight and body condition
- Physical examination
- In clinic blood glucose curve to commence after the owner first gives insulin and food at home. this may be desirable if home monitoring of BG is not regularly performed.
- Measurement of serum fructosamine

Adjusting insulin therapy

Clinical signs and Bg measurements at home or in clinic taking into account their limitations are the most important parameters on which to base adjustments in insulin dose. If clinical signs such as PU/PD have resolved and body weight is stable, cats are usually well controlled , although some may also be overdosed. Conversely, persistent clinical signs and weight loss suggest poor glycemic control and/or comorbidity.

If there is a discrepancy between clinical signs and results of a blood glucose curve, treatment decision should err on the side of caution , fructosamine concentration should be re-evaluated and a blood glucose curve be repeated after a few days before any treatment decision is made .

Bring the first 3 to 4 months of therapy the veterinarian should interpret blood glucose curves and make decisions on treatment adjustments . However , with support from the veterinary health care team, during long-term management owners may gain sufficient experience to make slight insulin adjustments on their own, according to written guidelines. Postage adjustments should be made no more than every 5 to 7 days except in the case of hypoglycemia, to allow for equilibration to a new insulin dose .

During initial stabilization the insulin dose should be increased gradually and steps of 0.5 to 1 point 0 unit every 12 hours until the glucose nadir is 4.5-8.0 mml 0r 80-144 mg. if the glucose meter is in the desired range but the duration of insulin effect is consistently less than 8 to 10 hours and there are clinical signs of inadequate glycemic control, the cat should be switched to a longer-acting insulin preparation.

Ideally a blood glucose curve should be performed 5 to 7 days after any adjustment and Insulin dose or change in insulin preparation. However a blood glucose curve should be repeated sooner where there is a higher risk of hypoglycemia or a pre injection glucose of <8 mmol/l or 144 mg/dl. Where blood glucose curves are not possible, insulin adjustment should be made with extreme care. Those should be increased in very small steps no more than every 7 days until clinical signs resolved and glucosuria is negative or reduced to trace amounts . Serial fructosamine concentrations should also be measured.

Most cats ultimately require insulin doses between 0.5 and 6 .0 units per Cat every 12 hours for diabetic control. If the dose is greater than 1 point 5 units per kilogram every 12 hours investigation of causes of insulin resistance should be considered.

Diabetic remission

Action and management of diabetic remission can be challenging. If urine is persistently negative for glucose, all BG measurements are within the normal range \ and/or serum fructosamine is less than 350 µmol/l, the insulin dose should generally be reduced by 0.25 to 1 unit per Cat every 12 hours every 1 to 2 weeks . There's a low or low normal BG concentrations, more rapid reduction or temporary withholding of insulin therapy may be required.

When a dose of 0.5 units per cat per day is reached and b.g. Remains normal, insulin administration should be discontinued. If – glucose urea and / or you glycemia are maintained for 2 to 4 weeks without insulin, the cat has likely achieved remission.

If BG measurements cannot be made, and remission is suspected in a well regulated cat without glucose urea, the insulin dose may be slowly reduced I 0.5 to 1 unit per Cat every 12 hours every 1 to 2 weeks, either until clinical signs or glucosuria reappear, or until insulin administration can be discontinued.

Cats in remission should remain on a low carbohydrate diet and should be monitored closely for recurrence of clinical signs. Regular b g my twice-weekly initially, are also recommended and can be performed by the owner at home where possible.

Complications

Diabetic ketoacidosis

Not all cats with ketonemia and ketonuria will be suffering from DKA, a cat with DKA will have a low blood pH and will be unwell. Ketotic non acidotic cat can be managed in the same way as a nonketotic cat , but if DKA is present immediate hospitalization with intensive treatment and monitoring is required . The main objectives and treatment are to:

- Correct dehydration and electrolyte deficits
- Correct acidosis
- Provide adequate amounts of insulin to normalize intermediary metabolism, gradually stop ketogenesis and reduce hyperglycemia
- Provide parenteral carbohydrate Source in vomiting animals or when required during insulin treatment
- Identify precipitating factors such as infection

For these cats, a short-acting insulin preparation is generally given intramuscularly or this infusion. If regular / soluble insulin is not available, has been suggested that glargine may also be given IM or intravenously, although good data on its efficacy by these routes is currently lacking. When the cat is stabilized, insulin treatment is changed to a longer-acting insulin bv given via the subcutaneous route and the cat is managed as a stable diabetic.

Hypoglycemia

Hypoglycemia (BG <3.0mmol/l or 54mg/dl)maybe more common in diabetic cats than dogs, can be life-threatening and should be treated rapidly. Owners should be advised on signs – seizures, recumbency, anorexia, vomiting, ataxia, lethargy – and home first aid treatment including liberal

application of honey or glucose to mucous membranes. Ideally, owners should keep dextrose gels available at home in case of hypoglycemia .

Severe hypoglycemia appears to be more common in cats receiving ghost is of insulin greater than 6 units per cat and requires in clinic management with parenteral glucose supplementation . A 50% extra solution should be diluted 1:2 and then initial dose of 2-4 mls IV over 5 to 10 minutes. blood glucose should be monitored and further dextrose Administration given to affect. Euglycemia should result in Rapid clinical Improvement, but treatment should still be followed with a 5% dextrose constant rate infusion adjusted to maintain normal glucose with BG being closely monitored. Insulin antagonists, such as corticosteroids llama or a glucagon CRI may also be used. With insulin therapy needs to be reinstituted, or should be done cautiously, with very close monitoring .

Unstable diabetic

While he tailed discussion of the unstable diabetic cat is outside the scope of this presentation , clearly any unstable diabetic should undergo further investigation. The precise nature of this may vary according to the problems encountered, and the presence of other known or previous concurrent diseases or comorbidities .

Investigations to consider include:

- Insulin storage and administration
- Diabetic history including starting dose of insulin, type of insulin, duration of effect t' and BG nadir
- Over what time. Insulin has been increased and by how much
- Blood glucose curves
- Fructosamine results
- Monitoring of clinical signs, body weight change, dietary history, and any other medications that the cat is receiving
- Assessment for concurrent disease, to include consideration of a comprehensive workup indicated by clinical signs
- Feline pancreatic lipase assay
- Evaluation for acromegaly via insulin-like growth factor- 1 assay
- Evaluation of thyroid function and adrenal function

RESOURCES

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3.1.3. Management of Hyperthyroidism

Elizabeth J. Colleran DVM, MS DABVP (feline specialty)

Feline Hyperthyroidism (FHT) it Is often cited as the most common endocrinopathy in cats. It first became apparent about 35 years ago when initial reports appeared in the literature However, different studies have used different measures of disease rates, and there are also likely to be geographical differences in disease occurrence. It was apparent that this was a “new” not just an undiagnosed disease because studies within the prior decade showed a very low incidence of thyroid adenomas in cats. The prevalence of FHT has increased steadily worldwide and constitutes the most common endocrine disorder in middle-aged or older cats in the United States.

Histopathology, shows that most hyperthyroid cats suffer from a form of toxic nodular goiter similar to Plummer’ s disease seen in man. This is a benign condition in which growth and function are autonomous. To date, there are no known reports of cats exhibiting thyroid auto-antibodies as our present in Graves’ disease in humans.

The majority of hyperthyroid cats have bilateral disease. There is an increased in the functional thyroid hormones, thyroxine (T4) and triiodothyronine (T3) due to benign thyroid adenoma or adentomatous hyperplasia. Early experience indicated that removal of a functional adenoma on one side might be followed by development of a contralateral one. If ablative surgery or radioiodine was not chosen for management of the initial mass, scintigraphic evidence suggested that the adenoma could continue to grow, possibly leading to malignancy as occurs in human patients. Of importance to the veterinary practitioner only 2% of hyperthyroid cats have malignant carcinomas at the time of initial diagnosis.

A clear picture of the causes of FHT has not emerged. Multiple factors play a role but the relative importance of each is unknown. Genetics may influence susceptibility. In one study, Siamese and Burmese breeds have a decreased risk of developing the disease. Changes in husbandry since the 1970s to the present day, including a higher percentage of indoor cats, increased utilization of commercial cat food and longer lifespan may influenced prevalence.

Epidemiologic studies have produced a list of compounds which may be associated. Phenols from the lacquer linings of pop-top canned cat food released during the heating process may increase risk. Fish consumption has been associated (and not) depending upon the study selected. Soy protein in the diet has been demonstrated to increase thyroxine concentrations in cats. One study found that cats who consumed commercial foods without iodine supplementation are more than four times as likely to develop hyperthyroidism as cats that ate iodine supplemented foods. Environmental factors that have been associated with increased developing FHT include use of insecticidal products such as anti-flea products or fly sprays within the household, herbicides, fertilizers and flame retardants that were introduced into routine use for building materials, electronics, furnishings, foams, and textiles during the 1970s. No studies have prospectively evaluated lifelong exposure to a specific compound, all associations are conjecture and not proven fact.

Because thyroid hormone affects various body systems, the clinical presentation of a hyperthyroid cat can include a variety of signs. Typically they include weight loss, often with increased appetite, hyperactivity and cardiovascular signs. However, as FHT is being diagnosed earlier in its progression clinical signs may be subtle in many cats. A definitive diagnosis of FHT requires demonstration of persistently elevated thyroid hormone concentrations (T4 OR T4 plus free T4 by equilibrium dialysis (fT4ed) occurring concurrently with one or more of the typical clinical signs. (BOX OF CLASS SIGNS) (flowchart of diagnosis)

The hyperthyroid patient is classically greater than eight years old, active with a good appetite and some weight loss. The owner may also notice some degree of polyuria indicated by the need to clean the litter box more often. Drinking behavior patterns may change suggesting increased thirst. Initially, the owner may believe that new food or a diet plan is finally working, that their cat is senile or feeling great and acting young again. A thorough physical exam is important because findings in hyperthyroid cats can vary significantly. Classically, weight loss and muscle loss is most notable over the epaxial muscles. Palpably enlarged thyroid glands are suggestive but not necessarily indicative. Heart murmurs and arrhythmias are often ausculted in FHT. Systemic hypertension is often present.

The identification of hypertension in cats with FHT is critical. Monitoring blood pressure in suspected and diagnosed cats at every visit is optimal. Because of the veterinary setting, most cats will have an elevated systolic blood pressure, thus it may be difficult to distinguish. A complete fundic exam may indicate hypertensive retinopathy and aid in the conclusion of systemic hypertension. Monitoring both blood pressure and retinal anatomy throughout treatment of FHT is important because, if hypertension does not resolve with control of FHT, the cat will require additional diagnostic testing as well as need specific antihypertensive management. Some cats may even develop hypertension after reestablishment of euthyroidism.

For any cats suspected of hyperthyroidism a minimum day database is required to diagnose and identify any potential comorbidities; a CBC, serum chemistry, electrolytes, urinalysis and T4 assay. Definitive diagnosis of FHT may require additional testing, chest radiographs, echocardiography and abdominal imaging will illuminate the extent of nonthyroidal disease.

Diagnosis

Recent publication of hyperthyroid treatment guidelines categorize patients into 5 groups, each of which requires a different approach to diagnosis. While most FHT cases are clear cut, it is useful to consider a more comprehensive approach to identify those more ambiguous cases. (Treatment flow charts)

Hyperthyroidism and chronic kidney disease

Thyrotoxicosis leads to hemodynamic changes throughout the body, many of which specifically affect the kidneys. The Renin Angiotensin Aldosterone System (RAAS) is upregulated by increased thyroid hormone. The resulting increase in heart rate and left ventricular contractility increases cardiac output and overall increased renal blood flow, increased glomerular capillary hydrostatic pressure and increased glomerular filtration rate (GFR). Other pathways upregulate GFR further through feedback mechanisms in renal tubules.

Renal proteinuria is a common finding in cats with hyperthyroidism and cats with CKD. Increases in proteinuria have been hypothesized to occur secondarily to increased glomerular capillary pressure and impaired tubular resorptive capacity of remaining nephrons. Proteinuria is a risk factor for the development of azotemia and the progression of azotemic CKD. Fortunately, the magnitude of proteinuria tends to decrease once the euthyroid state is restored.

Despite suspected renal insufficiency, treatment of FHT should occur along with careful avoidance of a hypothyroid state and treatment of concurrent CKD. Treatment recommendations differ depending upon the degree of underlying renal disease. The presence or absence of azotemia assessed via serum Creatinine (Cr) and Blood Urea Nitrogen (BUN) may be affected by the hypermetabolic state that accompanies hyperthyroidism resulting in increased GFR. Decreased Cr production due to a reduction in muscle mass along with increased GFR can make pretreatment assessment of renal

excretory function difficult and even mask the presence of existing kidney disease if Cr and BUN are the only markers included.

All patients should be staged for renal function based upon International Renal Interest Society (IRIS) guidelines including assessment of systemic blood pressure and presence of proteinuria.

Cats in IRIS stage 1 or 2 categories who respond favorably to reversible treatment of FHT and have stable renal function may benefit by irreversible treatment. IRIS 3 and 4 patients may warrant a more prudent approach to FHT and more aggressive monitoring and treatment support for their kidney disease. To date, no single readily available serum or urinary biomarker is able to predict post-treatment renal function reliably in hyperthyroid cats. Although the successful treatment of hyperthyroidism has the potential to unmask pre-existing CKD, the associated changes in renal function are usually mild. Renal function typically stabilizes within 6 months of hyperthyroid treatment; overall survival of those cats that do become azotemic does not differ from non-azotemic ones. Thus, treatment of hyperthyroidism is recommended with the target total T4 in the middle of the reference range, without creating hypothyroidism. When treating non-azotemic hyperthyroid cats, it is important to remember that increases in serum Creatinine concentrations may occur over several months. Monitoring of renal function every 6 months following restoration of euthyroidism is recommended. When treating cats with evidence of CKD prior to treatment, the decreased survival times associated with pretherapy CKD should be discussed with owners. Continued monitoring of renal function on a regular basis is necessary. In addition, owing to the increased risk of worsening azotemia and poor prognosis in cats with iatrogenic hypothyroidism total t4 concentrations should be monitored for at minimum 6 months after euthyroidism is achieved. Iatrogenic hypothyroidism must be corrected by adjustment of antithyroid hormone medication or thyroid supplementation.

Hyperthyroidism and heart disease

Heart disease is common and hyperthyroid cats, and may or may not be a direct effect of FHT. As with other comorbidities, correction of hyperthyroidism should take place first. Heart disease should be reevaluated once the patient is euthyroid. Correction of the thyroid toxicity and systemic hypertension can improve cardiac disease in some cats. For several months following successful resolution of the hyperthyroid state their can be echocardiographic abnormalities that both emerge and resolve. Serial evaluation of echocardiogram for changes it is useful. N – terminal probrain natriuretic peptide (NT-proBNP) values increase in cats with FHT and in cats with hypertrophic cardiomyopathy (HCM). Typically these values decreased within three months of achieving a euthyroid state. If NT-proBNP remains elevated after three months further cardiac evaluation should be performed. Newly diagnosed, unregulated hyperthyroid cats with concurrent congestive heart failure require simultaneous treatment for both diseases as well as regular monitoring.

Treatment

Hyperthyroidism and cats is a life-threatening disease requiring prompt veterinary attention. After establishing a diagnosis of FHT, the clinician and owner have multiple treatment options. The choice of therapy often depends on factors such as age, comorbidities, treatment cost, and availability of treatment options. The goals of therapy are to restore euthyroidism, avoid hypothyroidism and minimize side effects of treatment. (chart of treatment options from AAFP)

Four common treatment options are available: radioactive iodine, medical management with methimazole or carbimazole, surgical thyroidectomy and dietary therapy using an iodine restricted food. Most clinicians recommend definitive therapy with radioactive iodine, especially if the cat it's

fairly young and otherwise healthy. Hyperthyroid cats at increased risk of complications including those with cardiovascular disease or severe hyperthyroidism, may benefits from treatment with methimazole for definitive treatment with radioactive iodine.

Radioactive Iodine

Radioactive iodine is the treatment of choice for most cats with FHT. the distinct advantages include:

- The potential to eliminate benign thyroid tumors or hyperplastic thyroid tissue with a single treatment
- Treatment of functional extra-thyroid tissue which may occur in 10 to 20% of cases
- No general anesthesia
- Minimal side effects.

Physiologically stable cats respond well. Those with clinically significant cardiovascular, renal, gastrointestinal or endocrine disease may not be good candidates for this approach, especially in light of the time necessary for isolation after treatment.

After administration, the thyroid gland actively concentrates radioiodine, although the physical half-life is eight days, the biological half-life is much shorter generally 1.5 to 4 days. Radio iodine in both beta particles and damn a radiation, the beta particles are responsible for the majority of tissue destruction, but are only locally destructive, traveling a maximum of 2 mm. Therefore, no significant damage to adjacent parathyroid tissue, atrophic thyroid tissue, or other cervical structures occurs. The main limitation two widespread use of radioactive iodine are the requirements for special licensure and isolation of the cat for variable periods after treatment. This can range from three days to four weeks depending upon regional radiation regulations and the dosage ministered. (scintigraphy image)

The goal of treatment is to restore euthyroidism with the smallest possible single-dose while at the same time avoiding development hypothyroidism. Controversy exists as to the best method of calculating the optimum dose for individual cats. No dose selection method guarantees a successful dose. In sight of the various stores selection methods, however, the success rate of a single treatment is very high over 95% in most studies. T4 declines into the reference interval buy 4 to 12 weeks post treatment,. Complete resolution of clinical signs of FHT make take several months. The 5% of cats that do not achieve euthyroidism with the single dose are usually those with larger tumors, more severe clinical signs, higher T4 values or carcinomas. Cats that do not have carcinomas generally respond favorable to a second dose. Conventional low-dose radioiodine fails to cure thyroid carcinomas because malignant cells do not concentrate iodine as efficiently as give hyperplastic or adenomatous cells. A very high dose of radioiodine or a combination of surgical debulking and the high dose is the most successful options for the treatment of thyroid carcinoma.

Depending on the treatment dose of radioiodine, up to 75% MAY become hypothyroid for some interval post therapy. Permanent posttreatment hypothyroidism however is an uncommon sequel. Cats treated with higher doses may experience damage to normal thyroid cells and are more likely to experience posttreatment hypothyroidism that may require hormone replacement. In the majority of cases it is transient, causes no clinical signs and the cat requires no supplementation with thyroid hormone. Up to 30% of cats remain hypothyroid three months after radioiodine treatment, with approximately half of those exhibiting clinical signs or experiencing a worsening renal function and requiring hormone supplementation. Hyperthyroid cats with carcinomas treated with high doses are at the greatest risk of clinical hypothyroidism post therapy. Thyroid hormone replacement may also be needed in cats with current kidney disease.

Between 30–40% of cats with hyperthyroidism have preexisting chronic kidney disease (CKD).

Concurrent CKD and Hypothyroidism

Iatrogenic hypothyroidism has been shown to contribute to worsening of azotemia and shortened life expectancy in cats with preexisting CKD. In hyperthyroid cats with concurrent azotemia, the transient hypothyroidism that follows radioiodine therapy may contribute to additional renal function decline and worsening of the cats' CKD stage.

The purpose of a 2012 study was to evaluate if prevention of this transient hypothyroidism would blunt the progression of azotemia commonly seen following the resolution of thyrotoxicosis in these cats with preexisting CKD. In this study, 195 hyperthyroid cats with concurrent CKD (IRIS stage 2 to 3) were treated with radioiodine (range, 1–10 mCi, median, 3 mCi). Of the 195 CKD cats, 85 cats were discharged on L-T4 (0.1 mg, PO q24 h), whereas the remaining 110 cats served as controls (no L-T4 supplementation). In both groups, total T4, BUN, and creatinine levels were recorded before treatment and then again at 1, 3 and 12 months following radioiodine therapy.

Following successful radioiodine therapy, both groups of cats with preexisting CKD demonstrated increases in serum BUN and creatinine levels that gradually progressed over the 12-month period. However, the percent rise in median creatinine concentrations in the 85 cats treated with L-T4 was significantly less than the rise in the 110 cats not supplemented with L-T4 (12.5% vs. 33.3%; $p < 0.05$). These results suggest that L-T4 supplementation of radioiodine-treated cats with CKD may help limit progression of azotemia, presumably by avoiding the transient hypothyroidism that commonly develops after radioiodine therapy.

The current protocol for treating cats with serum Cr ≥ 2 reflects these findings. These cats should be discharged on 0.1 mg Levothyroxin once daily on an empty stomach. Any medications causing alkaline pH (phosphorus binders, proton pump inhibitors, etc.) in the stomach should be given at another time of the day. TT4, free T4ed and TSH concentrations should be measured in 1 month. If hormone levels are within the normal range, tapering of levothyroxine may commence. If hypothyroid state is persistent, increase dose to twice daily. Further evaluation should take place at minimum 3, 6 and 12 months.

Medical Management

Anti-thyroid drugs can be used long-term as a sole treatment or short term to stabilize the patient before any surgery or anesthesia or if radioiodine therapy is not immediately available. A methimazole trial prior to radioiodine for bilateral surgery may predict the risk of significant renal compromise after definitive therapy for FHT.

Two pharmacologically active ingredients are available as licensed veterinary drugs for treatment of hyperthyroidism, methimazole (Felimazole;Dechra Veterinary Products) and carbimazole (Vidalta; MSD Animal Health). Carbimazole is not currently available in the US but is utilized in other countries. It is a metabolite of methimazole that has a similar mechanism of action, side effects, and dosing. Methimazole acts by blocking thyroid peroxidase thus inhibiting synthesis of thyroid hormone. As in humans, methimazole it Is thought to accumulate in the thyroid gland of cats. In healthy cats, oral methimazole is well absorbed in the pharmacokinetic parameters are not significantly altered by hyperthyroidism.

Methimazole should be started at a dose of 1.25 to 2.5 point five mg per cat every 12 hours. Twice daily dosing is associated with less serious side effects then a higher dose given once a day. After the cat becomes euthyroid with twice day dosing, giving the total daily dose every 24 hours may maintain euthyroidism and increase owner compliance. Transdermal methimazole preparations when

available can be useful for cats who are difficult to pill. In such cases, the same or a slightly higher starting dose than for the oral route should be used.

Most hyperthyroid cats are euthyroid within 2 to 3 weeks of commencing treatment with anti-thyroid drugs. T4 should thus monitored after that time. The cat is still hyperthyroid, methimazole dose adjustment can be made in increments of 1.25 to 2.5 mg/day until euthyroidism is achieved. When maintenance doses in excess of 10 mg per day are required, compliance should be investigated. If T4 drops below the lower end of the reference interval, the methimazole does it should be reduced in decrement of 1.25 to 2.5 mg/day and the T4 and renal parameters rechecked in one week. Treatment with transdermal methimazole can utilize a similar scheme as for the oral form. In cases of local skin irritation, switching to oral administration should be considered.

The most severe, though rare, Side effects observed with methimazole our hepatopathy and marked blood dyscrasias (severe leukopenia, anemia and thrombocytopenia). Gastrointestinal upset, lethargy, and facial pruritus occur at the variable frequency. Occurrence, frequency, and severity of side effects have not been shown to be dosed related. Gastrointestinal upset maybe less frequent with transdermal preparations. Most side effects appear within the first 4 to 6 weeks of therapy and are less common after two or three months of treatment.

Almost all hyperthyroid cats treated with methimazole will experience successful control of their disease. T4 responds to methimazole administration within one week of treatment. However, wonderful response to therapy may not be seen until T4 is maintained within the reference interval for 2-6 weeks. Because methimazole does not destroy hyperplastic or adenomatous thyroid tissue, abnormal tissue Will progressively grow overtime if methimazole is used as a long-term treatment. The size, volume, and number of functional thyroid nodules will increase proportionally with the duration of disease, so that the dose of methimazole necessary to control thyrotoxicosis may need to be progressively increased. Eventually, some cats will not tolerate the dose of methimazole necessary to control FHT or will become completely resistant to methimazole therapy, necessitating an exploration of alternative treatment methods.

Surgical thyroidectomy

Thyroidectomy is an established surgical technique that may be curative. Surgical options include bilateral thyroidectomy within intracapsular or extracapsular approach, unilateral thyroidectomy (reserved for cats with true unilateral disease) and staged bilateral thyroidectomy. Surgery and anesthesia are sometimes associated with substantial procedural morbidity and mortality. Hypocalcemia occurs in a widely varying range (6-82%) of thyroidectomy patients depending upon the surgical method elected. In cats that have had unilateral or bilateral thyroidectomy with careful preservation of the parathyroid glands, hypocalcemia maybe mild and transient and require no treatment. Severe hypocalcemia associated with hypoparathyroidism maybe transient (lasting days weeks or months) or permanent. Other complications of thyroidectomy include Horner's syndrome, laryngeal nerve paralysis and recurrence of hyperthyroidism.

If the surgeon fails to remove all abnormal thyroid tissue, the cat will require revision surgery. Technesium Imaging prior to surgery Will decrease the number of subtotal thyroidectomies by revealing multinodular disease and bilateral involvement. Imaging will also identify cats with ectopic tissue or a large void or that descends through the thoracic inlet into the chest.

In cats with substernal disease, surgical removal maybe difficult. Approximately 4 to 9% of hyperthyroid cats have adenomatous tissue in a topic sites (sublingual or substernal sites are most common) which a surgeon would likely miss at surgery.

Surgical thyroidectomy is associated with a high rate of both short and long-term success with most studies showing greater than 90% of cats achieving euthyroidism postoperatively and relapse rate

approaching only 5% within three years. The success of the procedure is highly dependent upon presurgical stabilization of the patients and the surgeons expertise. Because of the short half-life of T4 in cats, euthyroidism usually occurs within 24 to 48 hours of surgery. Unilateral thyroidectomy is associated with transients hypothyroidism that resolves within 1 to 3 months as remaining thyroid tissue recovers function. Bilateral thyroidectomy may result in clinical hypothyroidism that requires hormone supplementation. Persistence or recurrence of postsurgical hyperthyroidism is associated with incompletely removed abnormal tissue.

Dietary therapy

Production of thyroid hormone requires uptake by the thyroid gland I've sufficient amounts of dietary iodine. The only function of ingested iodine is for thyroid hormone synthesis. This finding led to the hypothesis that limiting dietary iodine intake could be used to control thyroid hormone production and potentially manage FHT. A restricted iodine diet (Hill's prescription diet Y/D feline; Hill's Pet Nutrition) containing 0.2 ppm (mg/kg) iodine on a dry matter basis is currently available for the management of FHT.

With good client compliance, 75% of cats have significantly reduced T4 and improvement of clinical signs within 28 days of starting the diet. Normalization they require up to 180 days in caps with severe elevations in T4 and some fail to reach euthyroidism. In a one year study, 83% of hyperthyroid cats went into remission on the diet.

A limitation of a restricted iodine diet his lack of palatability, affecting up to 12% of cat studied. Dietary management maybe difficult or contraindicated in the following settings:

- Patients in multicat households
- Hyperthyroid cats with concrete disease requiring other nutritional management
- Cats taken compounded flavored medications or supplements that contain iodine
- Indoor-outdoor cats

The long-term consequence of a restricted iodine diet in hyperthyroid cats is unknown. The iodine concentration of the restricted diet is lower than the iodine requirements of euthyroid adult cats. This may not cause problems because cats fed and even more iodine restricted diet for one year did not show signs of deficiency.

In addition to efficacy in restoring euthyroidism, three studies showed reductions in serum Creatinine concentrations together with stable or increasing bodyweight in hyperthyroid cats eating the iodine restricted diet. The mechanisms behind these effects are currently unknown.

A cat may undergo surgical excision of the thyroid tumor while on an iodine restricted diet but if an owner subsequently wants to undergo Radioiodine therapy, the optimum withdrawal time from the diet is unknown. Limited iodine diet increase iodine uptake in the autonomous thyroid glands of hyperthyroid cats. Further studies unnecessary to determine whether consumption of a limited iodine diet changes sensitivity of the thyroid gland to radioiodine treatment.

Monitoring

Monitoring of cats with hyperthyroidism is intended to measure effective control of disease and to avoid iatrogenic hypothyroidism. Close monitoring of hyperthyroid cats as they become regulated will

allow for recognition of comorbidities and either exacerbation or improvements of already identified concurrent disease.

Regardless of the treatment method a valuation of multiple parameters when monitoring newly diagnosed and treated hyperthyroid cats will optimize the cat's healthcare. Weight gain, improved body condition score, improved hair coat, resolving tachycardia and resolving behavioral changes are all positive indicators of improved thyroid hormone secretion. Complete blood count should be monitored for side effects when using methimazole or carbimazole. Renal parameters should be monitored including regular urinalysis.

Initial follow-up testing after starting treatment should occur at 2 to 4 weeks. Subsequent testing as recommended after any change in dose of medication. Stable, uncomplicated hyperthyroid cats are then monitored every 4 to 6 months via T4 assay, CBC, chemistry/electrolytes and urinalysis. Cats with concurrent disease may require other laboratory testing or imaging at a different monitoring interval. Clinical improvement in hyperthyroid cats can be expected when T4 levels are within the reference interval.

Prognosis

Although older studies report survival times of two years after diagnosis, more recent data shows the cats without concurrent CKD have a median survival of up to 5.3 years. Better awareness of the disease, routine screening tests and a variety of readily available treatment options have resulted in extending lives in a properly managed case. Untreated FHT is a progressive disease that can lead to significant morbidity and mortality. Morbidity and mortality in the well-managed hyperthyroid cat are more strongly influenced by the presence and severity of comorbid disease then by FHT itself.

FHT secondary to thyroid carcinoma carries a slightly less favorable prognosis than hyperplasia or adenoma due to the pathology of neoplastic disease. However, with appropriate treatment, even cats with thyroid carcinomas often die from unrelated nonthyroidal illness then from consequences of their thyroid tumor.

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3.1.4. UPDATE ON FIP: REASONS FOR OPTIMISM

Elizabeth J. Colleran DVM, MS, DABVP Feline Specialist

American Association of Feline Practitioners

Chico Hospital for Cats

Chico California

Feline Enteric Coronavirus. (Fecv)

Feline enteric coronavirus is an enveloped single strand RNA virus that is associated with asymptomatic, persistent and enteric infections. It is found worldwide and is ubiquitous in domestic and wild felines. There are 2 serotypes: 80% to 95% are serotype 1 (cat-like), 5% to 20% are serotype 2 (dog-like). Serotype 2 has a higher incidence in Asia than in North America and Europe. Clinically inapparent infection of kittens can start after weaning at 9 to 10 weeks of age. Virus shedding in feces, can persist for many weeks months or longer. Fecal-Oral transmission is facilitated by shared litter boxes. The virus displays tropism for the mature, apical epithelium of the lower intestine. Immunity develops slowly. Immunity is lost after shedding ceases, and recurrent infections are common.

Kittens can make IGM antibody and mount cell mediated immune responses from birth. IGG and IGA antibodies are absorbed from colostrum during the first few hours of life. Passive, systemic immunity results, from IGG and IGA from colostrum. Passive local immunity is derived from IGG and IGA antibiotics in the milk. Passive, systemic and local immunity protects kittens until their immune system matures. IGG and IGA production does not start until passive antibody is gone at 6 to 8 weeks of age. Kittens' immune systems do not reach adult levels until 12 to 16 weeks of age.

Kittens born to FECV exposed Queens, will have maternal immunity until 9 weeks of age. Primary infection will evoke both a systemic and a local antibody response. IGA goes from blood, transmitted across the intestinal epithelium into the mucus. There is no evidence of cell mediated immunity or any changes in lymphocyte populations. The IGA antibody response slowly leads to the cessation of virus shedding. Antibody titers wane as virus, shedding, ceases and cats, become susceptible to reinfection. Immunity to FECV infection is transient and recurrent infections are common.

Feline Infectious Peritonitis Virus. (FIP)

FIP arises from FECV, infection by mutation. FIPVs occur in regional lymphoid tissues of the lower intestine and 10% of FEC V, infected cats. Mutations result from positive selection pressures favoring replication in macrophages. FIPVs acquire tropism for peritoneal macrophages and lose tropism for intestinal epithelium. Tropism change results from mutations in Spike s and accessory 3C genes. FIP V mutation is unique to each cat. If FIPVS are strictly cell associated and local and systemic spread is in monoocytes and macrophages. FIPV is confined to infected macrophages which are not spread from cat to cat. There are rare cases of cat to cat spread (epidemic form) Serotype II FIPV.

FEC, be infections occur in virtually all cats and kittens. FECV to FIPV biotype conversion, occurs in eleven percent of cats. Only 1 in 10 to 1 in 30 cats with mutant viruses develop FIP. Worldwide feline mortality among all cats due to FIP is thought to be point 3 percent to 1.3 percent. FIP favors, multi-cat environments: Catteries, foster homes, rescue groups, shelters and cats living in dense, urban areas. if there is additional stress in these environments, the odds of FIP occurring increases. 95% of

cases occurring cats, less than 7 years of age. 70% in cats less than 1.5 years of age. 50 percent in cats, less than 7 months of age. Pedigree Cats have 3 times greater incidence of FIP than random bred cats. Males are slightly more susceptible.

Pathophysiology

Macrophages are infected by immune complex, virus through their FC receptors. FIP is typical of other macrocphage infections, such as tuberculosis, leprosy , and deep mycosis. FIP is mediated by cytokine responses of infected macrophages. Th 1cell mediated cytokine responses are protective. Protective immunity is innate at onset and then becomes adaptive. Failure to establish protective immunity leads to th2 inflammatory response and disease. Affected cats have delayed apoptosis of infected macrophages, allowing for increased virus production. The incubation period from first replication in macrophages, to clinical disease is days to months. The actual disease course, varies from days to months and rarely a year or more. Once typical disease signs appear, historically, fewer than 5 percent of affected cats have survived to 1 year.

There are 2 major disease forms effusive and non-effusive. Wet and dry FIP Resemble the lepromatous and tuberculoid forms of human leprosy respectively. The 2 forms of FIPV are dependent on the relative balance of cellular and humoral immune responses. Wet FIPV is characterized by a predominance of immediate hypersensitivity reactions, vasculitis, And high levels of virus replication and macrophages. Dry FIP is characterized by a predominance of delayed hypersensitivity reactions and low levels of virus replication in macrophages. The disease form in a cat, may change from wet FIPV to dry FIP, or dry to wet during the course of the illness.

Diagnosis

In most cases a diagnosis of FIPV can be made by obtaining a complete history and performing a thorough exam of the patient and using the following diagnostic tools to build a diagnostic wall" brick by brick.

- High index of Suspicion and playing the odds.
- Signal meant age, breed origin Typically shelter / sanctuary or other dense multi-cat situations.
- Sudden loss of activity, lethargy, anorexia weight loss.
- Failure to thrive. Smaller than normal, poor hair, coat thin.
- Recent stressful event: Vaccination, surgery, new home, relinquished to a shelter or foster home, other illnesses.
- Physical exam and presence of signs associated with FIPV: Jaundice, ascites, pleural fluid uveitis or retinitis neurologic sign, palpable abdominal masses.

Basic nondefinitive tests.

Complete, blood count may show anemia of chronic disease Leukocytosis or lymphopenia. Serum proteins Often have a total protein high with albumin and globulin, an Albumin:globulin, ratio of less than 0.6 With the lowest albumin:globulin ratios tending to be in cats with wet FIPV, rather than dry. Bilirubin is elevated, in 21% to 63% of FIPV cases, often without marked elevation in hepatic enzyme activity. Feline coronavirus antibiotics Titer cannot determine if antibody titers are against FECV or

FIPV. Abdominal and or thoracic effusions, maybe, yellow tinged, mucinous with partial clots., cloudy, containing non-degenerate neutrophils, monocytes, macrophages, or large foamy mcrophages and lymphocytes. Fluid protein may be 2 to 10 plus grams per deciliter. A Rivalta Test, should not replace a complete fluid analysis. but the test is inexpensive and easy to perform. Images for evidence of effusion and or organ and/or central lymph node, involvement include radiographs, abdominal ultrasound, MRI scans, with contrast and complete ophthalmic exam.

Definitive diagnosis occurs, when FECV / FIPV RNA is identified in effusion or diseased tissue. Histopathologic or microscopic appearance of lesions is not pathognomonic unless combined with the rest of the clinical picture. Immunohistochemistry positive for Coronavirus antigen in macrophages within effusions of diseased tissues. Polymerase chain reaction (rt-PCR) must have enough FIPV RNA in the effusion sample. FCOV 7b RNA PCR Is most sensitive. FIPV s mutation RNA is less sensitive. Positive 7B RNA test is diagnostic, even if the S mutation test is negative. PCR on blood is not highly sensitive. If you confirm the presence of FIPV virus antigen or RNA within peritoneal type macrocephages within typical effusions or lesions, you have made a definitive diagnosis. However, this is compounded by all the false negative test results that are made by laboratories using poor techniques, or that have been given non-representative samples.

Treatment

Current non-FDA-approved, antiviral drug status. FIPV is now considered a curable disease. Anecdotally, thousands of cats worldwide have been treated and possibly cured with antiviral compounds. Reversal of severe signs for both wet and dry forms of FIPV Can be seen within days of starting antiviral treatment. Recurrent known drug with the most significant Success for curing, FIPV is GS – 441524, Nucleoside analog produced by Gilead Sciences, which is under patent and not available for veterinary use. AniVive LifeSciences Incorporated is working to gain FDA approval of GC 376 as a treatment for FIPV.

Several companies in China, have developed what they suggest are similar or the same compound drug products and are b marketing these products worldwide as dietary supplements to treat FIPV. The compounds have not received, generally recommended as safe status (GRAS). Under us, FDA restrictions the use of non GRAS compounds in veterinary health care is illegal. Those treating cats with FIPV are acquiring a version of GS4 441524 Through online or non-Veterinary resources such as members of the public referred through Facebook groups. No assurances are available as to bioactivity ,safety, toxicity, and identity of the compounds being used in these non-FDA approved substances. The course of treatment recommended can be expensive. Prices vary among companies and whether cost is related to the quality of the product remains unknown. Suppliers of GS441524, should be chosen with care. No centralized data is being maintained a reviewed under scientific supervision. Veterinarians cannot prescribed, or dispensed these non-approved compounds. they can though choose to provide supportive and monitoring care for cats undergoing treatment. Establishing a good veterinarian client patient. Relationship is in the best interest of the patient.

Complex Risk

Stressful conditions have a tremendous impact on virus shedding. There are multiple mutations that cause disease from reservoirs of FECV in crowded conditions. Every virus shed is an experiment in potential mutation and exposure of cats to that mutation. Reducing the environmental viral load is a critical component in prevention. Stress appears to trigger disease in some cats. However, tools for

accurately analyzing stress triggers, may be somewhat lacking. Nutrition, lack of passive immunity for orphaned kittens, nd gastrointestinal dysbiosis are all worthy of investigating as possible stressors. Distinguishing, the role of stress from the role of comorbid conditions is not yet possible.

Strong Immune response and Virus elimination may occur for only a period of time. FECV does not induce durable immunity. Immunity wanes and cats become susceptible again. Passive, maternal antibodies are highly protective and may be useful in creating more durable immunity. Innate cellular immunity. is required in turn, requires growing, FECV serotype 1, in cell culture for vaccine development.

Eleven percent of cats, develop the FIP biotype mutations but only a fraction of those become sick. Identifying, the genetic component for this is crucial. A pedigree cats have increased susceptibility, it appears that all cats of a particular breed do not seem to be susceptible. Particular lineages, within a breed have high susceptibility. The reverse must then be true. There are lineages that have genetic resistance. There may be an interferon gamma gene that could be a marker for increased risk. Other markers may also exist given the complexity of this disease.

According to a recent study, certain Bentonite based cat litters can decrease viral shedding and environmental contamination. However, the clinical significance has not yet been demonstrated. Early, weaning of kittens is not desirable as passive immunity from colostrum And lactation can effectively protect kittens from coronavirus infection. A Corona virus Free environment is Not Practical as reinfection is nearly impossible to prevent.

In well-run shelters today FIPV is not a common problem. A well-functioning shelter should see less than 1% FIPV cases. Shelter should balance intake with healthy outcomes by reduced crowding, thus decreasing virus shedding and exposure to infectious disease. One study showed FECV shedding increased millions fold in some cats after a week in the shelter. Developing fostering programs. No bottle raised kittens or Queens with kittens, should not come into the shelter, but go straight into foster homes. This lessens the odds of exposure to all infectious diseases, including FIPV. Using double compartment and closures with 8.5 square feet of floor, space leads to a 50% decrease in the exposure to upper respiratory infections. Placing portal between compartments, decreases the incidence of respiratory disease by 90%. Group housing is not ideal for cats. If grouped place no more than 3 to 5 cats in each group. Keep the group, stable note in, and out movement of cats. Don’t mix long and short stay cats.

Our mission to end FIP is not finished. Research must continue in such areas as improving diagnostic methods, developing additional antiviral druGS and especially strategies to prevent FIPV infection in cats.

Recent Advances And Strategies

In Australia, treatment of cats with FIP with remdesivir given both intravenously and subcutaneously that’s taken place in October 2020 and protocols are constantly evolving . So far over 500 cats have been treated. There appears not to be a single protocol which suits all patients and every case has unique considerations, including the size of the patient, whether the cat is still happy, and eating adequately, or is the press and dehydrated. The important consideration is the emotional and financial commitment of the owner. It is important to remember that both druGS are very safe even in sick cats and kittens. The greatest experience has In with Remdesivir. This drug is expensive and the owner needs to make a commitment to a costly treatment course that spans A. Of 3 months. 1 approach in newly diagnosed cats with severe disease, is to hospitalize cats for the first 3 to 4 days of therapy while remdesivir is given intravenously effectively as a loading ghost. Patients begin their treatment with remdesivir while they are receiving Iv fluid therapy . On day 1 of hospitalization, remdesivir is administered at a high goats intravenously, 10 to 15 milligrams per kilogram diluted with saline and

given slowly over 20 to 30 minutes or longer to provide a loading dose to fill up the volume of distribution for the drug. This achieves rapid antiviral efficacy. In cases with CNS disease, 20 milligrams per kilogram it suggested as the daily IV gose. Note that many cats can appear somewhat depressed for a few hours after the Iv infusion of remdesivir . In human patients, remdesivir may cause confusion related reactions, including low blood pressure, nausea, vomiting, sweating, or shivering but these have not been observed in feline. Importantly, once the Iv catheter is secure, daily injections of remdesivir do not cause any pain or discomforImportantly, once the Iv catheter is secure daily injections of remdesivir do not cause any pain or discomfort. However, if a cat is eating and is diagnosed at an early stage in the disease course than IV therapy is not necessary and the same dose can be given subcutaneously saving a great deal of money

Cats with FIP treated with remdesivir typically improve markedly over the first 2 to 3 days. If you sip cases and especially those that have presented with pleural effusion prior to treatment should be monitored closely, as the combination of the antiviral effect of the remdesivir and greater than maintenance delivery of crystalloids can result in transient worsening of pleural effusion. This necessitates draining twice daily using a 19 gauge butterfly needle and a 3-way stopcock , ideally using ultrasound guidance to find the best window for needle insertion. These secondary pleural effusions can be fatal if not detected earlier and seem to occur in about 1 in 10 effusive cases treated with remdesivir .

A further problem occasionally seen at this time is the development of neurological signs including seizures. Such cats need careful observation while the development of seizure mandates the use of anticonvulsant medication such as midazolam , alfaxan, for propofol followed by Keppra . Phenobarbital is a reliable anticonvulsant however it has the propensity to increase the metabolism of many druGS and until we better understand the pharmacokinetics and Metabolism of remdesivir and GS it is probably safer to use Keppra in this setting . Some clinicians also administer dexamethasone or prednisolone as a 1-off treatment to help settle down the CNS inflammation .

Cats and kittens that are still happy and eating do not require Iv therapy at the outset and can instead be started with subcutaneous injections at 11:50 milligrams per kilogram per day for 20 milligrams per kilogram for CNS disease .

Subsequently, cats were given ongoing subcutaneous injections of remdesivir. Initially, this was for 84 days and such cases represented the bulk of cases treated in Australia to date . More recently an aggressive use of IV subcutaneous remdesivir for preliminary therapy and then Catholic transitioned on to oral GS for 10 weeks of consolidation therapy .

The following treatment protocols have evolved :

- Wet FIP 11:50 m Mg per kg once daily for 2 weeks

- I’m going to ocular involvement 15 mg per kg once a day by subcutaneous injection for 2 weeks . For cats with severe uveitis should also be given topical corticosteroid for 2 to 3 days but no longer and atropine eye ointment.

- For cats with neurologic FIP with CNS signs 20 milligrams per kilogram once-daily subcutaneously for 2 to 4 weeks

It is important that owners are counseled properly on how to optimally administer daily injections. That’s will find the injection less painful if the remdesivir solution in the syringe is allowed to come to room temperature rather than be injected when cold from the refrigerator . Furthermore, teaching them simple tasks such as using a new needle when injecting the cat and using 21 or 23 gauge needles will make injections more tolerable . Even though 21 gauge needles are larger, possibly the ability to inject more quickly gives them an advantage in some cats. Alternatively, veterinarians might

prepare a full week's worth of injections for the owner, to make thinGS simple and sterile, in a box to be kept in the refrigerator with a new syringe to be used every day.

In cats who find the subcutaneous injections painful gabapentin given orally and or trans mucosal or subcutaneous buprenorphine administered 30 to 60 minutes prior to the injection. The injection site reactions which have been reported with injectable GS overseas do not seem to occur with remdesivir here .

After 2 to 4 weeks of remdesivir and after fluid in the abdomen has disappeared, and ocular and CNS signs improved or resolved it is now suggested a change to GS tablets.

Usually the recommended oral dose of GS is just the same as the dose given subcutaneously or intravenously of remdesivir. In CNS cases where large doses are being given, it's probably best to give 10 milligrams per kilogram orally every 12 hours to circumvent the ceiling effect said to limit and absorption of large doses .

In situations when owners cannot afford a full course of therapy, mefloquine (Larium) once daily is given after preliminary remdesivir therapy. This drug has been shown to have an antiviral effect along with clofazimine and several other druGS . In cats where owners were unable to afford a full course of remdesivir, mefloquine it seemed effective in getting the cast across the line to achieve clinical cure .

Do not be concerned by transient increases in globulin concentrations during early therapy; when high protein infusions are absorbed, lots of extra immunoglobulins are dumped into the patient's plasma . It's can be common even up to week 8 of treatment but resolves by week 12.

We're the most traditional approach to a kitten with CNS signs he is an exhaustive work that can be prohibitively expensive a 3 to 5 day trial of IV or subcutaneous remdesivir therapy can be used as a therapeutic trial in cats with likely CNS FIP .

Likewise if your choice is an exploratory laparotomy, biopsy of abnormal tissues, histology, and immunohistochemistry for FIP antigen to diagnose dry intra-abdominal FIP versus a 3 to 5 day trial of remdesivir or GS the drug trial might be considered to be a better option in terms of both welfare and reduced-cost. In most cats with non effusive FIP there is prompt improvement with antiviral therapy with normalization of fever, improvement in appetite, and better overall attitude within 2 to 3 days.

EIDD-1931

Studies in multiple institutions of antivirals against alpha viruses we're done and funded by the US government as far back as 2004 with considerable financial support by the defense threat reduction agency with the goal to find an antiviral compound against Venezuelan equine and cephalon myelitis virus which was 1 of the first viruses seriously considered as a biological weapon. Additional funding came in 2019 from the National Institute of Allergy and Infectious Diseases could partner research for treatment of influenza. The stated intent the chemical alteration was to enhance its oral bioavailability which would ultimately allow it to be administered as pills rather than injections . A switch of research emphasis from influenza to SARS II- CoV came in 2019 and 2020 Resulting in molnupiravir by Merck and full approval by the FDA is on an accelerated course for the treatment of coronavirus.

Molnupiravir has been moved toward conditional approval within the last year as an oral drug for home treatment of early-stage infection. The success in treating FIP with antiviral druGS has prompted a recent study of EIDD-1931 And 2801 for their ability to inhibit FIP in tissue culture.

Although both hold great promise for the treatment of FIP there are several obstacles that make illegal use of these compounds are unlikely anytime soon. The great worldwide need for an FIP treatment rapidly fueled an unapproved market for GS out of China . This same need to treat FIP has recently fueled interest in molnupiravir beer as a treatment for FIP also out of China.

1 of the problems in the treatment of FIP in cats is the blood to leye and blood to brain barriers which become a great importance when the disease affects the eyes and or the brain. This problem has been overcome in large part in the treatment of ocular and neurologic forms of FIP with GS by progressively increasing the dosage to raise blood levels and therefore the concentration of drug in the aqueous humor and or brain . It appears that the EIDD-1931 can reach effective levels in the brain as indicated by studies in horses with encephalitis virus. Drug resistance is another problem that is now being seen in some cats being treated with GS especially individuals with a neurologic form of FIP . For long treatment courses and difficulty in getting sufficient drug into the brain favors the development of drug resistance.

The current recommended treatment of Covid-19 with molnupiravir it's for only 5 days at the early stage of treatment. This may effectively limit the effects of cytotoxicity and fatal mutations in RNA.

All antiviral druGS to date have yielded to the development of drug resistance through mutations in the viral genome . Although remdesivir RER has appeared less susceptible to such mutations than other druGS . Resistance to GS in cats being treated for FIP has been seen with greater frequency. Resistance 2 GS in cath is also likely to be more of a problem because cats with FIP are often treated for 12 weeks or more while remdesivir and molnupiravir beer are recommended for only 5 days during the initial viremic stage of Covid-19.

As anticipated Molnupiravir has recently been tested in Catholic FIP by at least 1 Chinese seller of GS and preliminary results reported on the FIP Warriors website . Field trials consisted of 286 cats with various forms of naturally occurring FIP seen in pet clinics in u.s., u k, Italy, Germany, France, Japan, remit Romania, turkey, and China. No deaths occurred among the 286 cats that participated in the trial including 7 cats with ocular and neurologic FIP . 28 of these cats were cured after 4 to 6 weeks of treatment and 258 after 8 weeks. All treated cats remain healthy 3 to 5 months later, a. During which relaxes would be expected in cats not successfully cured this data provides compelling evidence for the safety and efficacy of molnupiravir for cats with various forms of FIP. However, it is hoped that this field trial will be written in manuscript form and submitted for peer review and published. Nevertheless it is now being sold to owners of cats with FIP. At least 1 major seller of GS is also interested in molnupiravir for FIP indicating a demand for additional anti-viral drug treatments.

Safe and effective dosage of molnupiravir in cats with FIP has not been published. However, seller from China has provided some pharmacokinetic and field testing data in cats with naturally occurring FIP in their advertising flyer for a product called hero-2081. However, this information does not clearly State the amount of molnupiravir in 1 of their 50 mg tablets and the actual dosing interval. Fortunately an estimated starting dosage for molnupiravir and cast with FIP can be obtained from published in vitro cell culture studies. Infected subcutaneous dosage for molnupiravir would be approximately 1 half the recommended for mg per kg subcutaneously 20 every 24 hours GS or 2 milligrams per kilogram. 3 oral dosage would be doubled to account for less efficient oral absorption to a dosage of 4 milligrams per kilogram every 24 hours . An estimated starting dosage given orally in cats with FIP can also be calculated from available data on covid-19 treatment . Patients being treated for covid-19 argument 200 mg of molnupiravir orally every 12 hours for 5 days. This dosage was calculated from a pharmacokinetic study done on people with an average weight of 60 to 80 kilograms . A cat has a basal metabolic rate 1.5 times a human and assuming equal oral absorption for both people and cats the minimum cat dosage by this calculation would be 4 point 5 milligrams per kilogram every 12 hours. assuming that molnupiravir process the blood to eye and blood brain barrier at equal efficiency 2 GS

Gossage would be increased 1.5 to 2 times to allow for adequate penetration into aqueous humor and cerebrospinal fluid for cath with ocular and neurologic FIP . These recommendations are based on presumption from published information and more experience with molnupiravir in the field will be needed . it is doubtful that molnupiravir will prove effective and GS for the treatment of FIP but a third antiviral drug make could prove extremely helpful in preventing GS resistance or in treating cats that no longer respond well to GS.

Summary

1. Feline Enteric Corona virus (FECV) and Feline Infectious Peritonitis virus (FIP) are very different viruses that cause much different forms of infection

2. FIP diagnosis is not as difficult as clinicians make it. Because until recently, it has been a fatal diagnosis, clinicians have tried to find other causes of signs that are more promising

3. FIPV is now considered a curable disease. Anecdotally, thousands of cats worldwide have been treated and possibly cured with antiviral compounds.

4. Veterinarians cannot prescribed, or dispense these non-approved compounds. they can though choose to provide supportive and monitoring care for cats undergoing treatment

5. Stressful conditions have a tremendous impact on virus shedding

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3.1.5. CATS DON'T LIMP: CHRONIC PAIN IN THE SENIOR CAT

Elizabeth J. Colleran DVM, MS DABVP Feline Specialist

American Association of Feline Practitioners

Pathophysiology

Osteoarthritis (OA) is a common and complex progressive disease. Clinically it is defined as a slowly evolving articular disease characterized by the gradual development of joint pain, stiffness, and the limitation of range of motion. Pathologically at has been described as a disorder of synovial joints characterized by deterioration of articular cartilage and by the formation of new bone at the joint surfaces and margins. The median age of affected cats in another study was 10.2 years and increasing age was clearly a risk factor for the development of osteoarthritis and other degenerative arthropathies.

In cats older than 12 years of age one study found a 90% prevalence of all types of degenerative joint disease. (DJD) DJD is not the same as OA though the terms are commonly used interchangeably. OA is a subset of DJD which includes all forms of degenerative pathology of skeletal joints.

The hip and elbow joints are most commonly affected and bilateral disease was invariably a feature. In a group of 100 randomly selected cats aged up to 20 years old almost all of the cats had radiographic evidence of degenerative joint disease (DJD). Affected joints in descending order of frequency were hip, stifle, tarsus, and elbow.

OA associated pain starts at the peripheral join and results in decreased ability to perform daily activities and decreased mobility. This initiates musculoskeletal deterioration due to decreased use and altered body carriage. Additionally, the nociceptive pain input into the system can result in sensitization and more pain. Heightened pain results in further negative affects on the musculoskeletal system – muscle atrophy, trigger point development, muscle pain – which in turn results in a greater burden of pain as a result of decreased bone support. Thus there is concurrent deterioration of the musculoskeletal and sensory systems. Pain also has an effect on cognitive function and on emotional states, resulting in heightened fear, anxiety and poor sleep. These changes in turn feed back and heighten pain. The inability to perform daily activities, resulting from pain and deterioration of the musculoskeletal system, also drives negative affective changes through decreased and altered actions with the cat's environment.

Caregiver Observation

Owners may be completely unaware of subtle changes in their cat's behavior or of their potential significance as indications of pain. A validated musculoskeletal pain index can be helpful in uncovering evidence. (www.painfreecats.com) Among these may be:

- Avoiding other household members
- Increased grumpiness
- Decreased grooming
- Restlessness
- Changes in elimination behavior

- Clumsiness
- Reluctance to jump up or down

In the veterinary setting, assessing a cat's emotional and physical characteristics is often confounded by the stress of taking this territorial animal out of his home range and surrounding him with strangers. It can be especially challenging to assess gait and chronic musculoskeletal pain in an animal whose instinct is to freeze or flee or to distinguish pain from fear. With this in mind, a validated pain score has been developed the Feline Musculoskeletal Pain Index (FMPI) which gives the power of observation to caregivers in the home. Questions are addressed towards specific indicators using accessible language.

Arguably most important role of the caregiver in the diagnosis of OA pain is the use of video and photography. Most households have a "smart phone" with photographic and video capability. In the comfort of the home range, the locomotion of a cat may be most reliably observed and largely absent from the examination room. The quality of the video in particular can be demonstrated to the caregiver and is comprised of view tips and techniques to make it both a useful and efficient component of the diagnostic process. While caregivers will be tempted to provide long video segments, lovingly made, instructing them to limit the clip to a minute or less and from a distance where evaluation of the whole cat is critical to efficient examination time.

Physical Examination

A comprehensive physical examination is important but may yield little beyond assessment of the cat's gait in the examination room unless the circumstances are carefully managed. A quiet, secure and low stress environment is key. The cat should be allowed to acclimate to the room at which time a visual assessment of gait may be possible. A feline facial pheromone diffuser plugged in overnight in the room can help reduce a fear response. Cats do not walk in straight lines, are not usually trained to the leash and generally are more interested in investigating the unfamiliar environment or seeking somewhere to hide. In some cases it is possible to assess their willingness to jump. Palpation and manipulation of the joints must be done gently and it is not unusual for some cats to resent this even if joints are normal and pain-free.

A set of comprehensive videos giving full instruction on the appropriate position and method of physical examination is available online.

With so many complex changes occurring and multiple joint often involved, staging of the OA patient may seem daunting. However, staging is probably best performed by assessing the overall impact on the whole cat. A simple staging of the impact of OA based on activity and mobility could be:

Stage	Activity/mobility
1	Early signs of activity impairment
2	Intermittent signs of activity impairment
3	Obvious activity impairment and some decrease in mobility
4	Loss of mobility with significant pain

Key Therapeutic Points

Multi-Modal Treatment

Targeted multi-modal pain management is intended to reduce the risk of drug toxicities and to target the different components of chronic pain, including maladaptive pain.

Gabapentin

Pain modulation happens in the dorsal horn of the spinal cord. In the dorsal horn, there are dramatic anatomic changes that happen in the face of chronic maladaptive pain. Gabapentin affects the alpha-2-delta subunit of the calcium channel in the dorsal horn. This drug is really part of the gold standard for managing chronic maladaptive pain in humans, and what has recently become available is information that it also can play an important perioperative role in reducing the reliance that humans have on post-operative opiates. The downfall for gabapentin is that it must be dosed appropriately, Somewhere between 5-20 mg/kg two to three times per day. Under dosing patients will not address maladaptive pain. Doses should commence at 50mg/cat at night for 3-4 days because sedation may occur initially and alarm the caregiver. The dose is then titrated until it is effective. The second step is to give a dose every 12 hours. Dose effectiveness may change over time and should be regularly interrogated.

Polysulfated Glycosaminoglycans

Adequan is a polysulfated glycosaminoglycans that can be given subcutaneously in cats and is very helpful and well-tolerated. Use in cats is extra-label but is nonetheless an important mainstay of OA pain management. Owners can be instructed in subcutaneous administration and the entire bottle dispensed. The dose is 4.4 mg/kg twice weekly for 4 weeks, once weekly for 4 weeks and then at an interval that reflects effective duration, every 10-15 days. Owners will recognize the day on which the cat appears less comfortable and administer in a one day shorter interval.

NSAIDs

Nonsteroidal anti-inflammatory drugs (NSAIDs) are indicated in the treatment of pain and inflammation associated with OA, as they produce analgesic and anti-inflammatory effects. However, the potential toxicity of these compounds must be considered. NSAIDs act predominately by blocking the inflammatory effects of prostaglandins through inhibition of the breakdown of arachidonic acid buy cyclo-oxygenase (COX), specifically COX-2, which is responsible for producing inflammatory prostaglandins. COX-1 also plays an important part in the inflammatory process and pain perception.

Nutriceuticals

Diets rich in omega-3 fatty acids sourced from fish oil are recommended for cats with OA. Not only are the absolute levels of these omega-3 fatty acids important but also the ratio of omega-3 to omega-6 fatty acids. These diets have been shown to improve weight-bearing and reduced inflammation. Cats given a diet rich in omega-3 or supplemented with omega-3 fatty acids may be comfortable on lower doses of NSAIDs after a period of 6 to 8 weeks. Other sources include Wellactin 125 mg/ml (Nutramax) and Nordic Naturals 150mg/ml. Extrapolated dosage for cats is 75mg/kg/day.

Pulsed Electromagnetic Field Therapy

Pulsed electromagnetic field (PEMF) therapy is a non-invasive, non-thermal treatment that involves pulsing electromagnetic fields in tissue to promote healing. PEMF devices have been approved by the U.S. Food and Drug Administration (FDA) to treat non-union fractures and cleared to treat post-operative pain and edema, osteoarthtitis and plantar fasciitis. Implementation of PEMF therapy in veterinary medicine is increasing. Pathologies that are often treated with PEMF devices include bone fractures, inflammation and arthritis, pain, edema, and chronic wounds. Though there is a growing body of basic and clinical evidence in support of PEMF treatment as a therapeutic modality, veterinary practitioners and animal owners report significant confusion about PEMF devices largely due to the number of different types of devices and the varying amounts of evidence that support each type of device.

Feline-Specific Anti-nerve Growth Antibody

Neutralizing antibodies against nerve growth factor (NGF) are analgesic in rodent models, naturally occurring degenerative joint disease(DJD) pain in dogs and chronic pain in humans. Currently, the nonsteroidal anti-inflammatory drug (NSAID) meloxicam is approved in Europe for use in treating chronic pain and cats, but has not been approved for this use in the United States. There are concerns about the use of NSAIDS for long periods of time and cats, especially because of the majority of cats presenting with DJD related pain have evidence of chronic kidney disease. A double blind, placebo controlled randomized pilot study with 12 cats in each of three groups evaluated the efficacy of a fully felinized anti-NGF antibody (NV-02) for the treatment DJD pain and mobility impairment in cats. The results of this study showed a clear positive treatment effect with NV–02 in the study cats given the drug. The beneficial effects were seen for objectively measured activity, and also, despite a large caregiver placebo effect, for owner assessed subjective measures. The duration of affect appear to be about six weeks, based on objectively measured activity. This is similar to the duration of efficacy of 0.2 mgs/kg IV in dogs of at least four weeks. The investigators concluded that the potential impact in veterinary medicine of an injection lasting approximately six weeks for the control of long term pain in the cat is very positive and clinically relevant. Further clinical studies are warranted.

SUMMARY

1. Osteoarthritis is an important cause of chronic pain and loss of quality of life in cats

2. There are multiple tools available to help clinicians and caregivers recognize the behaviors that demonstrate pain, create a sense of urgency around its treatment and evaluate the efficacy of a pain management plan upon implementation

3. A multi-modal pain management plan is necessary to improve mobility and quality of life

4. Future scientific investigations will result in new methods of pain management that will integrated into a multimodal plan

5. Clinicians have an obligation to balance the importance of relieving pain and the impact that their plan may have on the relationship between cat and caregiver

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3.1.6. PANDORA SYNDROME: IT'S MORE THAN FIC

ELIZABETH COLLERAN DVM, MS, DABVP FELINE DIPLOMATE

Lower urinary tract signs (LUTS) – dysuria, periuria, pollakiuria and stranguria – are a common reason pet cats are brought to veterinary practices. When presented with a cat with these signs clinicians need to know whether this is the first episode or whether it is a chronic, recurrent disease as well as what other health problems the cat may have. Armed with this information an appropriate diagnostic plan can be made.

Cats may have multiple reasons for their clinical signs as well as other medical conditions and environmental requirements that need to be addressed. For example, Buffington et al. have presented evidence that some cats with severe, chronic LUTS seem to have a functional rather than a structural lower urinary tract disorder and that periuria can occur in apparently healthy cats exposed to stressful circumstances. There is significant overlap at the present time among treatment recommendations for some LUT disorders particularly with regard to ensuring that the patient's environmental needs are met.

Severe chronic idiopathic LUTS has been described as a naturally occurring model of interstitial cystitis in women. Interstitial cystitis (IC) has been defined as a disease of chronic irritative voiding signs, sterile and cytologically negative urine and cystoscopic observation of submucosal petechial hemorrhages. The same description in which cystoscopy was not performed in cats but in which other appropriate diagnostic procedures did not identify a cause became defined as Feline Interstitial Cystitis (FIC)

In addition to epithelial abnormalities identified in the bladder of cats with FIC, investigators found significant alterations in components of acetylcholine synthesis and release in the esophageal mucosa from cats with FIC. This suggested that changes in the nonneuronal cholinergic system may contribute to alterations in cell-to-cell contacts and possibly communication with underlying cells that may, in turn, contribute to changes in sensory function and visceral hyperalgesia. Differences in sensory neuron anatomy and physiology also are present in cats with FIC suggesting a more widespread abnormality of sensory neuron function.The acoustic startle response is a reflex motor protective response to a perceived threat. It is a brainstem reflex response to unexpected auditory stimuli and is increased in cats with FIC.

Differences in sympathetic nervous system function have also been identified in cats with FIC. Among them are changes in the brain stem in the region associated with the most important source of norepinephrine in cats and humans. It is involved in such brain functions as vigilance, arousal and analgesia and mediates the visceral response to stress. Other changes in brainstem help to explain the waxing and waning course of symptoms and the aggravation of signs by environment stressors .

Some cats with FIC appear to have abnormalities in the hypothalamic-pituitary-adrenal axis such that there is a decrease in serum cortisol secretion compared with healthy cats. Adrenal glands in these cats were grossly smaller in cats with FIC when compared to healthy cats.

Cats with FIC often have variable combinations of comorbid disorders such as behavioral, endocrine, cardiovascular and GI problems. External stressors appear to exacerbate clinical signs of these disorders. Many human beings with IC suffer from variable combinations of comorbid disorders as well. These appear to have no consistent pattern of onset and so

cannot be attributed to LUTS but rather may be some common disorder affecting more than one organ which then responds in its own way.

Ongoing research in both humans and cats with chronic LUTS has begun to include a more comprehensive evaluation of the entire patient. Nosology is defined as the classification of diseases. Until a better understanding of the larger picture of cats presenting with LUTS, naming this constellation of symptoms and organs systems involved should remain vague and not reflect only LUTS. Dr. Buffington has suggested "Pandora's Syndrome" He and his colleagues, Drs. Westropp and Chew propose tentative criteria for diagnosis of Pandora syndrome:

Presence of clinical signs referable to other organ systems in addition to chronic idiopathic signs for which the patient is being evaluated

Evidence of early adverse experience (e.g abandonment, orphaning) and which may differ by individual

Waxing and waning of severity of clinical signs with events that (presumably) activate the central stress response system

Resolution of sings with effective multimodal environmental modification

Whatever the eventual name, restricting the description of these patients to their LUTS does not capture all of the currently recognized features of the syndrome. A more comprehensive evaluation of cats with these and other chronic idiopathic signs may result in a more complete diagnosis and lead to additional treatment approaches that may improve outcomes. For example, the relationship between the environment and health is quadratic rather than linear, with both deficient and threatening environment increasing the risk of poor health outcomes.

Individual patients presenting with chronic LUTS benefit by a more comprehensive evaluation to elucidate the effect on risk for Pandora syndrome. Included in this history should be:

Where the cat was obtained

Any other health or behavior problems that may be present

Structure of the cat's environment – amount of time indoors, activity level, availability and management of resources, other cats in the home, people living with the cat.

Presences of signs referable to other organ systems

Perceived allergic responses to skin, lung or GI tract

Any unusual or problematic behaviors

The physical exam should be performed with evaluation of the lower urinary tract last to avoid being distracted and missing other abnormalities such as over-grooming, obesity, acne, cardiac abnormalities or GI tract issues.

For an initial episode in an apparently healthy, young unobstructed patient, the most likely explanation is either a sickness behavior in an otherwise healthy cat or acute idiopathic LUTS. After ruling out other causes of LUTS, the client should be counseled regarding individually tailored multimodal environmental modification (MEMO) to make sure the cat's environmental needs are being met. The client can also be taught to look for other signs of sickness behaviors and to evaluate response to MEMO for adequacy of accommodation.

Table 1. Forms used as part of the evaluation of cats presented the Ohio State University Veterinary Medical Center for evaluation of chronic lower urinary tract signs. These forms have not been formally validated beyond their face validity for cases in the authors' practice area. They are offered as an example of an instrument that could be developed and validated for broader use

Cat and Client History Form

Cat's name_____ **Owner name**_____ **Date**_____

Contact information: Telephone: ☐___ E-mail: ☐ ___

☐ Please check preferred method of contact

Cat Information: Breed_____ Color_____ Date of Birth _____ Weight __☐ lb ☐kg

Owned for? _____ years _____months; ☐ M ☐F ☐Neutered? If yes, date: _____

(month/year)

Declawed? ☐N ☐Y If yes, Front only ☐ All four paws ☐

Body Condition (please check box that looks most like your cat):

☐Skinny	☐Lean	☐Moderate	☐Stout	☐Obese
				

Please check the boxes that best apply to your cat:

Diet: (please be as specific as you can, eg, Buckeye Best (company) Adult Chicken and Rice (flavor)

Wet food: name_____ **☐None** **☐25%** **☐50%** **☐75%** **☐100%**

Dry food: name_____ **☐None** **☐25%** **☐50%** **☐75%** **☐100%**

How many hours each day, on average: does your cat spend indoors? **☐Indoor only** **☐18-24** **☐12-18** **☐6-12**

☐0-6 Is time outside supervised? ☐Yes ☐No

If you have more than one cat, what is their relationship? ☐Not related

☐Littermate ☐ Sibling ☐Parent-Offspring ☐Other (_____)

Where did you obtain your cat (source)?

☐Shelter ☐Offspring from a pet I already own(ed)

☐Purchased from a friend ☐Gift

☐Purchased from a breeder ☐Purchased from a pet shop

☐Stray/orphan ☐Other _____

Does your cat frequently (please check all that apply):

☐ Try to escape

☐ Pace at outside doors

☐ Cry at outside doors

☐ Hide

☐ Act fearful

☐ Act friendly

☐ Follow owners around the home

☐ Destroy things when left alone

☐ Act 'depressed' (little interest in feeding, grooming, environment, etc.)

Housing (_____): *Apartment*: ☐ studio ☐1-2 bedrooms ☐3 or more bedrooms,

Zip Code

House: ☐attached/twin duplex ☐ attached, 3 or more units, ☐single

☐other_____

Total Cats_____ Total Dogs_____ Other Pets_____

Other People_____

Please help us understand what your cat does around the house by placing a check (✓) in the box next to each behavior that best describes how commonly your cat does each of the behaviors described below

Does your cat:	All of the time	Most of the time	A good Bit of the Time	Some of the time	A little bit of the time	None of the Time	Does Not apply
Leave household articles (furniture, drapes, clothing, plants, etc) alone	☐	☐	☐	☐	☐	☐	☐
Eat small amounts calmly at intervals throughout the day	☐	☐	☐	☐	☐	☐	☐
Drink small amounts calmly at intervals throughout the day	☐	☐	☐	☐	☐	☐	☐
Use the litterbox	☐	☐	☐	☐	☐	☐	☐
Get along with people in the home	☐	☐	☐	☐	☐	☐	☐
Get along with other pets in the home	☐	☐	☐	☐	☐	☐	☐
Remain calm when left alone	☐	☐	☐	☐	☐	☐	☐
Stay relaxed during normal, everyday handling (grooming, petting)	☐	☐	☐	☐	☐	☐	☐
Calm down quickly if startled or excited	☐	☐	☐	☐	☐	☐	☐
React calmly to everyday events (telephone or doorbell ringing)	☐	☐	☐	☐	☐	☐	☐
Play well with people	☐	☐	☐	☐	☐	☐	☐
Play well with other family cats	☐	☐	☐	☐	☐	☐	☐

Show affection without acting clingy or annoying	☐	☐	☐	☐	☐	☐	☐
Tolerate confinement in a carrier (including travel)	☐	☐	☐	☐	☐	☐	☐
Groom entire body calmly	☐	☐	☐	☐	☐	☐	☐
Use scratching posts	☐	☐	☐	☐	☐	☐	☐
Play with toys	☐	☐	☐	☐	☐	☐	☐

Comments; anything else your cat regularly does or does not do that you think might be helpful for us to know about?

_____

2. Health History

The cat's condition today is _____

Previous illnesses or surgeries _____

Current medications _____

***Directions*:** For items below, please use the following choices to describe how many times you have seen your pet experience the symptom, adding **comments/explanation** as appropriate.

Score =

0 = I have **NEVER** seen it

1 = I have seen it **at least ONCE**

2 = I see it **at least ONCE per YEAR**

3 = I see it **at least ONCE per MONTH**

4 = I see it **at least ONCE per WEEK**

5 = I see it **DAILY**

Score	How often does your cat:	Comments/explanation
	Cough	
	Sneeze	
	Have difficulty breathing	
	Stop eating	
	Vomit ☐food ☐hair ☐bile ☐other	
	Have hairballs	
	Have diarrhea	
	Have constipation	
	Defecate outside the litter box	
	Strain to urinate	
	Have frequent attempts to urinate	
	Urinate outside the litter box	
	Have blood in the urine	
	Spray urine	
	Groom more than cats usually do	
	Shed more than cats usually do	
	Scratch him/herself more than cats usually do	
	Have discharge from eyes	

	Seem fearful	
	Seem to need a great deal of contact or attention	
	Destroy things when left alone	

Please check any of the following diseases your cat has been diagnosed with:

☐ Periodontal (dental) disease
☐ Inflammatory bowel disease
☐ Allergies
☐ Cardiomyopathy (heart problems)
☐ Other_____

☐ Asthma
☐ Skin disease
☐ Diabetes mellitus
☐ Obesity

Household Resource Checklist

The following questions ask about your cat's resources so we can learn more about the environment your cat(s) live in. Please ✓ **DK** if you don't know, **NA** if it does not apply, or **Yes** or **No** after each question. If you have more than one cat, please answer for **all** cats. Resources (food, water, litter and resting areas) for each cat are assumed to be out of (cat) sight of each other, such as around a corner or in another room. If they are in sight of each other, please answer **No**.

Space		**DK**	**NA**	**Yes**	**No**
1	Each cat has its own resting area in a convenient location that provides some privacy	☐	☐	☐	☐
2	Resting areas are located such that another animal cannot sneak up on the cat while it rests	☐	☐	☐	☐
3	Resting areas are located away from appliances or air ducts that could come on unexpectedly (machinery) while the cat rests	☐	☐	☐	☐
4	Perches are provided so each cat can look down on its surroundings	☐	☐	☐	☐
5	Each cat can move about freely, explore, climb, stretch, and play if it chooses to	☐	☐	☐	☐
6	Each cat has the opportunity to move to a warmer or cooler area if it chooses to	☐	☐	☐	☐
7	A radio or TV is left playing when the cat is home alone	☐	☐	☐	☐
Food and water					
8	Each cat has its own food bowl	☐	☐	☐	☐
9	Each cat has its own water bowl	☐	☐	☐	☐
10	Bowls are located in a convenient location to provide privacy while the cat eats or drinks	☐	☐	☐	☐
11	Bowls are located such that other animals cannot sneak up on the cat while it eats or drinks	☐	☐	☐	☐
12	Bowls are washed regularly (at least weekly) with a mild detergent	☐	☐	☐	☐
13	Bowls are located away from machinery	☐	☐	☐	☐
Litter boxes					
14	Each cat has its own box (one box per cat, plus one)	☐	☐	☐	☐

15	Boxes are located in convenient, well-ventilated locations that still give each cat some privacy while using it	☐	☐	☐	☐
16	Boxes are located on more than one level in multi-level houses	☐	☐	☐	☐
17	Boxes are located so another animal cannot sneak up on the cat during use	☐	☐	☐	☐
18	Boxes are located away from machinery that could come on unexpectedly during use	☐	☐	☐	☐
19	The litter is scooped daily	☐	☐	☐	☐
20	The litter is completely replaced weekly	☐	☐	☐	☐
21	Boxes are washed regularly (at least monthly) with a mild detergent (like dishwashing liquid), rather than strongly scented cleaners	☐	☐	☐	☐
Litter boxes (continued)		**DK**	**NA**	**Yes**	**No**
22	Unscented clumping litter is used	☐	☐	☐	☐
23	A different brand or type of litter is purchased infrequently (less than monthly)	☐	☐	☐	☐
24	If a different type of litter is provided, it is put in a separate box so the cat can choose to use it (or not) if it wants to	☐	☐	☐	☐
Social contact					
25	Each cat has the opportunity to play with other animals or the owner if it chooses to on a daily basis	☐	☐	☐	☐
26	Each cat has the option to disengage from other animals or people in the household at all times	☐	☐	☐	☐
27	Do any cats interact with outdoor cats through windows?	☐	☐	☐	☐
Body care and activity					
28	Horizontal scratching posts are provided	☐	☐	☐	☐
29	Vertical scratching posts are provided	☐	☐	☐	☐
31	Chew items (eg, cat-safe grasses) are provided	☐	☐	☐	☐
32	Toys to chase that mimic quickly moving prey are provided	☐	☐	☐	☐
33	Toys that can be picked up, carried, and tossed in the air are provided	☐	☐	☐	☐
34	Toys are rotated on a regular basis (at least weekly) to provide novelty	☐	☐	☐	☐

If you have additional comments on any of the questions, please write them below, including the question #.

_____
_____

_____
_____
_____
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_____
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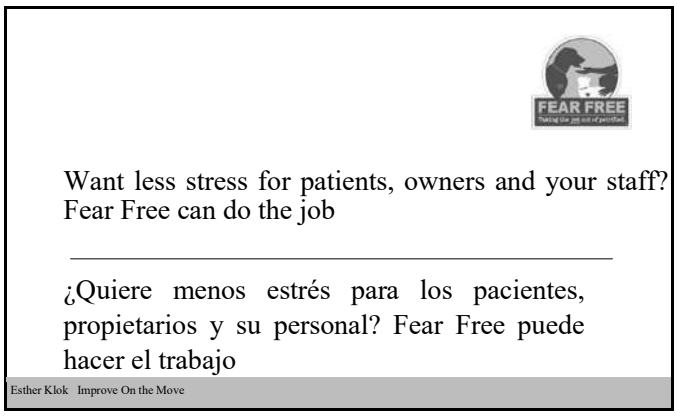
_____

By submitting this form, you agree that anonymous information from it may be used for cat health-related research

Esther Klok, CVT

4. Esther KlokWant less stress for patients, owners and yourstaff? Fear Free can do the job



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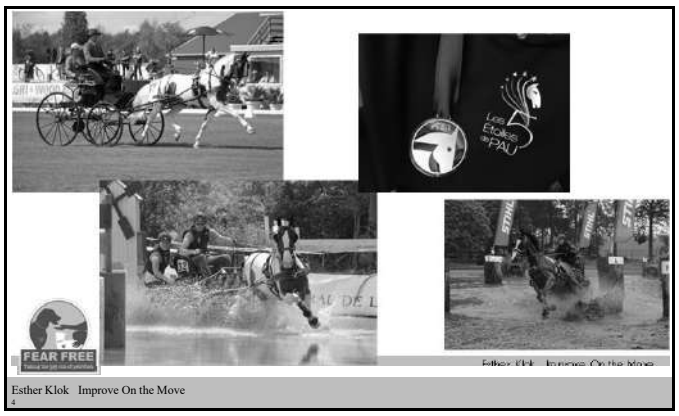

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What is Fear Free

Fear Free is an education company providing online and in-person CE courses for veterinary professionals, pet professionals and pet owners to alleviate and reduce fear, anxiety and stress in pets and provide enrichment. Already more than 80.000 people registered at Fear Free

Qué es Fear Free

Fear Free es una empresa de educación que ofrece cursos de CE en línea y presenciales para profesionales veterinarios, profesionales de animales de compañía y propietarios de mascotas para aliviar y reducir el miedo, la ansiedad y el estrés en las mascotas y proporcionar enriquecimiento

Ya hay más de 80.000 personas registradas en Fear Free

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2016 NAVC Orlando
DR. Marty Becker

FEAR FREE CERTIFIED Professional

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F ear (MIEDO)

A nxiety (ANSIEDAD)

S tress (Estrés)

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Fear Free Certification Program Syllabus

Level 1
Eight Modules – 9 RACE approved hours of CE

- Module 1: Fear Free Behavior Modification Basics
- Module 2: Fear Free Transport of Cats and Dogs to and from the Veterinary Hospital
- Module 3: Fear Free Reception and Waiting Area
- Module 4: Fear Free Exam Room
- Module 5: Fear Free In-Hospital Care
- Module 6: Fear Free Procedures
- Module 7a: Pre-visit Protocols: Complementary Therapeutics, Products & Pharmaceuticals
- Module 7b: In-Hospital Protocols: Sedation, Anesthesia, & Analgesia

- Total; 3 levels

Link for more information: https://fearfreepets.com/fear-free-certification-overview/

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What did the Fear Free program for me?

- It's starts low threshold so accessible and understandable for the whole team!
- Possible to start with "baby steps" and growth as much as possible for each team member.
- A part of the team can learn more and more, but still the whole team can start with it because;
- Even if you do it better on 1 client a day……. you will have reached 20 victories in a month!

¿Qué ha hecho el programa Fear Free por mi?

- ¡Comienza con un umbral bajo, de manera accesible y comprensible para todo el equipo!
- Es possible comenzar con "pequeños pasos" y crecer tanto como sea posible para cada mienbro del equipo.
- Una parte del equipo puede aprender más y más, pero aun así todo el equipo puede empezar porque;
- Tan solo con hacerlo mejor con 1 cliente al día……. ¡habrás alcanzado 20 victorias en un mes!

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Additional Member Benefits

- Marketing Materials
- Education Library
- Toolbox Resources
- Private Facebook Group
- Additional Free and Discounted CE Courses
- Podcast Series
- Directory Listing
- Online Store
- 100% of CE is RACE approved
- Preferred Product Discounts

Link for more information: https://fearfreepets.com/veterinary-professionals/

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Testimonios de clientes;

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Quotes from clients;

I always was so stressed when I had the yearly appointment for my cat's vaccination, so sometimes I skipped it. But with Fear Free no stress for me anymore.

Testimonios de clientes;

Siempre me estresaba mucho cuando tenía la revisión y vacunación anual de mi gato, por lo que a veces me la saltaba. Pero con Fear Free ya no me estreso nunca.

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Out in the world, working as a vet with furry creatures, who did not understand I was trying to help them getting better, was hard. And that made work frustrating. Adding to the stress and increasing fear was never my intention but could also rarely be avoided. Fear Free introduced me to new ways to handle my patients better and create a compatible environment for the pets AND my self as a vet.

En el mundo real, trabajar como veterinario con criaturas peludas, que no entendían que estaba tratando de ayudarles a mejorar, fue difícil. Y eso hizo que el trabajo fuera frustrante. Nunca fue mi intención aumentar su estrés y aumentar su miedo, pero rara vez podía evitarlo. Fear Free me presentó nuevas formas de manejar mejor a mis pacientes y crear un entorno compatible para las mascotas Y para mí mismo como veterinario.

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Quotes from clients;

Thanks to Fear Free it is a party for my dog to go to your practice, she is not afraid anymore.

Testimonios de clientes;

Gracias a Fear Free ir a la clínica es una fiesta para mi perra, ya no se asusta.

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The results of high FAS will be;

Animals and owners DO NOT love to go to our clinic.

We can not, not early enough, not good enough treat animals!

Los resultados de FAS altos serán;

Los animales y sus dueños NO estarán encantados de venir a nuestra clínica

Por lo que No Podemos tratar a los animals, o no a tiempo o no lo suficientemente bien

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Quotes from clients;

In the past I hated it to bring my cat to the vet, so sad for her. But now in this practice she is safe.

Testimonios de clientes;

Antes odiaba llevar a mi gata al veterinario, era muy triste para ella. Pero ahora en esta clínica ella está a salvo.

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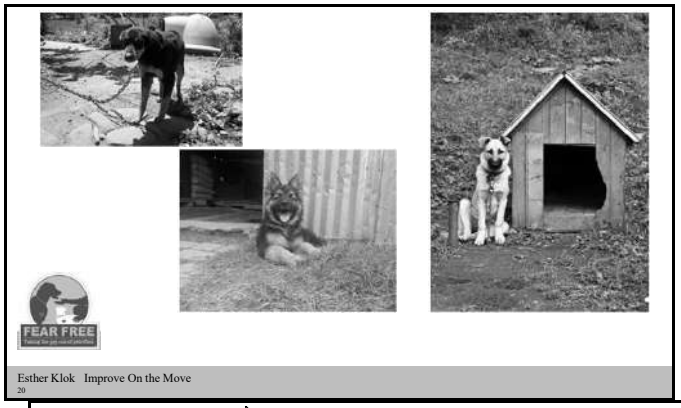
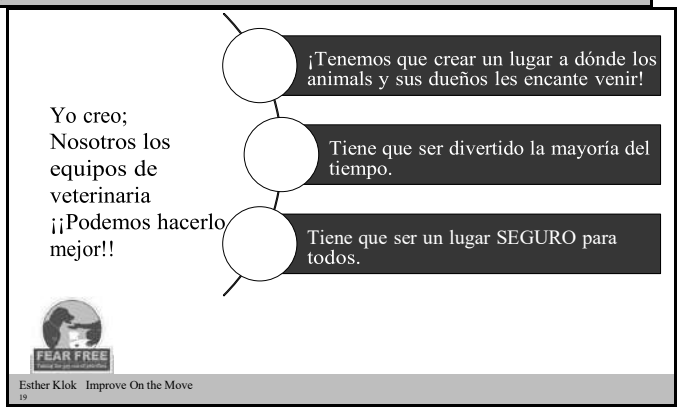
I think;
We vet-teams can do better!

- We need to create a place where animals and owners love to come!
- It should be fun most of the time!
- It needs to be a SAFE place for everybody.





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Mucha atención al bienestar animal

- Partido político por los animales
- Entrenador olímpico Mark Todd suspendido por pegar a un caballo
- Carreras de galgos prohibidas en Florida
- Granjas con marca de calidad animal-friendly

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But…….. We can do it different!

You all can do it different
You all can change vet med in the future
You are the Fear Free future.....

Pero..... ¡Podemos hacerlo diferente!

Todos ustedes pueden hacerlo diferente
Todos ustedes pueden cambiar vet med en el futuro
Tú eres el futuro sin miedo.....

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A lot of attention for animal welfare

- Political party for animals
- Olympisch eventing champion Mark Todd suspended for hitting a horse
- Greyhoundraces are prohibited in Florida
- Quality mark animal-friendly children farms

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And…… when do we change?
When are vet-practices changing?
When do we adapt to the world where animals have different places in the human world?

Y..... ¿cuándo cambiamos?
¿Cuándo cambian las prácticas veterinarias?
¿Cuándo nos adaptamos al mundo en el que los animales ocupan un lugar diferente en el mundo humano

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Taking the pet out of petrified.

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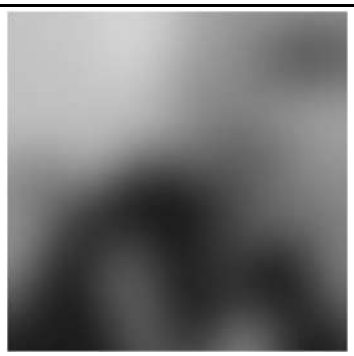

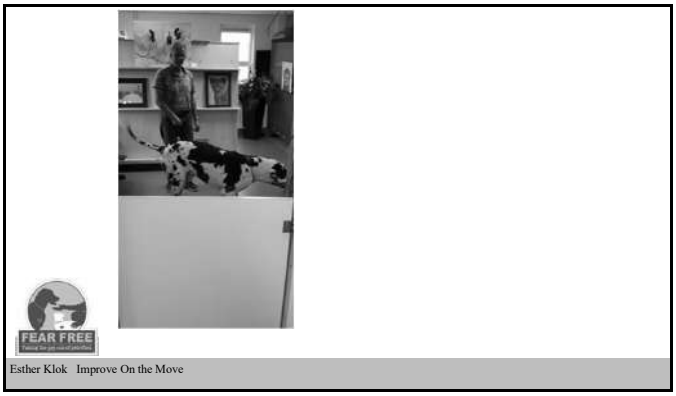

Results:

- Animals and owners DO NOT love to come in.
- We can not early enough, not good enough treat animals.

- Resultados:
- Los animales y los propietarios NO aman a venir.

- No podemos lo suficientemente pronto, no lo suficientemente bueno tratar a los animales.

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What do we need to start Fear Free

Love and; “Tools “

Qué necesitamos para empezar a no tener miedo

Amor y; "Herramientas"

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Traveling to your clinic.
El desplazamiento a su clínica.

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48 49 52

Arrival at your clinic.
Llegada a su clínica.

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Try not to scare them at your clinic.

Intenta no asustarles en tu clínica.

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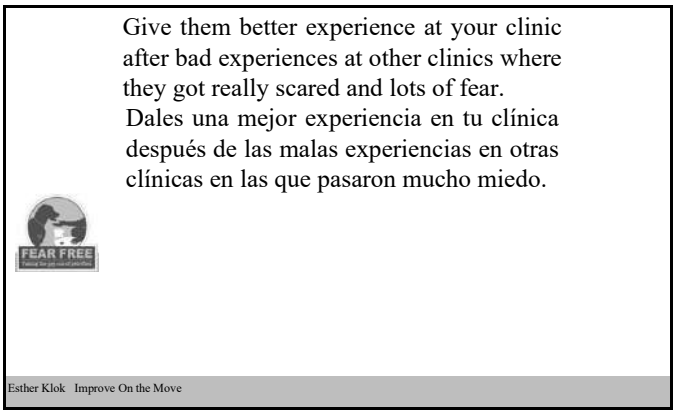

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Results:

- We can earlier, more often and better treat animals.
- We will have more income.
- Our staff will have less mental and physical problems when animals AND owners like us a lot

Resultados de trabajar con Fear Free:

- Podemos tartar a los animales antes, más a menudo y mejor.
- Tendremos más ingresos.
- Nuestros empleados tendrán menos problemas mentales y fisicos
- cuando les gustamos mucho a los animalesy los dueños.

Questions?

estherklok@live.nl

Facebook: Esther Klok

www.improveonthemove.nl

WhatsApp; 0031-630090657

Fear Free: Stephanie Bachman

Stephanie.Bachman@fearfreepets.com

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Benefits of Fear Free:
Happy and relaxed animals
AND owners

Beneficios de Fear Free:
Animales y propietarios felices
y relajados

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Fear Free is for Students, Faculty & Staff, Too! COMPLIMENTARY!

Fear Free is excited to offer all students, faculty, and staff at veterinary schools, veterinary technician/nurse schools, and veterinary assistant schools complimentary membership to our program! This offer is open to students of all levels for the duration of their time in school, and we encourage you to take advantage of the program as early as possible.

NOTE: This offer was previously only valid for one calendar year from the date of registration. However, this offer has been revised to cover the entire time a student is in school. However, you must re-submit the student form below to renew for free each year. Upon graduation, you may retain your complimentary membership for the remainder of that year. To renew after that, fill out the form below with your most current student information.

GO to;
www.fearfreepets.com

- Veterinary professionals
- Student and faculty applications

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fearfreepets.com

Discount: discount code is FFKLOK22, it provides 20% off the Veterinary Professional Certification, the Animal Trainer Certification, and the Groomer Certification courses
Descuento: el código de descuento es FFKLOK22, que proporciona un 20% de descuento en los cursos de Certificación Profesional Veterinaria, Certificación de Entrenador de Animales y Certificación de Peluquería.
www.fearfreepets.com
www.fearfreeshelters.com
www.fearfreehappyhomes.com

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4.1.2. Yes you can! Fear Free can let your practice grow

Yes you can! Fear Free can let your practice grow

¡Sí se puede! Fear Free puede permitir que tu práctica crezca

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1

The results of high FAS will be;

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-not early enough,
not good enough
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Por lo que
No Podemos tratar a los animals, o no a tiempo o no lo suficientemente bien

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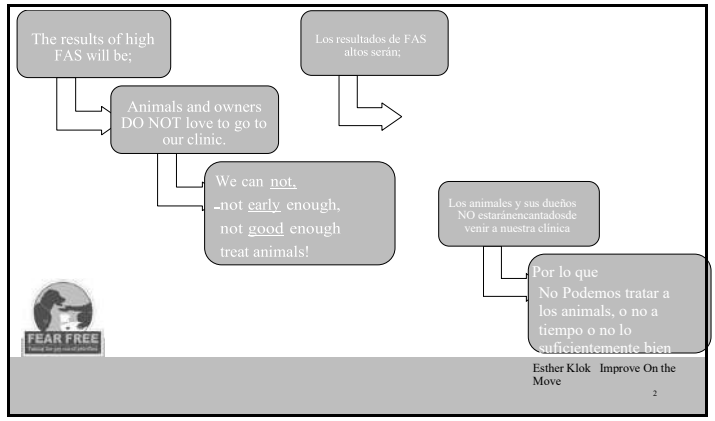
2



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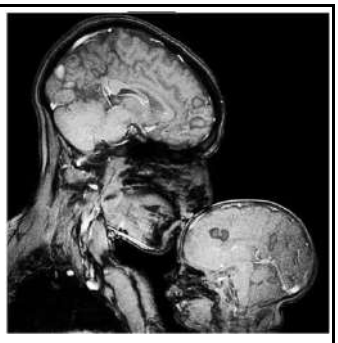
Neuroloog Rebecca Saxe presenteerde de mooiste foto van het jaar. Sterker nog, de afbeelding van een magnetische resonantie vastgelegd wanneer een moeder haar slechts twee maanden oude zoon kust. De lippen die op het hoofd van de kleine man geplaatst worden, triggeren meteen een reactie in zijn hersenen. Dopamine komt vrij, die blijdschap en een genotsgevoel veroorzaken. Daarnaast komt ook oxytocine vrij, gekend als het "liefdeshormoon" omdat het verantwoordelijk is voor het scheppen van geborgenheid en veiligheid. Het vermindert angst en vergroot het vertrouwen, geeft vonken aan gevoelens van diezelfde wederzijdse liefde ervaren en weerspiegeld in de hersenen van de moeder.

Love is just one kiss away



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Dogs and cats; The ability to see the UVB spectrum is interesting because it means that some materials appear to fluoresce to dogs and cats. Your professional-looking white doctor's coat could be lighting up like a christmas tree to your patients.

Perros y gatos; La capacidad de ver el espectro UVB es interesante porque significa que algunos materiales parecen ser fluorescentes para los perros y los gatos. Su bata blanca de médico de aspecto profesional podría iluminarse como un árbol de navidad para sus pacientes.

Esther Klok & Mariët Winkelman ImproveOn theMove

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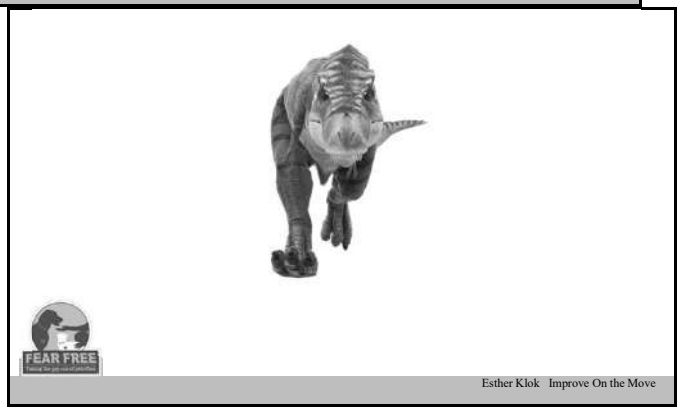
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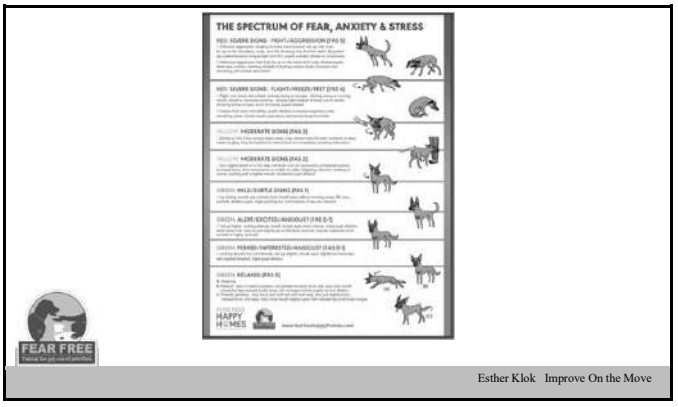
THE SPECTRUM OF FEAR, ANXIETY & STRESS
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What do we need to start Fear Free

Love and; “Tools “

Qué necesitamos para empezar a no tener miedo

Amor y; "Herramientas"

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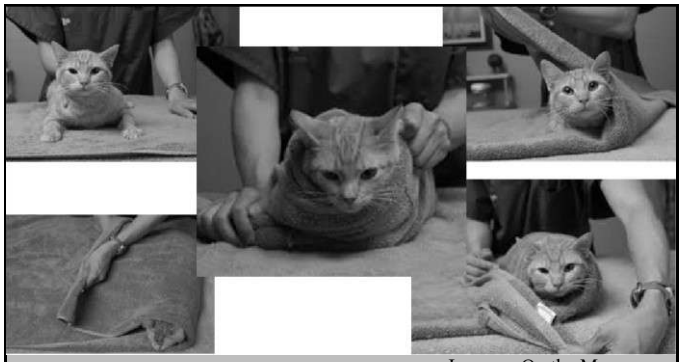

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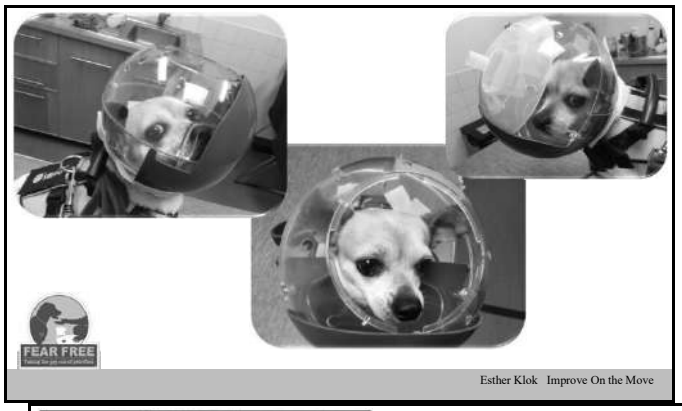

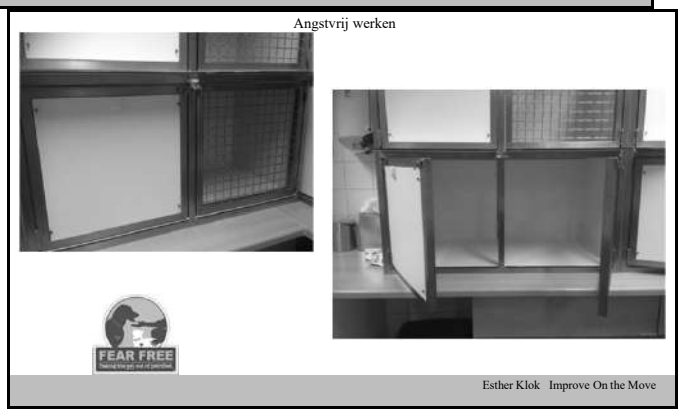

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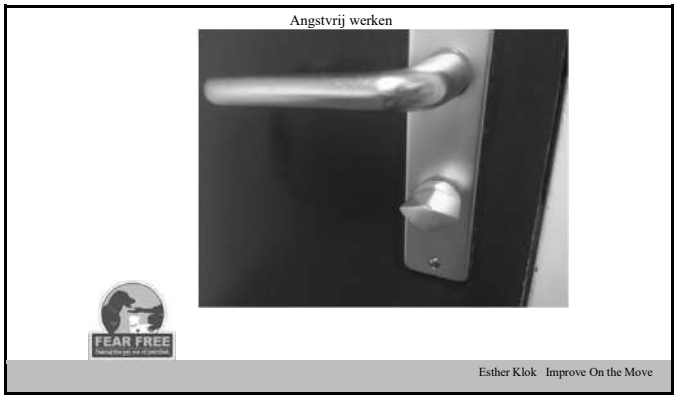

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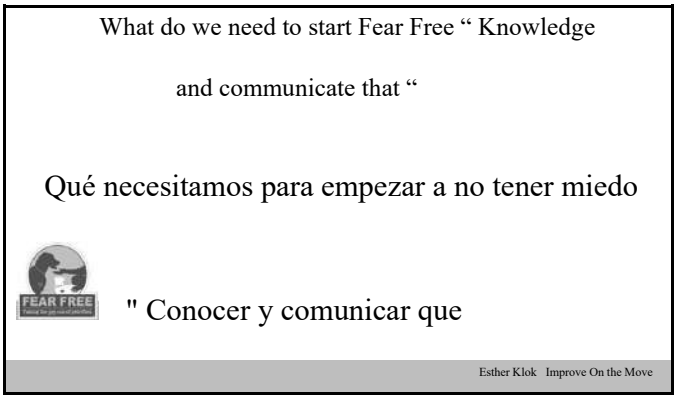

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Are Fear, Anxiety, and Stress (FAS) Always Present?

FAS occurs along a continuum from barely stressed at all, to severely stressed with compromised well-being and safety of all involved

All patients probably experience some stress, but quickly return to baseline

Some patients show more signs of FAS, delayed return

Unable to return to baseline

Level 1: the patient is slightly stressed but quickly returns to baseline with treats, Considerate Approach & Gentle Control severely delayed

Level 2-3: these patients take longer to return to baseline and return is without are severely stressed, aggression, and increasing FAS and health utilization of Considerate can Approach & Gentle Control be given immediate attention. This happening to our patients and how

Level 4-5: these patients likely good recognition of to use have compromised and well-being. This happen quickly and should is what we want to avoid Fear Free can help

38

Caution

- Moderate interest/ disinterest in treats, toys, and/or attention
- Fidgeting, difficulty settling
- Pharmaceutical/ nutraceutical PVP

Pre-Visit Pharmaceutical

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38

FAS Scale

Traffic light

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Stop

- Little to no interest in treats, toys, and/or attention
- Fight, freeze, or flight response
- Sedation + pharmaceutical/ nutraceutical PVP

Pre-Visit Pharmaceutical

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Go

- Readily accepts treats, toys, and/or attention
- Relaxed or mild signs of FAS
- Nutraceutical PVP

Pre-Visit Pharmaceutical

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42 43 46

Must want

Debo

quiero

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Is it a " must "or a " want " ¿Es una "obligación" o un "deseo"?

"obligación"

" deseo "

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Start / think simple!
Try food, toys, attention and LOVE!

¡Empieza / piensa en lo simple!
Prueba con comida, juguetes, atención y AMOR.

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Plan A Plan B Plan C

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Plan A

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48 49 52

Angstvrij werken

*Bot oefenen

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50

Perro, si tras 3 segundos de manejo tiene FAS; haz un descanso

Puedes intentarlo 3 veces. Si no, plan B

Fear Free rules;

Gato, si tras 2 segundos de manejo tiene FAS; haz un descanso

Puedes intentarlo 2 veces. Si no, plan B

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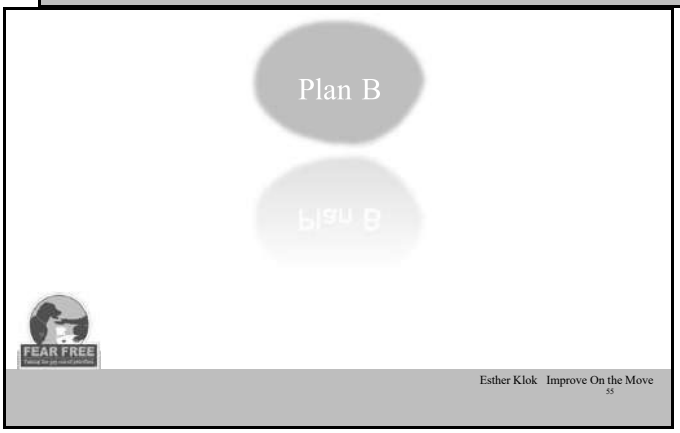

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Fear Free
Complementary & Alternative Medicine

PRODUCT	ACTION	DOSAGE	FORMULATION	RISKS/CONTRAINDICATIONS	NOTES
alpha-casozepine	anxiety reduction (benzodiazepine type effect)	13.0 mg/kg (or Higher up to 25.0 mg/kg) daily, beginning 1-2 days in advance of need	oral; may be in combination with other products or diets	no reported risks or contraindications	enzymic hydrolysate of milk protein
l-theanine	fear and anxiety reduction	2.3-3.0 mg/kg PO twice daily, 2-4 weeks to effect Acute dosing, 2.5-5.0 mg PO 1-2 hours prior and again 3 hours prior to a fearful event	oral	no reported risks or contraindications	amino acid found in green tea leaves
l-tryptophan	anxiety reduction; serotonin precursor may increase serotonin levels	10-15 mg/kg per day	oral	may increase serotonin; therefore use cautiously with drugs that increase serotonin	most effective when combined with a low protein diet; may take several weeks to see effects
pheromone therapy	appeasing and calming	n/a	spray, wipes, diffusers – dogs and cats collars (dogs only)	none reported risks or contraindications	effects are species specific - products do not have effect on all animals

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DRUG	ACTION	DOSAGE*	SIDE EFFECTS	WARNINGS	NOTES
gabapentin	neuropathic pain/ analgesia; calming/ sedation at higher doses; decreased anxiety	**Dog**: 10.0-40.0 mg/kg/dose PO; **Cat**: 10.0-20.0 mg/kg/dose or 50.0-100.0 **mg/CAT (NOT /kg)**; administer 1-2 hours before need	may intensify sedation from other drugs		combines well with other drugs; for maximum sedation give a loading dose the night before
lorazepam	anxiolytic	**Dog**: 0.02-0.1 mg/kg/dose PO (up to 0.5 mg/kg/dose); **Cat**: 0.25-0.5 **mg/CAT (NOT/kg)** PO; administer 45-60 min before need	ataxia; paradoxical excitation;	possible behavioral disinhibition	no active intermediate metabolite - safer for hepatic & geriatric patients
trazodone	anxiolytic, sedation	**Dog**: 5.0-10.0 mg/kg/dose PO (max dose of 300 mg); **Cat**: 50.0 **mg/CAT (NOT /kg)**; administer 1-2 hours before need	sleepiness; paradoxical excitation; variable mild GI effects; may cause 3rd eyelid protrusion in cats	use caution when combining with other drugs that may increase serotonin (SSRIs, TCAs, tramadol, tryptophan)	4+ hours duration; compatible with injectable sedation & gas anesthesia; best given on an empty stomach; for dogs consider loading dose the night before

*Individual variability; Pre-visit test dosing recommended to verify time to onset, dose, effect, duration of effect and any possible adverse effects to insure that drugs can be given sufficiently in advance of visit to be achieve peak effect.

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Cats

Dogs

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Fear Free™
Pre-Visit Pharmaceuticals

DRUG	CLASS & ACTION	DOSAGE*	SIDE EFFECTS	WARNINGS	NOTES
acepromazine	sedative	depends on other drugs in combination; single agent use: **Dog/Cat**: .05-2.0 mg/kg PO	increased aggression; increased noise responsiveness	possible increased aggression	not recommended as a single drug agent; use in combination with anxiolytic drugs for adjunctive sedation
alprazolam	anxiolytic – panniolytic effects in humans	**Dog**: 0.02-0.1 mg/kg/dose PO; **Cat**: 0.125-0.25 mg **/CAT (NOT /kg)** PO; administer 30-60 min before need	ataxia; paradoxical excitation;	possible behavioral disinhibition	metabolized by hydroxylation – may reduce potential for liver toxicity in cats; test dose in advance of need
clonidine	alpha-2 agonist – reduces noradrenaline effects	**Dog**: 0.01-0.05 mg/kg/dose PO; **EFFICACY NOT ESTABLISHED IN CATS**; administer 1 ½ hours before need	sedation; ataxia; constipation	**DOSE/EFFICACY NOT ESTABLISHED IN CATS**	can be used in combination with other anxiolytic drugs
diazepam	anxiolytic	**Dog**: 0.5-2.0 mg/kg/dose PO; **DO NOT GIVE TO CATS PO**; administer 30-60 min before need	ataxia; paradoxical excitation; may be increased activity at higher doses	possible behavioral disinhibition; avoid in cats due to potential hepatotoxicity	metabolized rapidly; variable response among individuals

*Individual variability; Pre-visit test dosing recommended to verify time to onset, dose, effect, duration of effect, and any possible adverse effects to insure that drugs can be given sufficiently in advance of visit to be achieve peak effect.

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Be careful and check really well if you can use certain products!
Every country has his own rules about medication.
In the USA it is no problem to use Gabapentine or Alprazolam. But for example in the Netherlands we have to use the CASCADE-rules.

¡Ten cuidado y comprueba bien si puedes usar ciertos productos!
Cada país tiene sus propias reglas en cuanto a medicación.
En USA no hay ningún problema por usar Gabapentina o Alprazolam.
Pero por ejemplo en Países Bajos tenemos que seguir la regla de la CASCADA.

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Hills AD challenge
Desafío de Hills AD

Katten tabletten ingeven

69

Results:

- We can earlier, more often and better treat animals.
- We will have more income.
- Our staff will have less mental and physical problems when animals AND owners like us a lot

Resultados de trabajar con Fear Free:

- Podemos tartar a los animales antes, más a menudo y mejor.
- Tendremos más ingresos.
- Nuestros empleados tendrán menos problemas mentales y físicos cuando les gustamos mucho a los animalesy los dueños.

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Fear Free is for Students, Faculty & Staff, Too! COMPLIMENTARY!

Fear Free is excited to offer all students, faculty, and staff at veterinary schools, veterinary technician/nurse schools, and veterinary assistant schools complimentary membership to our program! This offer is open to students of all levels for the duration of their time in school, and we encourage you to take advantage of the program as early as possible.

NOTE: This offer was previously only valid for one calendar year from the date of registration. However, this offer has been revised to cover the entire time a student is in school. However, you must re-submit the student form below to renew for free each year. Upon graduation, you may retain your complimentary membership for the remainder of that year. To renew after that, fill out the form below with your most current student information.

GO to;
www.fearfreepets.com
- Veterinary professionals
- Student and faculty applications

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Questions?
estherklok@live.nl
Facebook: Esther Klok
www.improveonthemove.nl
WhatsApp; 0031-630090657

Fear Free: Stephanie Bachman

Stephanie.Bachman@fearfreepets.com

4.1.3. ¿Relaciones públicas y marketing difícil? Fear Free puede ponértelo muy fácil

¿Relaciones públicas y marketing difícil? Fear Free puede ponértelo muy fácil

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"Public relations and marketing is done with the whole team".

" Las relaciones públicas y el marketing se hacen con todo el equipo "

Esther Klok Improve On the Move 2

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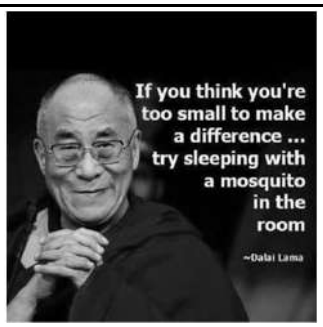
Esther Klok Improve On the Move 3



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Marketing is all about emotions!

El marketing se basa en las emociones.

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1) Pet owners do not come for a building, but for the people who work there; vets and vet-techs. Show who you are. 1) Los propietarios de mascotas no vienen por un edificio, sino por las personas que trabajan en él; Demuestra quién eres.

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5 6 7 8

2) Do not use stock photo's, use your own. Interaction between animals and humans.
2) No utilices fotos de archivo, utiliza las tuyas propias. Interacción entre animales y humanos.

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9

Esther Klok Improve On the Move
10

1) Pet owners do not come for a building, but for the people who work there; vets and vet-techs. Show who you are. 1) Los propietarios de mascotas no vienen por un edificio, sino por las personas que trabajan en él; Demuestra quién eres.

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7

1) Pet owners do not come for a building, but for the people who work there; vets and vet-techs. Show who you are. 1) Los propietarios de mascotas no vienen por un edificio, sino por las personas que trabajan en él; Demuestra quién eres.

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8

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11

2) Do not use stock photo's, use your own. Interaction between animals and humans.

2) No utilices fotos de archivo, utiliza las tuyas propias. Interacción entre animales y humanos.

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12

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15

3) Show that you care for your community.
Demuestre que se preocupa por su comunidad

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17 18 19 20

3) Show that you care for your community. 3) Demuestre que se preocupa por su com

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4) Send owners pictures or movies On whatsapp of there babies
4) Enviar a los propietarios fotos o películas en whatsapp de sus bebés

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22

4) Send owners pictures or movies On whatsapp of there babies
4) Enviar a los propietarios fotos o películas en whatsapp de sus bebés

5)

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Pages " likes " (a good post should reach ½) Páginas " likes " (un buen post debe alcanzar ½)

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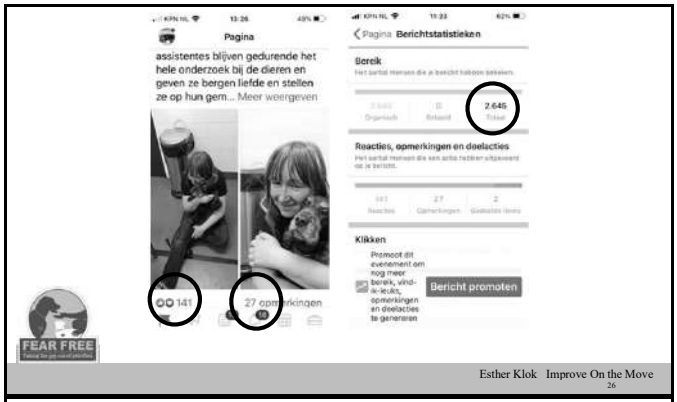

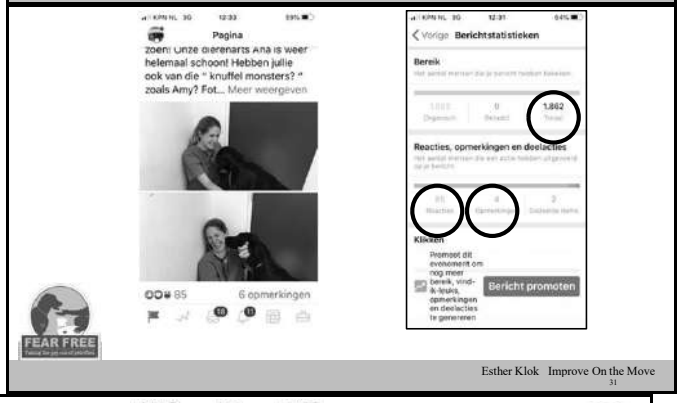

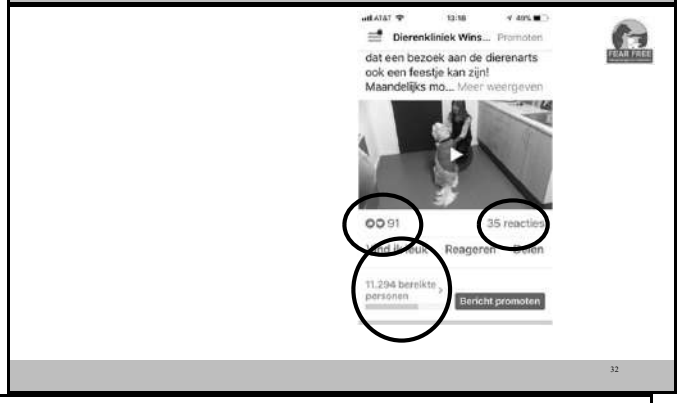

An active communitie is important on social media.
Some ideas for subjects;
Una comunidad activa es importante en las redes sociales.
Algunas ideas para los temas;

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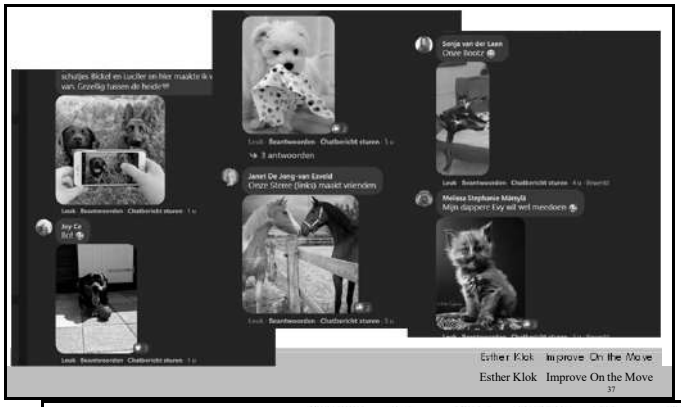

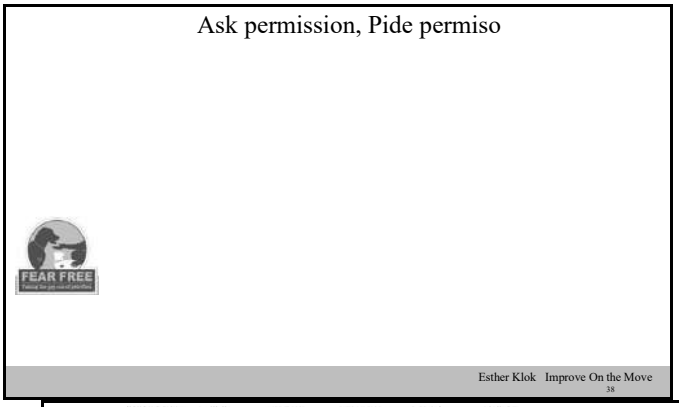

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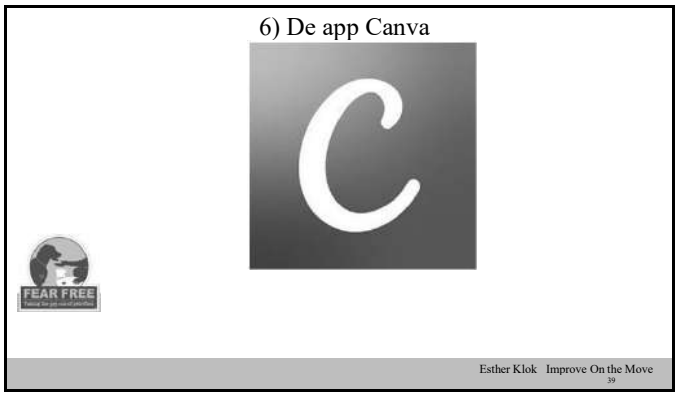

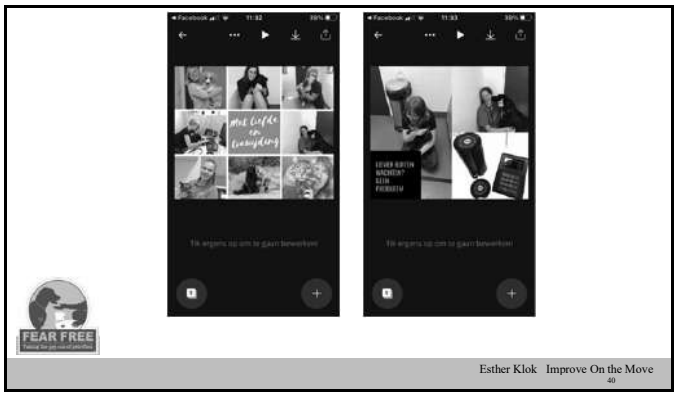

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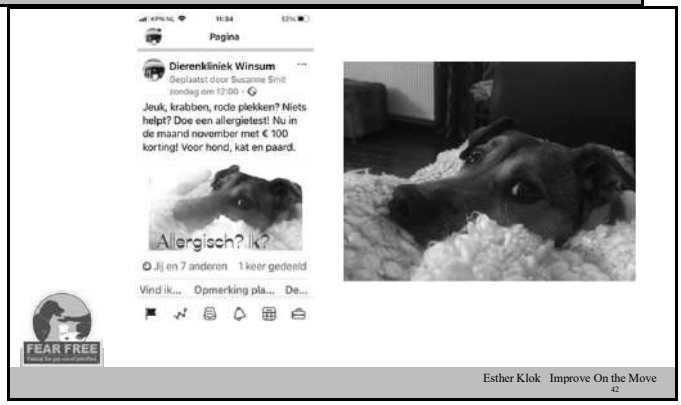
7) De app PhotoRoom



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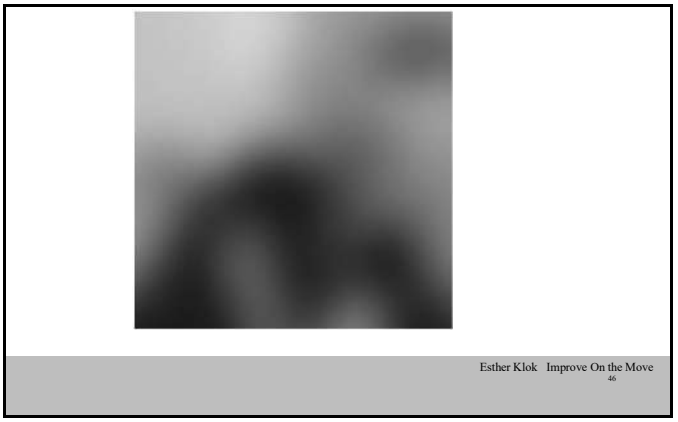
8) De app Quick



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10) Animal shows Espectáculos de animales

compliance

Katten tabletten ingeven

9) Bring your practice to a higher level and start small Lleve su práctica a un nivel superior y empiece con algo pequeño

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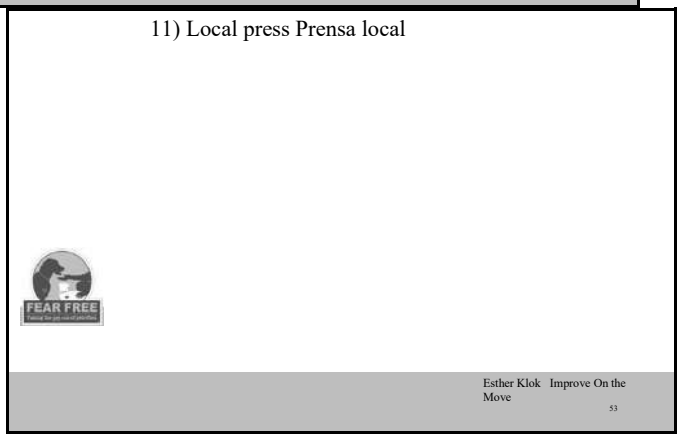
11) Local press Prensa local



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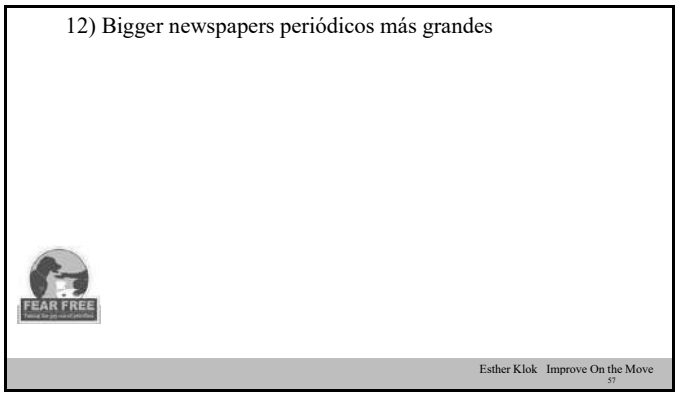
12) Bigger newspapers periódicos más grandes



" direct digitale x ray "

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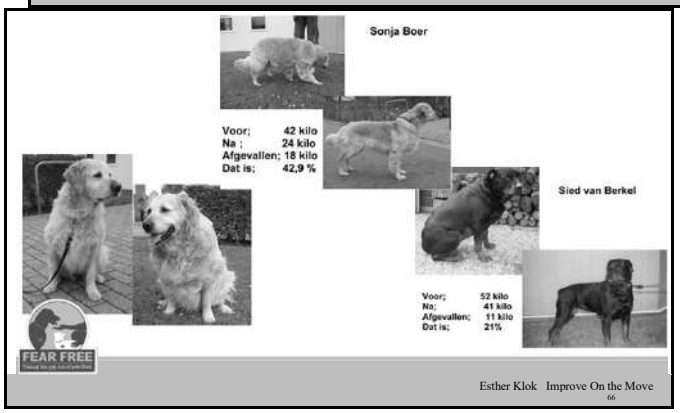

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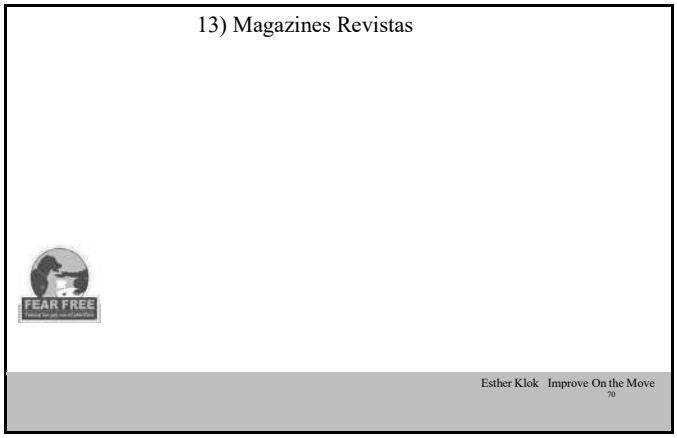
13) Magazines Revistas



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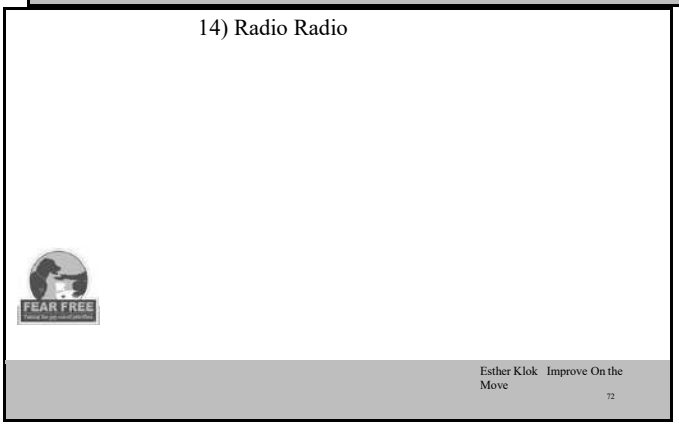

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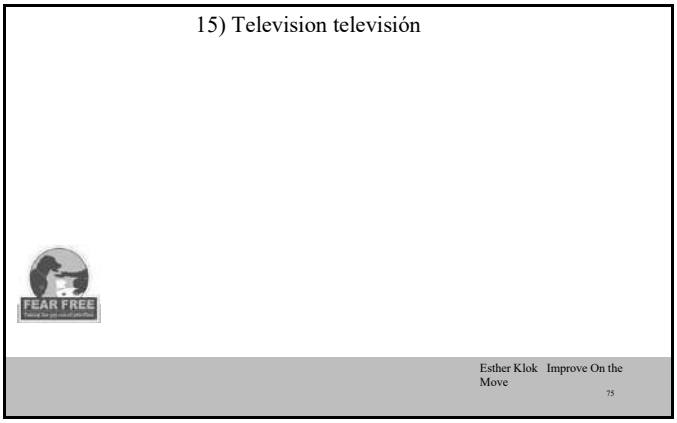

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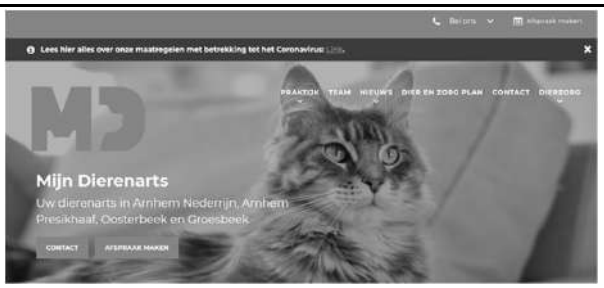
16) And do NOT forget your own “newschanel”; your website! Y NO olvides tu propio "newschanel"; ¡tu sitio web!



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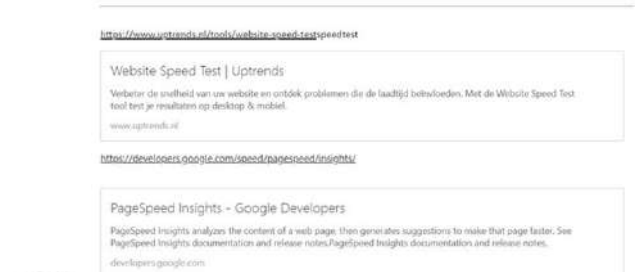

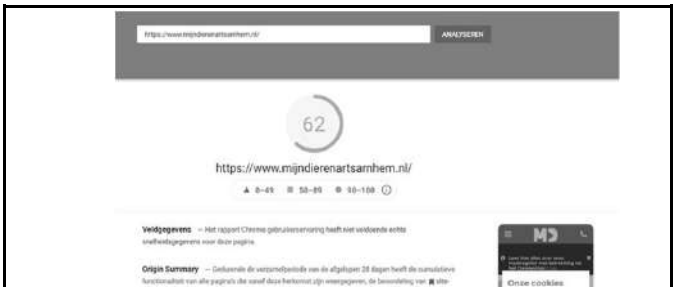

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Fear Free is for Students, Faculty & Staff, Too! COMPLIMENTARY!

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GO to;
www.fearfreepets.com
- Veterinary professionals
- Student and faculty applications

fearfreepets.com

Discount: discount code is FFKLOK22, it provides 20% off the Veterinary Professional Certification, the Animal Trainer Certification, and the Groomer Certification courses
Descuento: el código de descuento es FFKLOK22, que proporciona un 20% de descuento en los cursos de Certificación Profesional Veterinaria, Certificación de Entrenador de Animales y Certificación de Peluquería.
www.fearfreepets.com
www.fearfreeshelters.com
www.fearfreehappyhomes.com

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Questions??

estherklok@live.nl
Facebook: Esther Klok
www.improveonthemove.nl
Tel. 0031-630090657

Fear Free: Stephanie Bachman
Stephanie.Bachman@fearfreepets.com

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Michael R. Lappin, DVM, PhD, DACVIM

5.1.1. UPDATE ON SELECT TICK BORNE DISEASES IN DOGS AND CATS

Michael R. Lappin, DVM, PhD, DACVIM

The Kenneth W. Smith Professor in Small Animal Clinical Veterinary Medicine

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins Colorado

ABSTRACT. In these lectures, cases will be used to show how to manage dogs and cats with tick associated vector borne diseases. Anaplasmosis, babesiosis, bartonellosis, cytauxzoonosis, ehrlichiosis, hemoplasmosis and others will be discussed. Emphasis will be placed on how to recognize the agents, use of serology and PCR assays, optimal treatment, and the use of products to prevent flea and tick infestations. The objectives of the lecture are:

1. To review the major tick associated infections of dogs and cats.
2. To discuss the use of serology and PCR assays in the diagnosis of tick borne agents.
3. To review the optimal treatments for tick borne agents.
4. To learn the importance of prevention tick borne infections.

Key words. Vector; tick; flea; Anaplasma; Ehrlichis;

There are multiple vector borne diseases in dogs; those transmitted by ticks (multiple agents), fleas (multiple agents), mosquitoes (Dirofilaria immitis) or sandflies (Leishmania spp.) are among the most common. The Companion Animal Parasite Council website (www.capcvet.org) and European guidelines ((https://www.esccap.org/guidelines/) are excellent sources of information about vector borne diseases.

The organisms of the Order Rickettsiales, in the families Rickettsiaceae and Anaplasmataceae, were reclassified in 2001 following phylogenetic analyses of the 16S rRNA and groESL gene sequences (Dumler and colleagues, 2001). Some Ehrlichia spp. were transferred to the Neorickettsia genus (including E. risticii) and some Ehrlichia spp., including E. phagocytophila (also called E. equi and human granulocytic Ehrlichia) and E. platys) were placed into the genus Anaplasma. The genera Ehrlichia and Neorickettsia were transferred to the family Anaplasmataceae; the genera of Rickettsia and Orientia remained in the Rickettsiaceae. The organisms in the Ehrlichia, Anaplasma, and Neorickettsia genera are classified genetically and by cell tropism (Monocytotropic, granulocytotropic, or thrombocytotropic).

Babesia spp., Borrelia burgdorferi, Fransicella tularensis, Hepatozoon spp., Mycoplasma haemocanis, and Rickettsia rickettsii are also vectored by ticks, relatively common within geographical ranges, and are associated with illness in dogs. It is also possible that some Bartonella spp. of dogs, which are usually flea-borne, are tick transmitted. The purpose of this proceedings is to provide attendees an update on the management of a select group of tick borne disease agents that infect dogs and cats.

CANINE GRANULOCYTOTROPIC ANAPLASMOSIS

Etiology and epidemiology. Anaplasma phagocytophilum (previously E. equi, E. phagocytophila, canine granulocytic Ehrlichia, and human granulocytic ehrlichiosis agent) is known to infect a variety of animals, including small mammals, mountain lions, coyotes, sheep, cattle, deer, dogs, horses, and people. Small mammals and deer are natural reservoirs. The distribution of A. phagocytophilum is defined by the range of Ixodes ticks and so is most common in California, Wisconsin, Minnesota, and the northeastern states and other areas of the world with this tick genus including Europe, Asia, and Africa. Birds may play a role in spreading infected ticks and may also serve as a reservoir. Borrelia burgdorferi is also transmitted by Ixodes ticks and so co-infections can occur. The vector needs to be attached for approximately 24-48 hours in order to transmit the agent. Clinical signs usually develop approximately 1-2 weeks after infection. Neutrophils (and rarely, other leukocytes) phagocytize the organism, and once intracellular, A. phagocytophilum prevents phagolysosome fusion. This mechanism allows for multiplication within the phagosome, which gives the appearance of morulae in neutrophils under light microscopy. The exact pathogenesis of disease is still undetermined and it is unclear why some dogs but not others develop clinical signs of disease.

Clinical features. Anaplasma phagocytophilum infection appears to be primarily an acute disease in dogs. It has been associated most commonly with non-specific signs of fever, lethargy and inappetence. Stiffness and lameness consistent with musculoskeletal pain are also common and A. phagocytophilum has been associated with polyarthritis. Vomiting, diarrhea, difficult breathing, cough, lymphadenopathy, hepatosplenomegaly, and central nervous system signs (seizures and ataxia) have also been reported. Dogs can be chronic, subclinical carriers and so exacerbation of disease could occur in some dogs. However, chronic disease syndromes like those associated with E. canis infection have not been documented. In one study of valvular endocarditis, all dogs with Bartonella spp. associated disease were also seropositive for A. phagocytophilum (MacDonald and colleagues, 2004). Whether the coinfection potentiated the Bartonella associated disease is unknown.

Diagnosis. Morulae of A. phagocytophilum are commonly detected in neutrophils of most clinically affected dogs and so infection is usually confirmed during performance of a complete blood cell count. While thrombocytopenia and lymphopenia are common, neutrophil counts are usually normal. Reported biochemical panel and urinalysis

abnormalities are mild and nonspecific. The morulae cannot be distinguished from those of E. ewingii, but the geographical range of the infections varies between the organisms and so the travel history can aid in ranking the differentials. Serologic test results (IFA and ELISA) can be used if morulae are not identified. A point of care assay that detects antibodies against A. phagocytophilum is available (SNAP®4Dx, IDEXX Laboratories, Portland, ME) and several commercial laboratories have antibody assays (Antech Diagnostics, Lake Success, NY). Antibody assay results can be falsely negative in acute cases and so a convalescent test 2-3 weeks later may be required to confirm exposure. As A. phagocytophilum infections are limited geographically, this antibody test result is not needed in the majority of the United States. Polymerase chain reaction assays performed on blood collected in EDTA can be used to confirm infection and differentiate A. phagocytophilum infection from other infections, but microbial DNA can also be amplified from healthy dogs. Most dogs infected by A. phagocytophilum have subclinical infections, most infected dogs only have an acute phase, exposure rates in endemic areas are high, and the disease syndromes associated with infection have multiple other causes. Thus, antibody test results and PCR assay results alone cannot be used to prove clinical disease associated with A. phagocytophilum infection.

Treatment. Several antibiotics are effective against A. phagocytophilum in vitro. Doxycycline administered at 5-10 mg/kg, PO, q12-24 hr for at least 10 days is recommended by most clinicians. Whether a 28 day course of doxycycline therapy as recommended for E. canis is needed is unknown. If tetracyclines are used, 22 mg/kg, PO, q8hr for 2-3 weeks is recommended. Chloramphenicol administered at 15-25 mg/kg, PO, q 8hr for 14-21 days may be effective in puppies and should be used to avoid dental discoloration. Most dogs respond to therapy within hours to days of initiating therapy.

Zoonotic aspects and prevention. Anaplasma phagocytophilum infects people as well as dogs and so the organism is zoonotic. Human infections most likely acquired by direct tick transmission, however, handling infected blood and carcasses can also lead to infection. Care should also be taken when handling ticks. There is currently no vaccine for A. phagocytophilum infection. Infection can be avoided by controlling ticks or prophylactic use of tetracyclines when visiting endemic areas. In one study, application of imidacloprid-permethrin prevented transmission of A. phagocytophilum from naturally infected Ixodes scapularis ticks to dogs (Blagburn and colleagues, 2004). In another study, application of permethrin 54.5% and fipronil 6.1% (Effitix; Virbac) was effective for Ixodes ricinus and so the product could also lessen likelihood of transmission of A. phagocytophilum and Borrelia burgdorferi (Bonneau et al, 2015). Dogs appear to be susceptible to reinfection and so tick control should be maintained at all times in endemic areas. Dogs used for blood donors that reside in endemic areas should be screened for A. phagocytophilum infections by serology or PCR (Wardrop et al, 2016).

CANINE MONOCYTOTROPIC EHRLICHIOSIS

Etiology and epidemiology. Organisms that are associated with monocytotropic ehrlichiosis in naturally-infected dogs include Ehrlichia canis, E. chaffeensis, and

Neorickettsia risticii var atypicalis. An individual dog can be infected by more than one ehrlichial agent and coinfections with other tick borne pathogens are common (Kordick and colleagues, 1999).

Ehrlichia canis is the most common of these agents and causes the most severe clinical disease; it is maintained in the environment from passage from ticks to dogs. Rhipicephalus sanguineus and Dermacentor variabilis are the known vectors. The organism is not passed transovarially in the tick, so unexposed ticks must feed on a rickettsemic dog in the acute phase to become infected and perpetuate the disease. Male R. sanguineus can take multiple feedings and can both acquire and transmit E. canis in the absence of female ticks. Dogs seropositive for E. canis have been identified in many regions of the world and most of the United States, but the majority of cases occur in areas with high concentrations of R. sanguineus such as the Southwest and Gulf Coast.

Ehrlichia chaffeensis is a cause of human mononuclear ehrlichiosis. White tailed deer, voles, coyotes, and opossums are reservoirs and Amblyomma americanum, D. variabilis, and some Ixodes ticks are vectors. Infections by E. chaffeensis are detected primarily in the southeastern United States. Clinical manifestations in dogs are currently being detailed and appear to be rare.

Ehrlichia canis infection causes acute, subclinical, and chronic phases of disease. Infected mononuclear cells marginate in small vessels or migrate into endothelial tissues, inducing vasculitis during the acute phase. The acute phase begins 1 to 3 weeks after infection, and lasts 2 to 4 weeks; most immunocompetent dogs survive. The subclinical phase lasts months to years in naturally infected dogs. Although some dogs clear the organism during the subclinical phase, the organism persists intracellularly in some, leading to the chronic phase of infection. Many of the clinical and clinicopathologic abnormalities that develop during the chronic phase are due to immune reactions against the intracellular organism. The variable duration of the subclinical phase of disease explains why E. canis infection does not have a distinct seasonal incidence like Rocky Mountain spotted fever (RMSF). However, acute phase disease is recognized most frequently in the spring and summer when the tick vectors are most active.

Clinical features. Clinical disease from ehrlichial infection can occur in any dog, but its severity varies depending on the organism, host factors, and presence of coinfections. Virulence is thought to vary with different field strains of E. canis. Dogs with depressed cell-mediated immunity develop severe disease.

Clinical findings in dogs with E. canis infections vary with the timing of infection. The clinical manifestations of acute phase disease are very similar to those of RMSF, owing to the development of vasculitis. Ticks are most commonly found on dogs during the acute phase of infection. Fever can occur in both clinical phases of infection but is more common in dogs with acute ehrlichiosis. Petechiae or other evidence of bleeding noted during the acute phase are generally caused by a combination of mild thrombocytopenia

(consumption or immune-mediated destruction) and vasculitis; thrombocytopenia (consumption, immune-mediated destruction, sequestration, decreased production), vasculitis, and platelet function abnormalities occur in the chronic phase. The thrombocytopenia in the acute phase is generally not severe enough to result in spontaneous bleeding and so bleeding may be primarily from vasculitis and decreased platelet function.

Pale mucous membranes usually only occur in the chronic phase during the development of pancytopenia. Hepatomegaly, splenomegaly, and lymphadenopathy are from chronic immune stimulation (i.e. lymphoreticular hyperplasia) and are detected most frequently in dogs in the chronic phase. Interstitial or alveolar edema secondary to vasculitis or to inflammation, pulmonary parenchymal hemorrhage secondary to vasculitis or thrombocytopenia, or secondary infections from neutropenia are mechanisms resulting in dyspnea or cough in some dogs with ehrlichiosis. Polyuria, polydipsia, and proteinuria are reported in some dogs that develop renal insufficiency.

Stiffness, exercise intolerance, and swollen painful joints occur in some dogs with suppurative polyarthritis. Most dogs with polyarthritis from which the organism has been demonstrated have been infected with E. ewingii or A. phagocytophilum. Ophthalmic manifestations of disease are common; tortuous retinal vessels, perivascular retinal infiltrates, retinal hemorrhage, anterior uveitis, and exudative retinal detachment occur. CNS signs can include depression, pain, ataxia, paresis, nystagmus, and seizures.

Diagnosis. Neutropenia is common during acute phase vasculitis and after bone marrow suppression in the chronic phase. Chronic immune stimulation causes monocytosis and lymphocytosis; lymphocytes often have cytoplasmic azurophilic granules (i.e., large granular lymphocytes). Regenerative anemia is from blood loss (acute and chronic phases); normocytic, normochromic nonregenerative anemia is from bone marrow suppression or anemia of chronic disease (chronic phase). Thrombocytopenia can occur with either acute or chronic ehrlichiosis, but is generally more severe with chronic phase disease. Thrombocytopathies from hyperglobulinemia potentiate bleeding in some dogs with chronic ehrlichiosis. Chronic ehrlichiosis is classically associated with pancytopenia, but any combination of neutropenia, thrombocytopenia, and anemia can occur. Changes in bone marrow cell lines associated with ehrlichiosis vary from hypercellular (acute phase) to hypocellular (chronic phase). Bone marrow plasmacytosis is common in dogs with subclinical and chronic ehrlichiosis, and the disease can be confused with multiple myeloma, particularly in those dogs with monoclonal gammopathies. Dogs with ehrlichiosis are usually not hypercalcemic and do not have lytic bone lesions.

Hypoalbuminemia in the acute phase is probably caused by third spacing of albumin in tissues because of vasculitis, whereas in chronic phase disease it is due to glomerular loss from immune complex deposition or chronic immunostimulation (i.e., monoclonal or polyclonal gammopathy). Prerenal azotemia can occur with acute or chronic disease; renal azotemia develops in some dogs with severe glomerulonephritis from chronic ehrlichiosis. The combination of hyperglobulinemia and hypoalbuminemia is consistent

with subclinical or chronic ehrlichiosis. Polyclonal gammopathies are most common, but monoclonal (e.g., IgG) gammopathies can also occur.

Aspirates of enlarged lymph nodes and spleen reveal reactive lymphoreticular and plasma cell hyperplasia. Nondegenerate neutrophils are the primary cells in synovial fluid from dogs with polyarthritis caused by any Ehrlichia spp.; E. ewingii and A. phagocytophilum morulae can be identified in synovial neutrophils from some dogs. Bone marrow aspirates in dogs with chronic ehrlichiosis typically reveal myeloid, erythroid, and megakaryocytic hypoplasia in association with lymphoid and plasma cell hyperplasia. Morulae from E. canis are rarely detected in the cytoplasm of mononuclear cells. Ehrlichiosis generally causes mononuclear pleocytosis and increased protein concentrations in CSF. Antiplatelet antibodies, antinuclear antibodies (ANA), antierythrocyte antibodies (by direct Coombs' test), and rheumatoid factors are detected in some dogs with ehrlichiosis, leading to an inappropriate diagnosis of primary immune-mediated disease.

No pathognomonic radiographic signs appear in dogs with ehrlichiosis. The polyarthritis is nonerosive, and dogs with respiratory signs most commonly have increased pulmonary interstitial markings, but alveolar patterns can occur. Identification of morulae in cells documents Ehrlichia infection, but it is uncommon with monocytotropic strains. Examination of buffy coat smears or blood smears made from blood collected from an ear margin vessel may increase the chances of finding morulae. Some Ehrlichia spp. can be cultured, but the procedure is low-yield and expensive and so is not clinically useful.

Most commercial laboratories (using IFAs or ELISA) and one point-of-care diagnostic test (SNAP®4Dx, IDEXX Laboratories, Portland, ME) use reagents that detect antibodies against E. canis in serum. These tests are generally used as the first screening procedures in dogs suspected to have ehrlichiosis. The American College of Veterinary Internal Medicine (ACVIM) Infectious Disease Study Group suggests that E. canis IFA antibody titers between 1:10 and 1:80 be rechecked in 2 to 3 weeks because of the potential for false-positive results at these titer levels.

If serum antibodies against E. canis are detected in a dog with clinical signs consistent with ehrlichiosis, a presumptive diagnosis of canine ehrlichiosis infection should be made and appropriate treatment begun. However, detection of antibodies alone is not diagnostic of ehrlichiosis because some dogs are subclinically infected. Additionally, negative test results do not totally exclude ehrlichiosis from the list of differential diagnoses, because clinical disease can be detected before seroconversion and not all Ehrlichia spp. induce antibodies that consistently detected in E. canis assays (Moroff et al, 2014).

PCR assays are now available commercially and can be used to detect organism-specific DNA in peripheral blood. It can be performed on joint fluid, aqueous humor, CSF, and tissues. Blood PCR results can be positive before seroconversion in some

experimentally inoculated dogs, and positive results document infection, whereas positive serologic tests only document exposure (Moroff et al, 2014). However, as for serology, no standardization between laboratories currently exists, and insufficient quality control can lead to both false-positive and false-negative results. Until more information is available, the ACVIM Infectious Disease Study Group suggests using PCR with serology, not in lieu of it. Because antibiotic treatment rapidly induces negative blood PCR results, the clinician should draw the blood sample for testing and place it in an EDTA tube before treatment. In one recent study, tissues (lymph nodes, spleen, liver, bone marrow, and blood) from naturally infected dogs were assayed by PCR. Blood and lymph nodes were the most likely to be positive, but were falsely negative in approximately 30% of the samples.

Treatment. Supportive care should be provided as indicated. Several different tetracycline, doxycycline, chloramphenicol, and imidocarb diproprionate protocols have been used. The ACVIM Infectious Disease Study Group currently recommends doxycycline (5 mg/kg, PO, q12hr or 10 mg/kg PO q24h for at least 28 days). In one study of experimentally infected dogs, ticks still could acquire E. canis from feeding on dogs previously treated with doxycycline for 14 days (Schaefer and colleagues, 2007). Clinical signs and thrombocytopenia should rapidly resolve. If clinical abnormalities are not resolving within 7 days, other differential diagnoses should be considered. Results of studies using imidocarb diproprionate (5 to 7 mg/kg IM or SQ repeated in 14 days) to treat canine ehrlichiosis have been variable. In one study, thrombocytopenia persisted and infection was not cleared in experimentally inoculated dogs (Eddlestone and colleagues, 2006). Some patients develop pain at the injection site, salivation, oculonasal discharge, diarrhea, tremors, and dyspnea after administration of this drug. Quinolones are not effective for the treatment of E. canis infections in dogs.

Positive antibody titers have been detected for up to 31 months after therapy in some naturally infected dogs. Dogs with low (< 1:1024) antibody titers generally revert to negative within 1 year after therapy. Dogs with antibody titers greater than 1:1024 often maintain positive antibody titers after therapy. It is undetermined whether these dogs are persistent carriers of the organism. Based on these findings, antibody titers are considered to be ineffective for monitoring response to therapy. The ACVIM Infectious Disease Study Group recommends monitoring resolution of thrombocytopenia and of hyperglobulinemia as markers of therapeutic elimination of the organism.

It is currently unknown whether ehrlichial infections are cleared by treatment. If PCR is to be used to monitor treatment, the ACVIM Infectious Disease Study Group recommends the following steps be taken: The PCR test should be repeated 2 weeks after stopping treatment. If still positive, treatment should be reinstituted for 4 weeks and retesting performed. If PCR results are still positive after 2 treatment cycles, an alternate anti-Ehrlichia drug should be used. If PCR results are negative, the test should be repeated in 8 weeks, and if still negative it can be assumed therapeutic elimination is likely. In one study, PCR assay performed on splenic aspirates was superior to blood PCR to document elimination of infection (Harrus and colleagues, 2004).

Whether to treat seropositive, healthy dogs is controversial. Arguments for and against testing or treating healthy dogs were reviewed by the ACVIM Infectious Disease Study Group. The primary reason to treat a seropositive, healthy dog is to try to eliminate infection before development of chronic phase disease. However, treatment of healthy dogs is controversial for at least six reasons: (1) it is unknown whether treatment halts progression to the chronic phase; (2) not all seropositive dogs are infected; (3) not all seropositive dogs progress to the chronic phase; (4) it is unknown whether treatment eliminates infection; (5) even if infection is eliminated, reinfection can occur; and (6) treatment of healthy carriers may result in antimicrobial resistance. Because further data are needed to make definitive recommendations, owners should be given the pros and cons and asked to make treatment decisions.

The prognosis is good for dogs with acute ehrlichiosis, and it is variable to guarded for those with chronic ehrlichiosis. Fever, petechiation, vomiting, diarrhea, epistaxis, and thrombocytopenia often resolve within days after initiation of therapy in acute cases. Bone marrow suppression from chronic phase ehrlichiosis may not respond for weeks to months, if at all. Anabolic steroids and other bone marrow stimulants can be administered but are unlikely to be effective because precursor cells are often lacking. Immune-mediated events resulting in the destruction of red blood cells or platelets are likely to occur with ehrlichiosis, leading to the recommendation to administer anti-inflammatory or immunosuppressive doses of glucocorticoids to acutely affected animals. Prednisone (2.2 mg/kg PO divided q12h during the first 3 to 4 days after diagnosis) may be beneficial in some cases.

Zoonotic aspects and prevention. Dogs and people are both infected by Ehrlichia canis, E. ewingii, and E. chaffeensis. Although people cannot acquire ehrlichiosis from handling an infected dog, dogs may be reservoirs for these agents and may play a role in the human disease by bringing vectors into the human environment. Ticks should be removed and handled with care.

Tick control should be maintained at all times as reinfection can occur. Products that repel ticks are likely to be the best products for prevention of E. canis infection as the transmission times after tick attachment may be as short as 3 hours. In one study comparing topically applied permethrin/imidacloprid to 2 orally administered acaracides, the topical product was superior for blocking E. canis transmission (Jongejan et al, 2016). Use of collars (examples Seresto; Bayer Animal Health; Preventic; Virbac) that also repel ticks can be beneficial for blocking transmission of vector borne agents with short transmission times and can increase compliance.

Because Ehrlichia canis is not passed transovarially in the tick, it can be eliminated in the environment by tick control or by treating all dogs through a generation of ticks. Rhipicephalus can only transmit E. canis for approximately 155 days; if tick control is not feasible, tetracycline can be administered (6.6 mg/kg PO daily for 200 days). During this time, infected dogs will not infect new ticks and previously infected ticks will lose the ability to transmit the organism. Doxycycline given at 100 mg/dog per day was also used successfully as a chemopreventative (Davoust and colleagues, 2005). Dogs used as

blood donors should be screened serologically yearly and seropositive dogs should not be used.

CANINE GRANULOCYTOTROPIC EHRLICHIOSIS

Etiology and epidemiology. Ehrlichia ewingii forms morulae in neutrophils and eosinophils and has been detected in dogs and people that reside in the southern and southeastern United States. Ehrlichia ewingii has been detected in a number of ticks, but Amblyomma americanum is the only proven vector to date. Deer are infected and serve as a reservoir. The incubation period after tick exposure is approximately 13 days. Pathogenesis of disease is unknown, but is likely similar to other Ehrlichia spp. In general, clinical signs of E. ewingii infection are less severe thnt those of E. canis. Concurrent disease or infections may play a significant role in the pathogenesis of E. ewingii infection.

Clinical Features. Non-specific signs of E. ewingii infection include fever, lethargy, anorexia, depression, and signs consistent with polyarthritis, such as stiffness. Other clinical signs include vomiting, diarrhea, peripheral edema and neurological signs like ataxia, paresis, and vestibular disease. Clinical signs can be mild, self-limited, or inapparent. Similar to R. rickettsii, acute disease seems to be most common and so E. ewingii infection should be highest on the list of differential diagnoses from the spring through autumn when A. americanum is most active.

Diagnosis. Suppurative polyarthritis is most common. Other clinicopathologic findings typically associated with acute E. canis infection, such as mild to moderate thrombocytopenia and anemia, also occur. Morulae can be detected in neutrophils and eosinophils in peripheral blood and in neutrophils from synovial fluid. However, presence of morulae is transient and so easily missed cytologically. The organism has not been cultured to date and so a specific serological test is not available. However, because the organism is closely related to E. canis, antibodies against E. ewingii can often be detected in some E. canis assays. However, E. ewingii antibodies to not bind to the E. canis peptide used in one commercial assay (Antech Diagnostics) and so this assay cannot be used to screen dogs for E. canis infection (Moroff et al, 2014). PCR assays are now used to differentiate between members of the Ehrlichia, Anaplasma, and Neorickettsia genera and should be performed on blood collected in EDTA before administration of antibiotics.

Treatment. Supportive care should be provided as indicated. The tetracycline, doxycycline, and chloramphenicol protocols recommended for E. canis infections are generally effective. The ACVIM Infectious Disease Study Group currently recommends doxycycline (5 mg/kg, PO, q12h or 10 mg/kg PO q24h for at least 28 days) for Ehrlichia spp, infections of dogs.

Zoonotic aspects and Prevention. Dogs and people are both infected by Ehrlichia canis, E. ewingii, and E. chaffeensis. Although people cannot acquire ehrlichiosis from handling an infected dog, dogs may be reservoirs for these agents and may play a role in the human disease by bringing vectors into the human environment. Ticks should be removed and handled with care. Dogs used as blood donors should be screened serologically with E. canis IFA tests yearly and seropositive dogs should not be used.

ROCKY MOUNTAIN SPOTTED FEVER

Etiology and epidemiology. Rocky Mountain spotted fever (RMSF) is caused by Rickettsia rickettsii. Other members of the genus also infect dogs in the United States; however, they are not associated with clinical disease but can induce antibodies that cross-react with R. rickettsii (see Diagnosis). In another study of dogs coinfected with several tick-borne pathogens, infection with an uncharacterized rickettsial agent commonly induced cross-reacting antibodies to R. rickettsii (Kordick and colleagues, 1999). Canine RMSF is recognized predominantly in the southeastern states from April through September when the tick vectors are most active. Dermacentor andersoni (i.e., American wood tick), Dermacentor variabilis (i.e., American dog tick), and Amblyomma americanum (i.e., Lone Star tick) are the principal vectors, host, and reservoir of R. rickettsii. Recently, there has been a reemergence of RMSF in the southwestern states and R. sanguineous ticks are the vector (Demma and colleagues, 2005).

The organism is maintained in nature in a cycle between ticks and small mammals like voles, ground squirrels, and chipmunks, and it is transmitted transovarially in ticks, so nymphs and larvae can be infected without feeding. R. rickettsii replicates in endothelial tissues (causing vasculitis) and so can lead to diverse and sometimes severe clinical manifestations of disease as soon as 2 to 3 days after exposure. Antiplatelet antibodies can be detected in many infected dogs, suggesting an immune-mediated component to the thrombocytopenia that is frequently present.

Clinical features. Any dog not previously exposed to R. rickettsii can develop RMSF. Frequently, the tick has fed and left the dog before the development of clinical signs. In one study, only 5 of 30 owners knew their dogs had been infested by ticks (Gasser and colleagues, 2001). After infection, the majority of dogs are subclinical; some develop acute disease with a clinical course of approximately 14 days. No age or sex predilection exists.

Fever and depression are the most common clinical signs. Interstitial pulmonary disease, dyspnea, and cough occur in some dogs and gastrointestinal signs occur in some acutely infected dogs. Because the disease is generally acute, lymphadenopathy and splenomegaly are not as common as in dogs with ehrlichiosis. Petechiae, epistaxis, subconjunctival hemorrhage, hyphema, anterior uveitis, iris hemorrhage, retinal petechiae, and retinal edema occur frequently.

Cutaneous manifestations can include hyperemia, petechiae, edema, and dermal necrosis. Hemorrhage results from vasculitis, thrombocytopenia from consumption of platelets at sites of vasculitis, thrombocytopenia from immune destruction, and in some dogs, disseminated intravascular coagulation. Central nervous system (CNS) signs include vestibular lesions (nystagmus, ataxia, head tilt), seizures, paresis, tremors, changes in mentation, and hyperesthesia. Fatal RMSF is generally secondary to cardiac arrhythmias and shock, pulmonary disease, acute renal failure, or severe CNS disease.

Diagnosis. Clinicopathologic and radiographic abnormalities are common but do not definitively document RMSF. Neutrophilic leukocytosis, with or without a left shift and toxic cells, is found in most clinically affected dogs. Platelet counts are variable, but in one study, 14 of 30 dogs had less than 75,000 platelets/µl without evidence of disseminated intravascular coagulation (Gasser, 2001). In other dogs, hemostatic abnormalities consistent with disseminated intravascular coagulation occur. Anemia occurs in some dogs, primarily from blood loss. Increased activities of alanine aminotransferase, aspartate aminotransferase, and alkaline phosphatase, as well as hypoalbuminemia from blood loss or third spacing of albumin in tissues secondary to vasculitis occur frequently. Because R. rickettsii does not result in chronic intracellular infection like ehrlichiosis, hyperglobulinemia is rare. Renal insufficiency in some dogs causes azotemia and metabolic acidosis. Serum sodium, chloride, and potassium concentrations decrease in many dogs with gastrointestinal tract signs or renal insufficiency. In contrast to dogs with chronic ehrlichiosis, chronic proteinuria from glomerulonephritis is rare. Positive direct Coombs' test results occur in some dogs.

Nonseptic, suppurative polyarthritis occurs in some dogs. CNS inflammation usually causes increased protein concentrations and neutrophilic pleocytosis in CSF; some dogs may have mononuclear cell pleocytosis or mixed inflammation. No pathognomonic radiographic abnormalities are associated with RMSF, but both experimentally- and naturally- infected dogs commonly develop unstructured pulmonary interstitial patterns.

A presumptive diagnosis of canine RMSF can be based on the combination of appropriate clinical, historical, and clinicopathologic evidence of disease, serologic test results, exclusion of other causes of the clinical abnormalities, and response to anti-rickettsial drugs. Documentation of seroconversion or an increasing titer 2 to 3 weeks after initial serologic testing suggests recent infection. Diagnostic criteria used in one recent study included a fourfold rise in antibody titer or a single titer of greater than 1:1024 if the initial titer was submitted 1 week or more after initial onset of clinical abnormalities (Gasser and colleagues, 2001). Positive serum antibody test results alone do not prove RMSF because subclinical infection is common. In addition, positive serum antibody tests do not document infection by R. rickettsii because infection with nonpathogenic spotted fever group agents can induce cross-reacting antibodies. Demonstration of R. rickettsii by inoculating affected tissues or blood into susceptible laboratory animals or by documenting the organism in endothelial cells using direct fluorescent antibody staining leads to a definitive diagnosis of RMSF but are not clinically practical. Polymerase chain reaction (PCR) can be used to document the presence of rickettsial agents in blood, other fluids, or tissues and can be used to document infection. However, some apparently healthy dogs have had Rickettsia spp. DNA amplified from

blood and so positive PCR assay results may not always correlate to RMSF (Kordick and colleagues, 1999).

Treatment. Supportive care for gastrointestinal tract fluid and electrolyte losses, renal disease, disseminated intravascular coagulation, and anemia should be provided as indicated. Overzealous fluid therapy may worsen respiratory or CNS manifestations of disease if vasculitis is severe.

Tetracycline derivatives, chloramphenicol, and enrofloxacin are the antirickettsial drugs used most frequently. Tetracycline (22 mg/kg PO q8h for 14 to 21 days) was commonly used historically. Doxycycline (5 to 10 mg/kg PO q12h for 14 to 21 days) is an alternative to tetracyclines; GI absorption and CNS penetration are superior to tetracycline, owing to increased lipid solubility. Chloramphenicol (22 to 25 mg/kg PO q8h for 14 days) can be used in puppies less than 5 months of age to avoid dental staining associated with tetracyclines. Enrofloxacin (3 mg/kg PO q12h for 7 days) is as effective as tetracycline or chloramphenicol. In one study of 30 dogs with RMSF, all dogs survived and there were no apparent differences in response rate between tetracycline, doxycycline, chloramphenicol, or enrofloxacin (Gasser and colleagues, 2001). Fever, depression, and thrombocytopenia often begin to resolve within 24 to 48 hours after starting therapy.

Administration of prednisolone at antiinflammatory or immunosuppressive doses in combination with doxycycline did not potentiate RMSF in experimentally infected dogs. The prognosis for canine RMSF is fair; death occurs in less than 5% of affected dogs.

Zoonotic aspects and prevention. Because RMSF has not been reported twice in the same dog, permanent immunity is likely. Infection can be prevented by providing strict tick control. In a recently completed study, dogs in Oklahoma that were negative for select vector borne agents on Day 0 were randomized to be administered a topical product with repellent activity (permethrin 44.88% and fipronil 6.01%; Effitix; Virbac) or an orally administered product for 4 months while rechecked monthly for evidence of exposure to an Ehrlichia spp. or a Rickettsia spp. In that pilot study, 2 of the 21 dogs (9.5%) of the dogs administered the oral product develop antibodies against a Rickettsia spp. in contrast to 0 of 14 dogs administered the topical product (Lappin MR. Unpublished data, 2017).

It is unlikely that people acquire R. rickettsii from contact with dogs, but dogs may increase human exposure to RMSF by bringing ticks into the human environment. Two dogs and the owner all died of RMSF in one study (Elchos and Goddard, 2003). As in dogs, RMSF in people is most commonly recognized from April to September when the tick vectors are most active. Untreated RMSF is fatal in approximately 20% of infected people.

OTHER RICKETTSIAL INFECTIONS

Rickettsia felis was originally detected in a commercial cat flea (Ctenocephalides felis) colony and was has been shown to belong in the spotted fever group. Fever, headache, myalgia, and macular rash in humans have been attributed to R. felis infection in several countries around the world. The organism has been detected in C. felis, C. canis, and Pulex irritans; these fleas have a worldwide distribution. Ctenocephalides felis is a biological vector for R. felis; the organism can be transmitted transovarially and transtadially within the flea. Rickettsia felis DNA has been amplified from C. felis collected from cats in the United Kingdom, France, Israel, New Zealand, Australia, Thailand, and the United States but not in the blood of cats. Recently it was discovered that dogs are the likely reservoir but clinical illness has not been documented to date (Hii et al, 2011). However, it is possible that antibodies against R. felis cross react with those against R. rickettsii, confusing the diagnosis of RMSF. Use of flea control product would theoretically lessen risk of transmission to people.

Neorickettsia helminthoeca (i.e., salmon poisoning) causes enteric signs of disease in dogs from the Pacific Northwest. Coxiella burnetii infection is associated with parturient or aborting cats and is primarily a zoonotic disease. Haemobartonella canis has been reclassified as a Mycoplasma and has 2 species; Mycoplasma haemocanis and 'Candidatus M. haematoparvum'.

CANINE BARTONELLOSIS

Etiology and epidemiology. Bartonella vinsonii subsp. berkhoffii was initially isolated from a dog with endocarditis in North Carolina (Breitschwerdt and colleagues, 1995). Since that time, dogs in multiple areas of the world have been shown to seroreact with B. vinsonii (berkhoffii) antigens. Bartonella vinsonii (berkhoffii) is thought to be tick-borne. Serum of some infected dogs also seroreacts with B. henselae and B. clarridgeiae antigens; these Bartonella species are transmitted by fleas. Bartonella species that have been isolated from dogs or from which DNA has been amplified from blood or tissues include B. vinsonii (berkhoffii), B. henselae, B. clarridgeiae, B. washoensis, B. quintana, and B. elizabethae. Each of these organisms potentially can induce illness in dogs. Dogs infected with a Bartonella species are commonly coinfected with other agents like Anaplasma spp. or Ehrlichia spp. which may play a role in the pathogenesis of disease.

Clinical features. Clinical findings or syndromes most frequently attributed to Bartonella spp. infections of dogs include endocarditis, fever, arrhythmias, hepatitis, granulomatous lymphadenitis, cutaneous vasculitis, rhinitis, polyarthritis, meningoencephalitis, thrombocytopenia, eosinophilia, monocytosis, immune-mediated hemolytic anemia, epistaxis, and uveitis. Bartonella vinsonii (berkhoffii) and B. henselae seem to be the most likely species to be associated with clinical disease. In one study of valvular endocarditis, all dogs with Bartonella spp. associated disease were also seropositive for A. phagocytophilum (MacDonald and colleagues, 2004). Whether the coinfection potentiated the Bartonella associated disease is unknown. Both B. vinsonii and B.

henselae have been associated with endocarditis in dogs in Colorado and Wyoming (Fenimore et al, 2011) suggesting transmission from contact with fleas infesting coyotes and possibly fox.

Diagnosis. Serum antibodies can be detected in both healthy and clinically ill dogs, and so the presence of antibodies does not always correlate to illness. Some Bartonella species, in particular Bartonella vinsonii (berkhoffii), can be difficult to culture and so amplification of DNA by PCR assay with or without culture is often needed to confirm infection (Duncan et al, 2007). If positive test results are detected in a clinically ill dog and there is no other obvious explanation for the illness, treatment is indicated.

Treatment. As many cases of bartonellosis in dogs have been apparently resistant to administration of doxycycline, some clinicians believe that azithromycin is the treatment of choice. Fluoroquinolones, alone or in combination with amoxicillin, were apparently effective for the treatment of some dogs with suspected clinical bartonellosis. Rifampin may be required for resistant cases. No matter which drug is used, a minimum of 4-6 weeks of treatment is usually needed.

Zoonotic aspects and prevention. Bartonella vinsonii (berkhoffii) and B. henselae have been detected in both dogs and humans and cat scratch disease has been documented in a humans after exposure to dogs and by blood contaminated needles. Care should be taken to avoid bites or scratches while handling or treating infected dogs. Flea control is known lessen transmission of B. henselae amongst cats (Bradbury and Lappin, 2010). Flea and tick control is likely to lessen transmission of Bartonella species between dogs and perhaps from dogs to people.

FELINE GRANULOCYTOTROPIC ANAPLASMOSIS. Canine anaplasmosis has been recognized for many years. Cats have shown to be susceptible to A. phagocytophilum infection after experimental inoculation (Lappin et al, 2015). DNA of A. phagocytophilum DNA has been amplified from blood of naturally exposed cats in multiple countries (Bjöersdorff et al, 1999; Lappin et al, 2004; Adaszek et al, 2013; Bergmann et al, 2016; Lee et al, 2016; Savidge et al, 2016). The easiest way to remember the distribution of A. phagocytophilum infections in cats is to remember the range of Ixodes spp. or Lyme disease in people or dogs. In the United States, Ixodes scapularis transmits both A. phagocytophilum and B. burgdorferi but some of the current evidence suggests that A. phagocytophilum is the more likely cause of the clinical and laboratory abnormities.

While the pathogenesis of disease associated with A. phagocytophilum in cats is unknown, some cats experimentally inoculated with A. phagocytophilum developed anti-nuclear antibodies and increased IFN-gamma mRNA suggesting that an immune pathogenesis of disease may contribute to the clinical findings (Foley et al, 2003). Fever, anorexia, and lethargy are the most common clinical abnormalities in naturally infected cats (Savidge et al, 2016). Whether or not this agent is associated with chronic recurrent fever in cats is unknown. In a recent experimental study, cats infected with A. phagocytophilum by exposure to wild caught adult Ixodes scapularis from Rhode Island

remained clinically normal over the 70 day study period in spite of being PCR positive for A. phagocytophilum DNA in blood for several weeks (Lappin et al, 2015). In a larger unpublished study, we infested 10 cats with I. scapularis twice and induced A. phagocytophilum or Borrelia burgdorferi infection in all 10 cats (Lappin et al, 2017). While repeated or new infections with both organisms occurred, all cats remained clinically normal. Since both studies were performed using ticks from the same region, it is possible a less pathogenic strain of the organism was present (Rejmanek D et al, 2013).

Cats with fever in endemic areas can have blood smears examined cytologically but morulae are not always detected in cats with clinical signs of anaplasmosis. Some commercial laboratories offer serologic testing or PCR assays to amplify A. phagocytophilum DNA from blood. In experimental infections, DNA is amplified from blood prior to seroconversion for most cats (Lappin et al, 2015). Approximately 30% of cats with proven clinical infections induced by A. phagocytophilum are seronegative when first assessed serologically, but most of the proven cases evaluated to date have ultimately seroconverted. Therefore, cats with suspected anaplasmosis may need convalescent serum samples to prove infection. Alternately, antibody testing could be combined with PCR testing of whole blood in acute cases. The SNAP4DX Plus (IDEXX Laboratories) has been shown to be accurate for the detection of A. phagocytophilum antibodies in cats but is not labeled for this purpose (Lappin et al, 2015). In addition, another peptide (P44-4) than the one used on the commercial assays detected antibodies even sooner.

Several antibiotics have been administered to naturally infected cats, but most cats treated in the field become clinically normal within 24 to 48 hours after initiation of tetracycline or doxycycline administration and recurrence has not reported in any cat to my knowledge (Lappin et al, 2014; Savidge et al, 2016). While clinically normal, the organism DNA can still be amplified from the blood of some cats which suggests that treatment with tetracyclines for 21 to 30 days may be inadequate for eliminating the organism from the body. In one of our recent studies, the fact that an owner paid for a tick control product was not associated with decreased risk of having A. phagocytophilum antibodies in serum (Hoyt et al, 2017). These results suggest lack of compliance or lack of efficacy. As repeat new infections can occur, it is imperative to maintain tick control at all times, even in cats that have been previously infected (Lappin et al, 2017).

DNA homologous with A. platys has been amplified from the blood of cats in some countries with Rhipicephalus sanguineus (Lima et al, 2010; Qurollo et al, 2014). Further studies will be required to determine if disease associations exist with this agent in cats.

FELINE BORRELIOSIS. Borrelia burgdorferi is the cause of Lyme disease and is transmitted by Ixodes spp. Clinical illness in dogs and people is most common in the United States. While B. burgdorferi antibodies have been detected in the serum of cats for years, whether the agent induces illness in cats is still controversial (Burgess EC, et al 1992; Levy et al, 2003; Magnarelli et al, 2005; Krupka and Straubiner, 2010).

Recently, 2 manuscripts have attempted to ascribe clinical illness to B. burgdorferi infection in cats (Pantchev et al, 2016; Hoyt et al, 2018). The cats that were positive for B. burgdorferi antibodies in Belgium, Sweden and Germany had weakness, ataxia and lameness as the most common clinical signs and doxycycline was apparently effective for treatment (Pantchev et al, 2016). The biggest limitation in that study was the failure to report results of assays for other feline disease agents that may be responsive to doxycycline, in particular A. phagocytophilum. The cats in Maine with suspected borreliosis were seropositive to B. burgdorferi C6 peptide but negative for A. phagocytophilum antibodies, had fever, weakness, lameness, lethargy and inappetance as clinical signs, and had apparent responses to doxycycline (Hoyt et al, 2017). The biggest limitations in that study was the failure to perform A. phagocytophilum PCR or other diagnostic assays to evaluate for other feline disease agents that may be responsive to doxycycline. Recently, use of cefovecin was shown to be effective for the treatment of borreliosis in dogs (Wagner et al, 2015). Whether this will prove to be true for cats needs to be determined.

Borrelia garinii and afzelii have been amplified from ticks collected from cats in the United Kingdom (Unpublished data, Richard Walls, ISFM Congress 2017). Whether these agents are associated with clinical disease in cats is unknown.

There are currently no feline B. burgdorferi vaccines. In dogs, use of acaracides can block transmission of the agent and repeat infections can occur in cats (Honsberger et al, 2016; Lappin et al, 2017). Thus, use of acaracides is imperative for the control of this agent.

FELINE CYTAUXZOONOSIS. Cats in the United States and Europe are infected by Cytauxzoon spp. (Carli et al, 2012; Díaz-Regañón et al, 2017). Excellent review articles from European authors (Lloret Aet al, 2015) and American authors (Sherrill and Cohn, 2015) are recently available.

It is apparent that Cytauxzoon felis infections in the United States (transmitted by Amblyomma americanum) can be very pathogenic when compared to the Cytauxzoon spp. infections occurring in cats in other countries. This may represent different species in different countries (Gallusová M et al, 2016). However, C. felis strain variations also play a role in whether clinical disease occurs within countries as well. For example, while fatal C. felis infections are common in some regions in the United States, cats that survive or have subclinical infections are also common (Meinkoth et al, 2000; Rizzi et al, 2015). A recent study showed the C. felis could be transmitted between 36 and 48 hours of tick attachment and ingestion of A. americanum did not induce infections (Thomas et al, 2017).

In the United States, clinical infections are recognized most commonly in the spring, summer and fall. Non-specific complaints of lethargy and anorexia are reported

frequently by owners. The infected cats have fever or hypothermia if presented in the final shock phase. Common physical examination findings that might lead to consideration of this agent as a differential diagnosis include pale mucous membranes, icterus, splenomegaly, and hepatomegaly. Discomfort, clinical evidence of central nervous system disease including seizures, tachypnea with or without respiratory distress, and sudden death on manipulation all occur in some cats.

Piroplasmas can be seen on the erythrocytes frequently, but can be falsely negative in the acute stages of illness. The serious clinical signs of disease relate to the development of the shizonts in tissues. The syndrome can be diagnosed by cytological demonstration of the piroplasmas on erythrocytes, cytological demonstration of shizonts in spleen, liver, or bone marrow samples, or by PCR of Cytauxzoon spp. DNA in blood or tissue aspirates (Sherrill and Cohn, 2015).

To date, clinically affected cats have the best response to the combination of azithromycin at 10 mg/kg, PO, q24 hours and atovaquone at 15 mg/kg, PO, q8 hours (Cohn et al, 2011; Schreeg et al, 2015) with approximately 60% of treated cats responding. This combination is superior to diminezene or imidocarb protocols (Cohn et al, 2011; Lewis et al, 2014). Minimal restraint techniques should be used during administration of supportive care to lessen the likelihood of sudden death.

The poor overall treatment responses in clinical cytauxzoonosis cases is a perfect example of why tick control can be so important. It is always better to prevent a vector borne disease rather that attempt to treat it after illness has begun. Use of acaracides appropriately should lessen the risk of transmission of this agent (Reichard et al, 2013).

FELINE MONOCYTOTROPIC EHRLICHIOSIS. While canine ehrlichiosis is well characterized, less is known about the agents associated with disease in cats. It is likely that any country that has E. canis infections in dogs, has E canis infections in cats. Naturally exposed cats have been shown to have Ehrlichia like bodies or morulae in peripheral lymphocytes or monocytes, have had DNA consistent with E. canis amplified from the blood or tissues, and have had antibodies that react to E. canis morulae or peptides in many countries (see select reference list). However, in 2 separate experimental studies, we have failed to amplify monocytotropic Ehrlichia spp. from blood or detect seroconversion in cats inoculated SQ with different strains of cultured E. canis (Lappin and Breitschwerdt, unpublished observations, 2007; Lappin and Little, unpublished observations, 2010). These results indicate the E. canis-like DNA amplified from naturally-infected cats may be from a different Ehrlichia spp. more infective to cats, not all E. canis stains will infect cats, not all cats are susceptible to infection by E. canis, or SQ inoculation is not an effective method for infecting cats with E. canis. In addition, we have had field cases that have been positive for DNA identical to E. canis at 2 genes that never seroconverted (Breitschwert et al, 2002). It is likely that cats at greater risk for Rhipicephalus sanguineous infestation are more likely to have higher prevalence rates for E. canis in cats like in Brazil where 9.4% of cats were PCR positive in 1 study (Braga et al, 2014). In Sicily, E. canis DNA was amplified from ticks collected from some cats (Pennisi et al, 2015).

Fever, lethargy, and inappetance are commonly reported clinical abnormalities detected in cats with suspected ehrlichiosis and so testing may be indicated in these cats. Thrombocytopenia, anemia, and monocytosis appear to be the most common clinical laboratory findings in naturally infected cats (Bouloy et al, 1994; Peavy et al, 1997; Beaufils et al, 1999; Braga et al, 2013). Almost every abnormality noted in dogs with clinical ehrlichiosis has been detected in cats, including monoclonal gammapathy (Neer et al, 2002).

A validated serological assay is not currently available and some cats with E. canis-like DNA in blood were seronegative (Breitschwert et al, 2002). Positive serologic test results occur in both healthy and clinically ill cats, and so a diagnosis of clinical ehrlichiosis should not be based on serologic test results alone. Ehrlichia spp. PCR and gene sequencing can be used to confirm infection and should be considered the tests of choice at this time.

Clinical improvement after therapy with tetracycline, doxycycline, or imidocarb dipropionate was reported for most cats with suspected mononcytopic ehrlichiosis. However, for some cats a positive response to therapy was a criterion for the diagnosis of ehrlichiosis. The current recommendation of the ACVIM Infectious Disease Study Group (www.acvim.org) is to administer doxycycline (10 mg/kg PO q24h or 5 mg/kg PO q12h for 28 days). For cats with treatment failure or those intolerant of doxycycline, imidocarb diproprionate can be administered (5 mg/kg IM or SQ twice, 14 days apart). Salivation and pain at the injection site are the common adverse effects and imidocarb efficacy is in question for the treatment of canine monocytotropic ehrlichiosis.

Pancytopenia occurs in cats with ehrlichiosis and when occurs in dogs, may not respond to treatment (Breitscherdt et al, 2002). This is another example of why acaracides should be used to attempt to avoid infection with vector borne disease agents.

FELINE RICKETTSIOSIS. Rickettsia spp. are obligate intracellular gram negative bacteria that are divided into the spotted fever group and the typhus group. Cats can be infected by Rickettsia felis, the primary flea associated Rickettsia spp., and have been shown to have antibodies against R. rickettsii, which is tick borne. Rickettsia felis DNA has been amplified from C. felis, C. canis, and Pulex irritans; these fleas have a worldwide distribution. Ctenocephalides felis is a biological vector for R. felis; the organism can be transmitted transovarially and transtadially within the flea. Rickettsial infection is suspected to a cause of fever in cats but this has not been well documented. While we have commonly amplified R. felis from C. felis (67.4% of flea extracts in one study), we have not amplified the organism from the blood of healthy cats or cats with fever. It is now known that dogs are a more important reservoir for this agent.

In one study of cats with fever we showed R. felis and R. rickettsii antibody prevalence rates in cats in the USA to be 5.6% and 6.6%, respectively but neither organism was

amplified from blood. In Spain, R. conorii and R. massiliae antibodies were found in cat serum and DNA amplified from cat blood, suggesting cats could play a role in the life cycles of these agents, or be clinically affected (Segura et al, 2014). These results prove that cats are sometimes exposed to spotted fever group organisms but further data are needed to determine significance of diseases associations. Because clinical illness in cats has not been documented, optimal treatment is unknown. However, based on results in dogs with R. rickettsia infection, doxycycline or a fluoroquinolone would be logical choices.

Summary. Tick control is warranted for cats as well as dogs. Products with efficacy against fleas should also be used as fleas can be vectors for several Bartonella spp., potentially the hemoplasmas, potentially Coxiella burnetii, (Cypress), R. felis and Yersinia pestis.

References available on request to mlappin@colostate.edu

5.1.2. DID YOU KNOW THAT UP TO 80% OF CAT FLEAS CARRY HUMAN OR PET PATHOGENTS?

Michael R. Lappin, DVM, PhD, DACVIM

The Kenneth W. Smith Professor in Small Animal Clinical Veterinary Medicine

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins Colorado

A number of feline flea borne disease agents can be zoonotic. The most risk is from Bartonella spp., Rickettsia felis, and Yersinia pestis. Coxiella burnetii DNA has also be amplified from fleas. The purpose of this proceedings is provide an update on the diagnosis and management of clinical abnormalities associated with Bartonella spp, and Rickettsia spp. infections of cats. Please also see the AAFP reports on feline bartonellosis and zoonoses guidelines www.catvets.com.

BARTONELLOSIS

A number of Bartonella spp. including B. henselae, B. clarridgeiae, B. koehlerae, B. quintana and B. bovis have been cultured or amplified from client-owned cats with fever. Fever following experimental inoculation with B. henselae has been documented in a number of studies including a recent study in our laboratory where the CSU-1 strain of B. henselae induced significant fever in three of six cats after exposure to infected C. felis (Bradbury et al, 2010). None of the six cats administered imidacloprid-moxidectin in that study became infected or febrile. However, not all strains or Bartonella spp. induce fever in all cats; for example in the imidacloprid-moxidectin study, cats inoculated with the same strain intravenously failed to develop fever. Whether fever will occur during Bartonella spp. infection is likely a complex interaction that is influenced by both host and organism factors. Lymphadenopathy, endocarditis, myocarditis, and hyperglobulinemia are other well documented manifestations of bartonellosis in cats (Whittemore et al, 2012).

As B. henselae, B. clarridgeiae, B. koehlerae are transmitted by fleas, bacteremia and antibody positive rates can be very high. For example, serum antibodies were detected in 93% of cats housed in a North Carolina shelter and Bartonella spp. DNA was amplified from the blood of > 50% of cats housed in an Alabama shelter. The majority of these cats were thought to be normal which emphasizes that fever from bartonellosis cannot be documented by test results alone. In one study of pair matched cats with or without fever, serum Bartonella antibodies detected by ELISA or Western blot immunoassay were not correlated to the presence of fever (Lappin et al, 2009). In addition, serum antibody test results are negative in between 3 and 15% of bacteremic cats. Thus, if a cat with fever is to be evaluated for Bartonella spp. infection the combination of blood culture or PCR assay on blood, and serologic testing will detect the greatest number of cats that are currently or previously infected (www.dlab.colostate.edu;

www.galaxydx.com). Febrile cats that are seronegative and negative for Bartonella spp. in blood by culture or Bartonella spp. DNA in blood are unlikely to have the organism as the cause of fever.

If fever or other clinical signs from bartonellosis is suspected in a cat, administration of doxycycline or a fluoroquinolone is generally effective. Doxycycline at 10 mg/kg, PO, daily for 7 days as the initial therapeutic trial has been recommended by some veterinarians. If a positive response is achieved, continue treatment for 2 weeks past clinical resolution of disease or for a minimum of 28 days. If a poor response is achieved by day 7 or doxycycline is not tolerated and bartonellosis is still considered a valid differential diagnosis, fluoroquinolones are appropriate second choices. In experimental or field studies, administration of enrofloxacin or orbifloxacin have led to rapid resolution of fever in cats with presumed bartonellosis. Azithromycin is now considered contraindicated because of rapid induction of resistance (Biswas et al, 2010). The new veterinary fluoroquinolone, pradofloxacin (Veraflox, Bayer Animal Health) is the least likely to cause resistant strains of B. henselae and so may be the preferred quiniolone for the treatment of this syndrome (Biswas et al, 2010). Flea control with imidocloprid containing compounds (Advantage Multi and Seresto collar; Bayer Animal Health) has been shown to block transmission of B. henselae amongst cats by Ctenocephalides felis (Lappin et al, 2013).

The clinical manifestations of bartonellosis in people are more extensive than just cat-scratch disease, peliosis hepatis, bacillary angiomatosis, and valvular endocarditis. It is now apparent that immune-competent individuals can develop a number of Bartonella spp.–associated chronic inflammatory syndromes and Bartonella spp. infections are an occupational risk for veterinary health care providers (Breitschwerdt et al, 2007; Lantos et al, 2014; Oteo et al, 2017). For example, Bartonella spp. infection was commonly confirmed in people with rheumatic symptoms in a Lyme disease–endemic region (Maggi et al, 2012). Bartonella henselae may have contributed to the death of 2 veterinarians (Breitschwerdt et al, 2015). Veterinarians or others commonly exposed to cats or fleas that develop chronic inflammatory diseases should have Bartonella spp. on the list of differential diagnoses.

FELINE HEMOPLASMOSIS

Hemolytic anemia, with or without fever, are the most common abnormalities associated with infection by Mycoplasma haemofelis, ‘Candidatus Mycoplasma haemominutum’, or ‘Candidatus M. turicensis’. In multiple studies of experimentally infected cats, M. haemofelis is apparently the most pathogenic species. Dual infection with hemoplasmas may potentiate pathogenesis of disease. In one study, cats with chronic ‘Candidatus Mycoplasma haemominutum’ infection had more severe anemia and longer duration of anemia when experimentally infected with M. haemofelis when compared to cats infected with M. haemofelis alone. In one abstract, our research group reported an association between M. haemofelis and fever in cats without anemia. Clinical signs of disease depend on the degree of anemia, the stage of infection, and the immune status of

infected cats. Direct transmission may occur with the hemoplasmas and so the agents should be on the differential list for cats with a history of fighting (Dean et al, 2008).

Diagnosis of hemoplasmosis is based on demonstration of the organism on the surface of erythrocytes on examination of a thin blood film or by PCR assay results. Organism numbers fluctuate and so blood film examination can be falsely negative up to 50% of the time. The organism may be difficult to find cytologically, particularly in the chronic phase. Thus, PCR assays are the tests of choice due to sensitivity.

Doxycycline is often administered as a flavored suspension (to avoid esophageal strictures) at 10 mg/kg, PO, every 24 hours for a minimum of 7 - 10 days. In cats intolerant of doxycycline, enrofloxacin given at 5 mg/kg, PO, every 24 hours for 14 days was tolerated by cats and is equally effective or more effective than doxycycline. Administration of marbofloxacin or orbifloxacin gives similar results. Azithromycin was not effective for the treatment of hemoplasmosis in one study (Westfall et al, 2001). Pradofloxacin (Veraflox®; Bayer Animal Health) is the only drug proven to eliminate M. haemofelis infection in experimentally inoculated cats (Dowers et al, 2009). Most drug protocols have failed to eliminate infection and so at this time there is no clinical utility to repeat PCR testing. The owners should be warned that recurrences may occur but are unusual.

FELINE RICKETTSIOSIS

Rickettsia spp. are obligate intracellular gram negative bacteria that are divided into the spotted fever group and the typhus group. Cats can be infected by Rickettsia felis and have been shown to have antibodies against R. rickettsii. Rickettsia felis DNA has been amplified from C. felis, C. canis, and Pulex irritans; these fleas have a worldwide distribution. Ctenocephalides felis is a biological vector for R. felis; the organism can be transmitted transovarially and transtadially within the flea. Rickettsia felis DNA has been amplified from fleas collected from dogs or cats around the world including including Australia, France, Israel, New Zealand, Thailand, the United Kingdom, and the United States.

Fever, headache, myalgia, and macular rash in human beings have been attributed to R. felis infection around the world (Angelakis et al, 2016). Rickettsial infection is suspected to a cause of fever in cats but this has not been well documented. While we have commonly amplified R. felis from C. felis (67.4% of flea extracts in one study), we have not amplified the organism from the blood of healthy cats or cats with fever. However, in one study of cats with fever, we showed R. felis and R. rickettsii antibody prevalence rates in cats in the USA to be 5.6% and 6.6%, respectively but neither organism was amplified from blood (Bayliss et al, 2009). These results prove that cats are sometimes exposed to spotted fever group organisms but further data are needed to determine significance of diseases associations. Because clinical illness in cats has not

been documented, optimal treatment is unknown. However, based on results in dogs, doxycycline or a fluoroquinolone would be logical choices.

YERSINIA PESTIS (FELINE PLAGUE)

Yersinia pestis is the facultatively anaerobic gram-negative coccobacillus that causes plague. The organism is maintained in a sylvan life cycle between rodent fleas and infected rodents, including rock squirrels, ground squirrels, and prairie dogs. However, it has been shown that C. felis can be a competent vector, but transmission was less efficient than by a rodent flea in one experimental study (Eisen, 2008). Both cats and dogs are susceptible to infection. Antibodies against Y. pestis have also been detected in serum of nondomestic felids. Clinical disease is recognized most frequently from spring through early fall, when rodents and rodent fleas are most active. However, a recent unpublished case in Colorado was diagnosed in December of a mild winter. Most of the cases in human beings and cats in the United States have been documented in Colorado, New Mexico, Arizona, California, and Texas. Of the cases of human plague diagnosed from 1977 to 1998, 23 (7.7%) resulted from contact with infected cats (Gage et al, 2000).

Cats and dogs are infected after being bitten by infected rodent fleas, after ingestion of bacteremic rodents, or after inhalation of the organism. After ingestion, the organism replicates in the tonsils and pharyngeal lymph nodes, disseminates in the blood, and results in a neutrophilic inflammatory response and abscess formation in infected tissues. The incubation period is 2 to 6 days after a flea bite and 1 to 3 days after ingestion or inhalation of the organism. Outcomes in experimentally infected cats include death (6 of 16 cats; 38%), transient febrile illness with lymphadenopathy (7 of 16 cats; 44%), or inapparent infection (3 of 16 cats; 18%) (Gasper et al, 1993).

Bubonic, septicemic, and pneumonic plague can develop in infected human beings, dogs, and cats. Bubonic plague is the most common form of the disease in cats, but individual cats can show clinical signs of all three syndromes. Most infected cats or dogs are allowed outdoors and have a history of hunting. Anorexia, depression, cervical swelling, dyspnea, and cough are common presenting complaints; fever is detected in most infected cats. Unilateral or bilateral enlarged tonsils, mandibular lymph nodes, and anterior cervical lymph nodes are detected in approximately 50% of infected cats. Cats or dogs with pneumonic plague commonly have respiratory signs and may cough. In a series of 62 suspected dog cases, the most common clinical signs were included fever (100%), lethargy (97%), and anorexia (77%); only 23% of the dogs had lymphadenopathy (Nichols et al, 2013).

Supportive care should be administered as indicated for any bacteremic animal. Cervical lymph node abscesses should be drained and flushed with the clinician wearing gloves, a mask, and a gown. Parenteral antibiotics should be administered until anorexia and fever resolve. Optimal antibiotics for treatment of plague in infected cats in the United States are unknown. Streptomycin administered intramuscularly at 5 mg/kg q12h was

used historically but is not widely available. Cats treated with gentamicin intramuscularly or intravenously at 2 to 4 mg/kg q12-24h, or enrofloxacin intramuscularly or intravenously at 5 mg/kg q24h, have resolved clinical signs. Chloramphenicol administered orally or intravenously at 15 mg/kg q12h can be used in cats with central nervous system signs. Antibiotics should be administered orally for 21 days after the cat has survived the bacteremic phase; doxycycline at 5 mg/kg q12-24h is an appropriate choice. In one study 90.9% of cats treated with antibiotics survived, whereas only 23.8% of untreated cats survived (Eidson et al, 1991). In a dog case series, 73% of the 62 suspect cases were treated with antibiotics and 97% of the dogs survived (Nichols et al, 2013). The prognosis is believed to be worse for the pneumonic form of Y. pestis infection. A recent case seen at the authors institution developed a consolidated lung lobe and died after lobectomy.

Summary. Fleas on dogs and cats around the world are potential sources of zoonotic agents. When working with pets with heavy flea infestations, veterinarians should wear gloves or wash their hands carefully.

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5.1.3. INFECTIOUS DISEASE PREVENTION; HOT TOPICS

Michael R. Lappin, DVM, PhD, DACVIM

The Kenneth W. Smith Professor in Small Animal Clinical Veterinary Medicine

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins Colorado

SUMMARY

In this lecture series, Dr. Lappin will present “HOT TOPICS” based on the frequently asked questions he receives frequently on parasite control and both core and optional vaccines in dogs and cats.

Infectious diseases are a very common part of companion animal veterinary medicine. Some of the infectious agents can result in severe clinical disease, including death; canine parvovirus, leptospirosis, and feline panleukopenia are notable examples. Other infections have less severe manifestations during the acute phase, but can have long term sequelae of clinical significance; examples include Lyme polyarthritis and chronic upper respiratory infections induced by FHV-1 and FCV. Of even more importance are infections that are shared between animal and man; the zoonoses. Rabies virus and Bartonella henselae, the cat scratch disease agent, are common examples. Use of vaccines and parasite control products in comprehensive wellness programs can lessen risk of infectious diseases in dogs and cats. However, some pet owners and veterinarians are still worried about vaccine associated side-effects which may limit clinic visits and compliance to veterinarian recommendations.

Preventing infections is always preferred over treating infections. Deworming guidelines and information concerning vector borne disease agent control is available from the Companion Animal Parasite Council (www.capcvet.org) and in Europe (https://www.esccap.org/guidelines/). Avoiding exposure is the most effective way to prevent infections. Most infectious agents of dogs and cats are transmitted in fecal material, respiratory secretions, reproductive tract secretions, or urine; by bites or scratches; or by contact with vectors or reservoirs. Some infectious agents such as FHV-1, Bordetella bronchiseptica, and canine influenza viruses can be transmitted by direct contact with clinically normal, infected animals. Many infectious agents are environmentally resistant and can be transmitted by contact with a contaminated environment (fomites). The avoidance of zoonotic transfer of infectious agents is extremely important because some zoonotic diseases, such as plague and rabies, are life threatening. Recognition of risk factors associated with infectious agents is the initial step in the prevention of infectious diseases. Veterinarians should strive to understand the biology of each infectious agent so they can counsel clients and staff on the best strategies for prevention.

Vaccines available for some infectious agents can prevent infection or lessen clinical illness when infection occurs. However, vaccines are not uniformly effective, are not available for all pathogens, and sometimes induce serious adverse effects. Therefore the development of sound biosecurity procedures is paramount to avoid exposure to infectious agents when developing a preventive medicine program. Great vaccine guidelines are available from the World Small Animal Veterinary Association (https://wsava.org/global-guidelines/vaccination-guidelines/), the American Animal Hospital Association (AAHA; https://www.aaha.org/aaha-guidelines/vaccination-canine-configuration/vaccination-recommendations-for-general-practice/) and AAHA/American Association of Feline Practitioners (https://catvets.com/guidelines/practice-guidelines/aafp-aaha-feline-vaccination).

Vaccines are available for some infectious agents of dogs and cats and can be administered to prevent infection or limit disease depending on the agent. Vaccination stimulates humoral, mucosal, or cell-mediated immune responses. Humoral immune responses are characterized by the production of immunoglobulin M (IgM), IgG, IgA, and IgE class antibodies, which are produced by B-lymphocytes and plasma cells after being presented an antigen by macrophages. Binding of antibodies to an infectious agent or its toxins helps prevent infection or disease by facilitating agglutination (viruses), improving phagocytosis (opsonization), neutralizing toxins, blocking attachment to cell surfaces, initiating the complement cascade, and inducing antibody-dependent cell-mediated cytotoxicity. Antibody responses are most effective in controlling infectious agents during extracellular replication or toxin production. Cell-mediated immune responses are mediated principally by T-lymphocytes. Antigen-specific T-lymphocytes either destroy the infectious agent or mediate destruction of the agent by producing cytokines that stimulate other white blood cells, including macrophages, neutrophils, and natural killer cells. Cell-mediated immunity is required for the control of most cell-associated infections. Currently available vaccines are either infectious (attenuated [modified-live] organisms or live virus–vectored recombinant vaccines) or noninfectious (killed virus, killed bacteria [bacterins], and subunit vaccines).

Attenuated vaccines replicate in the host to effectively stimulate an immune response and therefore generally have low antigen mass and do not require adjuvants. Different products are administered locally (e.g., modified-live Bordetella bronchiseptica oral vaccine or intranasal FHV-1 and FCV vaccines) or parenterally (e.g., modified-live canine distemper vaccine). In live virus–vectored recombinant vaccines, the specific DNA that codes for the immunogenic components of the infectious agent is inserted into the genome of a nonpathogenic organism (vector) that will replicate in the species being vaccinated. As the vector replicates in the host, it expresses the immunogenic components of the infectious agent, resulting in the induction of specific immune responses. Because the virus-vectored vaccine is live and replicates in the host, adjuvants and high-antigen mass are not required. Because only DNA from the infectious agent is incorporated into the vaccine, no risk of reverting to the virulent parent strain exists, as occasionally occurs with attenuated vaccines. Only vectors that do not induce disease in the animal being vaccinated are used. Another advantage to vaccines of this type is the potential ability to overcome inactivation by maternal antibodies.

Killed virus, killed bacteria (bacterins), and subunit vaccines are noninfectious and therefore usually require higher antigen mass than infectious vaccines to stimulate immune responses because they do not replicate in the host. Some noninfectious vaccines may stimulate immune responses of lesser magnitude and shorter duration than infectious vaccines unless adjuvants are added. Adjuvants improve immune responses in part by stimulating uptake of antigens by macrophages that present the antigens to lymphocytes. Although adjuvants have historically been associated with vaccine adverse effects, most newer generation adjuvants induce less inflammation. Subunit vaccines can be superior to killed vaccines that use the entire organism because only the immunogenic parts of the organism are used, which may decrease the potential for vaccine reactions. However, for some infections use of only one antigen does not adequate induce adequate protection (e.g. feline calicivirus vaccines). Native DNA vaccines and gene-deleted vaccines are currently being evaluated for several infectious diseases.

VACCINE SELECTION

Selection of optimal vaccines for use in dogs and cats is complicated. Multiple products for most infectious agents are available, but efficacy studies that directly compare different products are often lacking. The veterinarian may need to choose from infectious and noninfectious options for the same vaccine antigen. Some vaccine antigens are for intranasal or oral administration and others are for parenteral administration. Not all vaccines for a given infectious disease are comparable in every situation. Long-term duration of immunity studies and studies evaluating a vaccine's ability to block infection by multiple field strains are not available for all individual products. When making decisions about which products to use or when evaluating a new vaccine, the practitioner should request information concerning efficacy, challenge studies, duration of immunity studies, adverse reactions, and cross-protection capability. Vaccine issues are commonly debated in veterinary journals and continuing education meetings; these are excellent sources of current information.

Not all dogs and cats need all available vaccines. Vaccines are not innocuous and should only be given if indicated. The type of vaccine and route of administration for the disease in question should also be considered. A benefit, risk, and cost assessment should be discussed with the owner of each individual animal before determining the optimal vaccination protocol. For example, FeLV only lives outside the host for minutes; it is highly unlikely that an owner would bring the virus into the household. Therefore cats housed indoors are not likely to come in contact with the virus.

Before administering vaccines, the animal should be evaluated for factors that may influence the ability to respond to the vaccine or that may affect whether vaccination could be detrimental. Hypothermic animals have poor T-lymphocyte and macrophage function and are unlikely to respond appropriately to vaccination. Dogs with body

temperature above 39.7° C respond poorly to canine distemper virus vaccines; this may be true for other vaccines as well. Immunosuppressed animals, including those with FeLV infection, FIV infection, canine parvovirus infection, Ehrlichia canis infection, and debilitating diseases, may not respond appropriately to vaccination; modified-live vaccines occasionally induce the disease in these animals.

If high levels of specific antibodies are present, vaccine efficacy is diminished. This is a particularly important consideration when vaccinating puppies or kittens from well-vaccinated dams. Disease may also develop in vaccinated puppies and kittens because infection had already occurred and was incubating when the animal was vaccinated. Vaccines can be rendered ineffective from mishandling. Vaccines should not be administered while the animal is under anesthesia because efficacy can be diminished; if a vaccine reaction occurs, it may be masked by the anesthesia.

Adverse reactions can potentially occur with any vaccine. However, they are relatively uncommon in dogs and cats. In a study of more than 1.2 million dogs, the overall rate of adverse reactions was 38.2/10,000 dogs that had received vaccines within the previous 3 days (Moore et al., 2005). In a study of 496,189 cats, the overall rate of adverse reactions was 51.6/10,000 cats that had received vaccines within the previous 30 days (Moore et al., 2007). Vaccination has been associated with injection site sarcomas in some cats and can be life threatening. These tumors can occur after administration of infectious or noninfectious vaccines (Dyer et al, 2008), but to date studies attempting to link different vaccine types or individual products to tumor formation have had variable results (Kass et al, 2003; Srivastav et al, 2012). Injection site sarcomas have developed after administration of other substances including parasiticides, long lasting glucocorticoids, meloxicam, cisplatin, antibiotics, and microchips. It is apparent that tumor development may relate to a genetic predisposition but P53 gene testing has not provided definitive results in all cases (Banerji et al, 2007; Muncha et al, 2012). Currently, the optimal way to avoid injection site sarcomas is to administer only products absolutely indicated by this route, including using the longest vaccination interval that is acceptable for the vaccine used. Intranasal products can result in transient sneezing and coughing.

Feline vaccines for which the viruses were grown on cell cultures induce antibodies that cross-react with feline renal tissues (Lappin et al., 2005), and some hypersensitized cats have developed lymphocytic-plasmacytic interstitial nephritis (Lappin et al., 2006b). The immunodominant cell line antigen recognized by parenterally vaccinated cats is alpha enolase which is present in all mammalian cells (Whittemore et al, 2010). In people, anti-enolase antibodies are markers for immune-mediated disease, including nephritis. It is unclear whether post-vaccination or naturally occurring anti-enolase antibodies are associated with nephritis in cats. However, it appears that FVRCP vaccines should not be given annual as they are not needed and may be associated with a significant side effects. In a recent paper, the major findings that associated with CKD in cats were severity of dental disease and frequency of vaccination (Finch et al, 2016).

Suspected adverse reactions to vaccination should be reported. Administration of any vaccine to animals with proven vaccine-associated sarcoma or immune-mediated diseases, such as immune-mediated polyarthritis, immune-mediated hemolytic anemia, immune-mediated thrombocytopenia, glomerulonephritis, or polyradiculoneuritis, is questionable because immune stimulation may exacerbate these conditions. However, the potential legal ramifications of waiving vaccination in these patients should be discussed with the owners. This is primarily of importance for rabies vaccination.

For some infectious agents, including canine distemper virus, canine parvovirus, feline panleukopenia virus (FPV), feline calicivirus (FCV), and FHV-1, serologic test results have been shown to correlate to resistance to disease after challenge in some studies. The advantages and disadvantages of the use of serologic testing have been reviewed (Moore et al., 2006). If validated laboratories or kits are used, results can be used accurately to make vaccination decisions for some dogs and cats (Lappin et al., 2002). For example, previously vaccinated animals that were presumed to have had a vaccine reaction and are still at risk of exposure to infectious agents could be assessed by serologic testing in lieu of arbitrary vaccination. In general, the positive predictive value of these tests is good (i.e., a positive test result usually predicts resistance on challenge).

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Catriona MacPhail, DVM, PhD, Diplomate ACVS

6. Catriona MacPhailTHE ABDOMINAL EXPLORATORY: SURGERY AS A DIAGNOSTIC TOOL

Catriona MacPhail, DVM, PhD, Diplomate ACVS

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins, Colorado, USA

Surgical exploration of the abdominal cavity can be a valuable diagnostic tool, particularly when imaging is equivocal in helping discover what is wrong with an animal. Gastrointestinal obstruction is one such clinical example, where surgery can rule-in or rule-out obstruction when less invasive methods are unrewarding. Abdominal exploratory and subsequent organ biopsies are also used to assist in diagnosis of chronic disease and to differentiate between benign and malignant processes. Stomach and proximal intestinal biopsies are commonly performed using endoscopy. However, biopsies are limited to the mucosal surface and are often only representative of those areas. Abdominal surgery allows for complete exploratory and examination of the entire length of the gastrointestinal tract Full-thickness samples can be retrieved from the duodenum, jejunum, and ileum to diagnose diseases such as inflammatory bowel disease, lymphangiectasia, and lymphoma. Routine sampling of the liver and lymph node should be considered when in the abdomen for removal of a possible malignant process (e.g., splenic mass, focal intestinal mass).

What should the length of an abdominal incision be for complete abdominal exploratory?

What should be done with the falciform fat?

What is the value of a surgical safety checklist?

Similar to a physical examination, a routine for abdominal exploration should be developed such that nothing will be overlooked. An exploratory can be performed by system or by quadrant; one approach is “cranial-right-left-caudal”:

- Starting cranially, the diaphragm is observed and then the liver is evaluated. Each lobe of the liver can be gently manipulated such that all surfaces are examined. From left to right, the lobes of the liver are left lateral, left medial, quadrate, right medial, right lateral, and caudate. The gallbladder sits between the quadrate and right medial lobes and can be gently palpated; some prefer to express the gallbladder to ensure patency of the common bile duct, but this is often unnecessary if hepatobiliary disease is not suspected. The stomach is then examined and palpated, starting at the terminal esophagus to the fundus, body, pyloric antrum, and pylorus.

- Heading to the right side of the abdomen, the descending duodenum can be lifted gently out of the abdomen to examine the structures within the mesoduodenum (right limb of the pancreas, common bile duct, and portal vein), and then the mesoduodenum

is used to hold back the small intestine to examine the right kidney, caudate lobe of the liver, and the caudal vena cava, often referred to the right gutter. A normal right adrenal gland is not readily visible as it sits under the liver alongside the caudal vena cava. It is difficult to continue to follow the small intestine oral to aboral as the duodenum is tethered at the duodenal flexure by the duodenal-colic ligament.

- Heading to the left side of the abdomen, the spleen is gently examined and palpated from the tail to the head, which is tethered to the greater curvature of the stomach by the short gastric vessels. The descending colon is then lifted to allow the mesocolon to hold back the small intestine and the left kidney and left adrenal gland can be examined (left gutter). The left adrenal gland is identified by the phrenicoabdominal vein coursing back to the caudal vena cava, bisecting the gland into cranial and caudal poles. The gastrointestinal tract is then evaluated from aboral to oral, from the colon to cecum and to the ileum, which is identified by the antimesenteric vessel. Continuing orally, the jejunum is palpated back to the duodenal flexure, taking note of the mesenteric lymph nodes. To examine the left limb of the pancreas, a hole is made in the superficial leaf of the omentum to enter the omental bursa and find the pancreas just dorsal to the greater curvature of the stomach.

- Caudally, the urinary bladder and distal ureters examined. In male dogs, the prostate is palpated by passing a finger dorsal to the urethra. In intact female dogs, the entire reproductive tract is examined from the ovaries to the cervix. In spayed female dogs, the uterine stump can be found dorsal to the bladder on the ventral surface of the distal colon. Medial iliac lymph nodes are found at the bifurcation of the aorta.

VISCERAL ORGAN BIOPSY

Catriona MacPhail, DVM, PhD, Diplomate ACVS

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins, Colorado, USA

LIVER BIOPSY

There are multiple methods for sampling the liver. If there is a distinct lesion that needs to be sampled, its size and location often dictate the biopsy method. For diffuse disease or routine sampling, the liver can be biopsied along the edge or margin. Marginal biopsies can be performed using a guillotine method, multiple mattress sutures, or stapling equipment. Lesions away from the edge can be sampled using Baker skin biopsy punch or Tru-cut biopsy instrument. Hemorrhage can be controlled using digital pressure, electrocoagulation, or hemostatic agents such as Gelfoam□ or Surgicel□.

Guillotine Biopsy Technique:

- Isolate an accessible liver lobe and determine an area that can be easily sample from the hepatic margin.

- Take a long strand of multifilament absorbable suture (e.g., 3-0 Polysorb□) and make a loop with a single-throw in place.
- Pass the loop around the tip of the isolated liver lobe and pull the suture snug to allow it to cut through the hepatic parenchyma.
- Small vessels and bile ducts will be bundled in the ligature. Make an additional three throws in the suture, securing the knot.
- Use Metzenbaum scissors to transect the hepatic tissue just distal to the ligature. Take care not to cut the suture.
- Impression smears, aerobic and anaerobic culture, metal testing, and histopathology can all be performed from liver biopsy.
- Observe the cut surface for hemorrhage.

Laparoscopic liver biopsy can be performed through a single port or, more commonly, a two-cannula approach with the animal in dorsal or left lateral recumbency. A 5 mm oval cup biopsy forceps is inserted through the instrument portal. The forceps are pushed into the edge of a liver lobe. The jaws are closed, and the sample held in place for 10-30 seconds before pulling it off the lobe. The site is observed for excessive hemorrhage.

LYMPH NODE BIOPSY

During abdominal exploratory, lymph nodes can be found around the pylorus and right limb of the pancreas, at the mesenteric root, along the descending colon, and at the aortic bifurcation (medial iliac lymph nodes). Lymph nodes can be sampled by fine-needle aspiration, wedge biopsy, or complete excision. The decision on method of sampling is based on involvement of surrounding structures and vascular supply to abdominal organs. Impression smears can be made from biopsy samples for immediate cytological examination to assist in ruling in or out lymphoma.

PANCREATIC BIOPSY

Due to risk of causing pancreatitis, veterinarians often avoid handling much less sampling, the pancreas. However, pancreatic biopsy is indicated to diagnose pancreatitis in cats, or differentiate benign versus neoplastic disease in dogs. If diffuse disease is present, the pancreas is best sampled from the left lobe to avoid damage to pancreatic ducts, the common bile duct, and the pancreaticoduodenal blood supply.

Technique:

- The left lobe of the pancreas is best visualized by opening the omental bursa.
- Gently isolate the caudal tip of the pancreas. Separate it from surrounding mesentery using sharp and blunt dissection.
- Make a loop of suture (as described for liver biopsy), pass it around a small section of pancreas, and cinch the suture snugly to allow it to crush through the pancreatic parenchyma.

- Use Metzenbaum scissors to obtain the sample of pancreatic tissue.

GASTRIC BIOPSY

Biopsies of the stomach are most commonly obtained through endoscopy. However, sampling by this method only retrieves pieces of the gastric mucosa. Surgical sampling retrieves full-thickness sections that may be beneficial in diagnosing schirrous gastric neoplasia that typically infiltrates deeper layers. Routine surgical biopsy is performed either in the ventral aspect of the body of the stomach between the lesser and greater curvature or in the left lateral aspect of the stomach if a gastrostomy tube is going to placed.

Technique:

- Isolate the stomach from the rest of the abdominal cavity using moistened laparotomy sponges.
- Place stay sutures at each end of the proposed gastric biopsy location.
- Make a full-thickness stab incision into the lumen of the stomach using a #15 scalpel blade.
- Extend the stab incision 1 to 2 cm using the scalpel blade or Metzenbaum scissors.
- Take a biopsy sample from one edge of the incision using Metzenbaum scissors. Make sure all layers of the stomach are sampled.
- Close the biopsy site using a single layer, full-thickness, simple continuous pattern with 3-0 monofilament absorbable suture (e.g., Biosyn□, Monocryl□).

SMALL INTESTINAL BIOPSY

Like the stomach, intestinal biopsies are commonly performed using endoscopy. However, biopsies are limited to the mucosal surface of the duodenum. Segmental disease or abnormalities in the deeper layers of the intestine may be missed with this method, which is of particular concern in cats as the jejunum and ileum are thought to be the most common locations for gastrointestinal lymphoma. Full-thickness samples can be retrieved from the entire length of the small intestine. The large intestine is rarely surgically biopsied due to the poor healing characteristics of the colon and the risk of peritoneal contamination. A recent study examined complications associated with full-thickness biopsies of the small intestine. Twelve percent of dogs died or were euthanized postoperatively due to biopsy site breakdown. Unfortunately, no predictors for risk of dehiscence were identified.

The most conventional method to biopsy the intestine is to make 2, 1 cm, parallel, longitudinal, full-thickness incisions in the antimesenteric aspect of the bowel using a scalpel blade. An alternative to this technique is to use a 4 to 6 mm Baker's biopsy punch to take a full-thickness sample from the antimesenteric border.

Standard Technique:

- A segment of small intestine is isolated from the rest of the abdominal cavity using moistened laparotomy sponges.
- An assistant's fingers, Doyen intestinal forceps, Penrose drains, or umbilical tape are used to hold back ingesta.
- Make a full-thickness stab incision into the lumen of the intestine on the antimesenteric border using a #11 or #15 scalpel blade.
- Extend the stab incision 1 to 2 cm using a scalpel blade or Metzenbaum scissors. Make sure all layers of the intestine are sampled.
- Close the biopsy site using a single-layer, full-thickness, simple continuous pattern with 3-0 or 4-0 monofilament absorbable suture (e.g., Biosyn□, Monocryl□, PDS□).
- Consider augmenting the enterotomy site with omentum or a serosal patch if the animal is debilitated or hypoalbuminemic.

KIDNEY BIOPSY

The kidney can be sampled percutaneously with ultrasound guidance, through a keyhole flank incision, or through laparoscopy or laparotomy. The two most common methods for sampling the kidney include needle biopsy or wedge biopsy. If exploratory laparotomy is performed, a wedge biopsy of the kidney allows a larger, more representative sample to be acquired. Hemorrhage can be controlled using digital pressure or hemostatic agents. A recent study found that wedge kidney biopsies were more likely to be of good quality compared to needle biopsies. The most common indication for renal biopsy was proteinuria while the most common complication was severe hemorrhage that occurred in approximately 10% of dogs and 17% of cats.

Technique:

- If disease if thought to be generalized, locate, and isolate the left kidney from a standard midline abdominal approach as the left kidney is more accessible due to its relative caudal location.
- Using a #15 or #11 scalpel blade, make a 1 cm wedge incision into the renal parenchyma along the dorsolateral surface.
- Place a small piece of moistened Gelfoam□ into the defect to control hemorrhage.
- Place a horizontal mattress suture (3-0 or 4-0 monofilament absorbable suture) through the renal capsule on either side of the wedge incision to close the defect.
- Confirm that hemorrhage has ceased before closing the abdominal cavity.

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6.1.2. GASTROTOMY/ENTEROTOMY TIPS & TRICKS

Catriona MacPhail, DVM, PhD, Diplomate ACVS

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins, Colorado, USA

Gastrointestinal foreign bodies are commonly encountered in small animal medicine. For gastric foreign bodies, there are several approaches depending on the type and amount of foreign material ingested. Similarly, the degree of clinical signs reflects what was indiscriminately eaten, from no clinical signs to protracted vomiting if the pylorus is obstructed.

Foreign bodies lodged in the pylorus or proximal duodenum may show classic bloodwork abnormalities of gastric outflow obstruction. In these cases, protracted vomiting causes significant loss of gastric secretions. This results in hypochloremic, metabolic alkalosis. Distal gastrointestinal obstruction more commonly results in metabolic acidosis

Options for removal of gastric foreign bodies are 1) let the material or object be digested by gastric acid (e.g., bone), 2) emesis induction, 3) endoscopic retrieval, and 4) surgical removal. Deciding the best approach is dependent on the type of material, equipment availability, level of endoscopic expertise, and cost.

After deciding to take an animal to surgery for gastric or intestinal foreign material, a full abdominal exploratory should be performed after entering the abdomen as there may be additional foreign material in the small intestine. Perioperative antimicrobials are indicated (cefazolin or cefoxitin 22 mg/kg IV q90min).

Gastric foreign bodies are removed through routine gastrotomy:

- Make a generous abdominal approach from the xiphoid past the umbilicus
- Place a Balfour abdominal retractor for improved visualization.
- Perform a full abdominal exploratory as there may be additional foreign material in the small intestine
- Pack off the stomach from the rest of the abdominal cavity using laparotomy sponges or surgical towels
- Place stay sutures at each end of the proposed incision. A typical gastrotomy incision is performed in the ventral body of the stomach between the lesser and greater curvature. Any suture material can be used. Suture ends should be quite long and secured with mosquito hemostatic forceps. An assistant can hold the stay sutures to

minimize spillage from the stomach; alternatively, the hemostats can be secured to the surgical drapes or looped over the Balfour if no surgical assistance is available.

- Make a stab incision into the lumen of the stomach with a #15 or #11 scalpel blade. Continue the incision with Metzenbaum scissors to create an opening large enough to remove the foreign material

- Babcock forceps, sponge forceps, or gloved hands can be used to remove the material from the stomach and place onto a nearby surgical towel, which is then taken away from the surgical area once all material is removed. The pylorus and cardia should be closely evaluated to make sure no foreign material is left behind. Change gloves prior to gastrotomy closure.

For closure of a gastrotomy incision, synthetic absorbable monofilament suture (e.g., 3-0 or 4-0 Monocryl, Biosyn, or PDS) with a swaged-on taper needle is the material of choice. There are numerous techniques to choose from when deciding how to close the stomach. Regardless of the suture pattern, the common theme for all gastrointestinal surgery is inclusion of the submucosal layer in the closure. Full-thickness purchase of the tissue ensures that this holding layer is incorporated in the suture line. Specific options for gastrotomy closure include:

- Single-layer full-thickness simple continuous pattern
- Single-layer full-thickness simple interrupted pattern
- Two-layer continuous inverting pattern
  - Full-thickness simple continuous pattern followed by,
  - Partial-thickness (seromuscular) Lembert or Cushing pattern
- Two-layer continuous inverting pattern
  - Simple continuous to close the mucosa and submucosa followed by,
  - Partial-thickness (seromuscular) Lembert or Cushing pattern

For simple gastrotomy, a single-layer full-thickness simple continuous pattern is preferred due to increased efficiency and decreased amount of suture material used. A two-layer pattern may be more appropriate if performing a partial gastrectomy or if there is a concern about tissue viability.

- Start the gastrotomy closure at the point of the gastrotomy incision furthest away from you.

- Begin a single-layer, full-thickness simple continuous pattern 2 to 3 mm away from the commissure of the incision.

- Place suture bites 3 mm apart and 3 mm from each edge incorporating all layers. (If the gastric mucosa is markedly everted, suture bites should come up in the middle and redirected instead of taking a suture bite across the incision all at once.)

- Trail the suture line towards you such that the suture material is snug against the gastric tissue.

- Finish the suture pattern 2 to 3 mm beyond the edge of the incision. Tie surgical knots securely using 6 throws.
- Assess the suture line for appropriate spacing and tightness. Place additional simple interrupted sutures if necessary.
- Perform a local lavage of the suture line and then remove the abdominal packing.
- Change gloves and use different instruments for routine closure of the abdomen.

Foreign bodies located in the small intestine are approached through a longitudinal incision aboral to the obstruction.

- Exteriorize the section of obstructed small intestine and pack off the rest of abdominal cavity using laparotomy sponges or surgical towels
- Ingesta can be held back by assistant or minimally traumatic instruments such as Doyens. An assistant can also provide traction across the segment; alternatively small stay sutures can be placed at each end of the proposed incision; the hemostats can be secured to the surgical drapes or looped over the Balfour.
- Using a #15 or #11 scalpel blade, make a stab incision on the antimesenteric border into the lumen of the small intestine aboral to the obstruction. Continue the incision longitudinally with Metzenbaum scissors to create an opening large enough to remove the foreign material

Following removal of the foreign material, the intestine is evaluated for viability. If there are any concerns about the health of the small intestine, a resection and anastomosis should be performed. Otherwise, the enterotomy incision is closed with a single-layer appositional pattern using 4-0 monofilament absorbable suture (e.g., Biosyn, PDS). Options for simple enterotomy closure include:

- Single-layer simple interrupted approximating pattern
- Single-layer simple continuous approximating pattern

- Begin a single-layer, full-thickness simple continuous pattern 2 to 3 mm away from the commissure of the incision.
- Place suture bites 2 mm apart and 2 mm from each edge incorporating all layers. (If the mucosa is markedly everted, suture bites should come up in the middle and redirected instead of taking a suture bite across the incision all at once.)
- Trail the suture line towards you such that the suture material is snug against the intestinal tissue.
- Finish the suture pattern 2 to 3 mm beyond the edge of the incision. Tie surgical knots securely using 6 throws.
- Assess the suture line for appropriate spacing and tightness. Place additional simple interrupted sutures if necessary.

- Consider leak testing.
- Perform a local lavage of the suture line and then remove the abdominal packing.
- Change gloves and use different instruments for routine closure of the abdomen.

Prior to closure, an elective right-sided gastropexy should be considered in breeds at risk for GDV. Postoperative pain management following gastrointestinal surgery can be challenging, as nonsteroidal anti-inflammatory drugs should be avoided. Local analgesia is advocated through the use of incisional blocks. Feeding is no longer delayed in the postoperative period, and the animal should be offered food once fully recovered from anesthesia.

FREQUENTLY ASKED QUESTIONS

1. What gastrointestinal medications do you use preoperatively and postoperatively?
2. What postoperative pain medications do you use following gastrointestinal surgery?
3. What suture material and suture pattern do you use for gastrointestinal closures?
4. Do I leak test enterotomy closures?
5. How do I monitor for dehiscence of gastrointestinal closures?
6. What is my perioperative and postoperative antimicrobial protocol for gastrointestinal surgery?
7. Does prophylactic gastropexy have any complications?
8. What is your preferred gastropexy technique?

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6.1.3. A SIMPLE CYSTOTOMY MAY NOT BE SO SIMPLE

Catriona MacPhail, DVM, PhD, Diplomate ACVS

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins, Colorado, USA

Cystotomy is one of the most common surgical procedures in small animal surgery; it is most often performed for removal of uroliths. However, "cystotomy failure" occurs in up to 20% of cases, meaning stones are left behind in the bladder or urethra. For radio-opaque stones, this can easily be avoided by performing postoperative abdominal radiographs while the animal is still under general anesthesia to ensure stone removal. If stones are visualized, the animal is taken back into the operating room to locate and remove the residual stones. Radiolucent stones are more challenging as obviously postoperative abdominal radiographs would not be helpful. Bladder ultrasound is confounded by significant gas artifact following surgery. Contrast studies (e.g., positive contrast cystourethrogram) are not recommended due to concerns about leakage of contrast from the cystotomy incision. In these cases, and in general, good surgical technique can minimize the risk of leaving stones behind.

Cystotomy is performed from a routine caudal abdominal approach. Exteriorize the urinary bladder and pack off the rest of the abdominal cavity. Place stay sutures are at the apex and trigone on the ventral aspect of the bladder; any suture material can be used. Suture ends should be quite long and secured with mosquito hemostatic forceps. An assistant can hold the stay sutures to gently pull the bladder cranially; alternatively, the hemostats can be secured to the surgical drapes if no surgical assistance is available. A stab incision is made into the lumen of the bladder using a fresh #11 or #15 scalpel blade and the urine is removed with suction. Complete the ventral cystotomy using Metzenbaum scissors. Calculi are removed from the bladder using forceps, spoon, or other smooth and blunt instrument. A urethral catheter is passed multiple times both normograde and retrograde to make sure that no stones remain in the bladder neck or urethra.

The urinary bladder is unique in that it regains nearly 100% of its original tensile strength by 14 days. Therefore, synthetic absorbable suture material is most suitable for cystotomy closure. Monofilament suture is preferred as there is some concern that contact between urine and multifilament suture may lead to an increased rate of absorption or may promote urolith formation. Nonabsorbable suture and staples are contraindicated in urinary bladder closure, as they are associated with the formation of urinary calculi.

There are several suture patterns that can be used to close the urinary bladder. The surgical goals are to minimize tissue trauma, create a watertight seal, and avoid promotion of calculi formation. Options for cystotomy closure include:

- Single-layer simple interrupted pattern
- Single-layer simple continuous pattern
- Two-layer appositional continuous pattern
  - Partial thickness simple continuous pattern followed by,
  - Partial thickness Lembert pattern
- Two-layer inverting continuous pattern
  - Partial-thickness Cushing pattern followed by,
  - Partial-thickness Lembert pattern

It has been shown that there is no difference in circular bursting wall tension of urinary bladders closed with single-layer simple interrupted appositional pattern versus a two-layer continuous inverting closure, and clinical outcomes are similar. Luminal compromise may occur if two-layer inverting patterns are used in urinary bladders with severely thickened walls. Most surgical texts state that the lumen of the bladder should not be entered with suture material. Urinary calculi formation has been associated with multifilament absorbable suture, nonabsorbable suture, and metal staples, however, there have been no studies assessing the lithogenic potential of the newer monofilament absorbable sutures. Full-thickness purchase of the bladder wall guarantees incorporation of the submucosal holding layer. Single layer partial-thickness closures of the urinary bladder that miss the submucosa may be inadequate for preventing urine leakage.

For simple cystotomy, a single-layer full-thickness simple continuous pattern is preferred by the author due to increased efficiency and decreased amount of suture material used.

- Start the cystotomy closure at the trigone to improve visualization and avoid suturing to the dorsal wall mucosa.
- Begin a single-layer, full-thickness simple continuous pattern 2 to 3 mm away from the commissure of the incision.
- Place suture bites 3 mm apart and 3 mm from each edge incorporating all layers. (If the bladder mucosa is markedly everted, suture bites should come up in the middle and redirected instead of taking a suture bite across the incision all at once.)
- Trail the suture line cranially you such that the suture material is snug against the bladder wall.
- Finish the suture pattern 2 to 3 mm beyond the edge of the incision. Tie surgical knots securely using 5 to 6 throws.

Once the cystotomy closure is complete, assess and critique the closure for appropriate spacing and tightness. Place additional simple interrupted suture if necessary. Gently

lavage the area, remove the stay sutures, and return the bladder to the abdominal cavity. Once the abdomen is closed, perform postoperative abdominal radiographs to document complete stone removal. The animal is typically recovered without a urethral catheter in place. Pollakiuria and hematuria are expected for 3 to 5 days postoperatively. If not contraindicated, nonsteroidal anti-inflammatory drugs can be very beneficial for pain management in postoperative period.

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6.1.4. SPLENECTOMY WITHOUT FANCY TOOLS!

Catriona MacPhail, DVM, PhD, Diplomate ACVS

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins, Colorado, USA

Complete splenectomy is indicated for splenic masses, splenic torsion, and splenic infarction or thrombosis. Acute, nontraumatic hemoabdomen frequently occurs in dogs due to spontaneous bleeding from parenchymal organs, most commonly the spleen. Emergency surgical treatment is indicated in animals with significant or active peritoneal hemorrhage. Splenic tumors occur far more frequently in dogs than in cats. Hemangiosarcoma, hemangioma, and hematoma are the most common lesions requiring splenectomy. Other less common splenic tumors include fibrosarcoma, leiomyosarcoma, mast cell tumor, and lymphoma.

Splenectomy requires a generous ventral midline abdominal incision. If there is active hemorrhage, the spleen should be removed before a complete abdominal exploratory. The spleen can be removed using advanced modalities such as surgical stapling equipment or vessel-sealing systems. Splenectomy has also been successfully performed by laparoscopy. However, these methods are problematic in a practice setting due to availability and cost.

The traditional method for splenectomy is using suture to ligate small bundles of the splenic vessels. This is most easily performed by bundling vessels close to the splenic parenchyma. This method avoids having to ligate the main splenic artery and vein separately and avoids the left gastroepiploic artery that comes of the splenic artery. The spleen can be removed from tail to head or head to tail. The short gastric vessels connecting the head of the spleen to the stomach can be clamped using two large clamps (e.g., Crile or Carmalt hemostatic forceps) and cutting in-between. Releasing the head of the spleen allows for the rest of the spleen to be exteriorized from the abdominal cavity and easier management of the remaining splenic vessels. These vessels can be gathered in large clamps in 3 to 5 bundles, with a clamp placed on the bundle towards the abdomen and a clamp towards the spleen, and the tissue is cut in-between using sharp Metzenbaum scissors, and the spleen is removed. Vascular bundles (pedicles) remaining with the body are ligated using large monofilament absorbable suture, such as 2-0 PDS or Maxon, using one or two Miller's knots or any variation on a Miller's knot.

As much blood as possible should be removed from the abdominal cavity using suction or large laparotomy sponges. Ideally, the abdomen should be lavaged with sterile saline to remove any residual blood or blood clots. The abdominal cavity is now explored to look for gross evidence of metastatic disease. If there are any concerns, the liver, regional lymph nodes, and omentum can be biopsied. Prior to closure, an elective right-sided gastropexy should be considered in breeds at risk for GDV.

The author prefers incisional gastropexies. An incisional gastropexy should not be confused with a midline, incorporating gastropexy, which is not recommended. For an incisional gastropexy, a 3-4 cm longitudinal incision is made through the seromuscular layer of the pyloric antrum, approximately 2-3 cm away from the pylorus. A matching incision is made in the transversus abdominus muscle on the right side of the abdomen caudal to the last rib. These incisions are then sutured together using 2-0 monofilament absorbable suture (e.g., PDS).

In the postoperative period, animals should be monitored for ventricular arrhythmias, and treated if hemodynamically indicated. Long-term prognosis following splenectomy is variable depending on the histopathology of the mass, however a recent retrospective study found perioperative mortality for dogs undergoing splenectomy was approximately 8%. In other words, there is over a 90% likelihood for dogs to be discharged from the hospital following removal of the spleen.

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6.1.5. UPDATE ON BRACHYCEPHALIC OBSTRUCTIVE AIRWAY SYNDROME

Catriona MacPhail, DVM, PhD, Diplomate ACVS

College of Veterinary Medicine and Biomedical Sciences

Colorado State University, Fort Collins, Colorado, USA

BOAS – FREQUENTLY ASKED QUESTIONS:

1. What other anatomic abnormalities can contribute to obstructive airway disease other than stenotic nares, elongated soft palate, and everted laryngeal saccules?
2. Why are thoracic radiographs indicated in animals with upper airway disease?
3. Are there differences in outcomes between different brachycephalic breeds?
4. How early should you surgically address stenotic nares?
5. How early should you surgically address an elongated soft palate?
6. What is the best method to surgically address an elongated soft palate?
7. What are the surgical options once a dog has stage 2 or stage 3 laryngeal collapse?

Brachycephalic obstructive airway syndrome refers to upper airway obstruction attributable to a combination of anatomic abnormalities seen in brachycephalic dogs. Concurrent tracheal hypoplasia, everted tonsils, nasopharyngeal turbinates, and other abnormalities often contribute to respiratory distress. Brachycephalic animals typically have a compressed face with poorly developed nares and a distorted nasopharynx. The head shape is the result of an inherited developmental defect in the bones of the base of the skull. These bones grow to a normal width but have a reduced length. The soft tissues of the head are not proportionately reduced and often appear redundant.

Stenotic nares are congenital malformations of the nasal cartilages that result in medial collapse and partial occlusion of the external nares. Airflow into the nasal cavity is restricted and greater inspiratory effort is necessary, causing mild to severe dyspnea. Resistance to airflow through the nasal cavity in normal dogs is 76% to 80% of total resistance, depending on the volume of airflow. As more and more negative pressure is exerted to breathe, intratracheal and intrapharyngeal pressures can become high enough to cause surrounding tissues to collapse.

Elongated soft palate is the most common component of brachycephalic syndrome and is frequently diagnosed in brachycephalic dogs. The elongated soft palate is pulled caudally during inspiration, obstructing the dorsal aspect of the glottis. It is sometimes drawn between the corniculate processes of the arytenoid cartilages which increases

inspiratory effort and causes more turbulent airflow. The laryngeal mucosa becomes inflamed and edematous, further narrowing the airway. The tip of the soft palate is blown into the nasopharynx during expiration. Affected dogs may have trouble swallowing because normal occlusion of the airway during deglutition compromises ventilation. Dysfunctional swallowing may produce aspiration pneumonia. Some affected animals with concurrent gastrointestinal problems (e.g., esophagitis, hiatal hernia) have improved following surgical treatment of the brachycephalic syndrome.

Laryngeal saccule eversion is diagnosed less often than elongated soft palate or stenotic nares, but has been in reported in over half of dogs with brachycephalic syndrome. It is uncommon to have everted laryngeal saccules as the only abnormality in brachycephalic dogs. Eversion of the laryngeal saccules is considered the first stage of laryngeal collapse. Increased airflow resistance and increased negative pressure generated to move air past obstructed areas (stenotic nares, dorsal glottis) pull the saccules from their crypts, causing them to swell. Once everted, the saccules are continuously irritated by turbulent airflow and become increasingly edematous. The saccules obstruct the ventral aspect of the glottis and further inhibit airflow. It may be difficult for an inexperienced examiner to differentiate everted laryngeal saccules from the vocal folds because of their proximity. Everted saccules partially or completely obscure the vocal folds and may be unilateral or bilateral.

In addition to components already described, everted tonsils, aryepiglottic collapse, corniculate collapse, tonsil eversion, redundant pharyngeal folds, nasopharyngeal collapse, macroglossia, nasopharyngeal turbinates, and laryngeal collapse may contribute to the severity of respiratory distress. Recently laryngeal collapse as a primary disease has been reported in English bull terriers, Norwich terriers, and other small breed dogs.

DIAGNOSTICS

Thoracic radiographs should be evaluated to detect underlying cardiopulmonary abnormalities (e.g., cardiomegaly, pulmonary edema, pneumonia) or other concurrent conditions (e.g., hypoplastic trachea, hiatal hernia, heart base tumor). Lateral cervical radiographs allow evaluation of the nasopharynx, the soft palate, the larynx, and the entire length of the trachea. An elongated soft palate may appear thickened and elongated. Nasopharyngeal, laryngeal, and tracheal masses may be identified.

Laryngeal examination can be broken down into structural and functional parts. Structural examination is most often indicated in brachycephalic breeds to assess the length of the soft palate, presence of everted tonsils or everted laryngeal saccules, and degree of laryngeal collapse. A normal soft palate should just touch the tip of the epiglottis. To appropriately assess soft palate length, the tongue should be in a normal position. An elongated soft palate typically extends past the tip of the epiglottis by at least several millimetres. Everted laryngeal saccules are protrusions of the mucosa diverticula rostral to the vocal folds. The saccules obstruct the ventral aspect of the glottis and further inhibit airflow. It may be difficult for an inexperienced examiner to

differentiate everted laryngeal saccules from the vocal folds because of the proximity. However, in most studies regarding brachycephalic airway syndrome, everted laryngeal saccules are present in 50-60% of affected dogs. Laryngeal collapse is caused by loss of cartilage rigidity that allows medial deviation of the laryngeal cartilages. There are three stages of severity to laryngeal collapse. Stage 1 is the eversion of the laryngeal saccules into the glottis. During stage 2, the cuneiform processes of the arytenoid cartilages lose rigidity and collapse into the laryngeal lumen. In addition, the aryepiglottic folds collapse ventromedially. The most advanced phase of laryngeal collapse is stage 3 in which the corniculate process of each arytenoid cartilage fatigues and then collapses toward midline, resulting in complete laryngeal collapse.

SURGICAL TREATMENT: STENOTIC NARES

Brachycephalic breeds may have a congenital malformation of the nasal cartilages resulting in medial collapse and restriction of airflow into the nasal cavity. Stenotic nares are easily correctable. Various surgical techniques are used, and all have the same result: permanent enlargement of the external nares. Techniques include wedge resection, nares amputation (Trader's technique), and alapexy. For wedge resection, a #11 scalpel blade, Baker's biopsy punch or laser can be used to make deep and even cuts in the wing of the nostril. There is no difference in outcome between a horizontal or vertical wedge resection. Haemorrhage is expected, but bleeding is managed by digital pressure and then controlled once sutures are in place. Absorbable 4-0 multifilament or monofilament suture in a simple interrupted pattern is used to appose cut surfaces.

SURGICAL TREATMENT: ELONGATED SOFT PALATE

Soft palate resection is a relatively simple procedure. The most important aspect of the surgery is to make sure that the palate is not made too short. The consequences of a short soft palate are nasal regurgitation and rhinitis. The procedure is typically performed by placing stay sutures on either side of the palate at the level of planned resection. Technique descriptions describe resecting the soft palate at the level of the cranial commissure of the tonsilar crypt, although most surgeons use the mid to caudal body of the tonsil as a landmark. Metzenbaum scissors are used to transect approximately one-third to one-half the width of the palate. A simple continuous pattern with 4-0 (1.5 metric) monofilament or multifilament absorbable suture is used to oppose the nasal and oral mucosa over the exposed palatine muscle. Removal of the rest of the palate is performed and the suture line is continued to the opposite side. Hemorrhage and swelling are usually minimal, but premedication with dexamethasone (0.25 – 0.5 mg/kg, IV) is often routine.

Soft palate resection may also be performed using surgical laser or Ligasure□. Surgical time is significantly shorter with these modalities; however, clinical outcomes are similar with those receiving traditional resection.

A folded-flap palatoplasty has been described for dogs that have excessive length and excessive thickness of the soft palate. In this technique the soft palate is thinned by excision of a portion of the oropharyngeal mucosa, underlying soft tissues and part of

the levator veli palatini muscle. The palate is made shorter by bringing the caudal edge of the palate rostrally, folding it onto itself until the caudal nasopharyngeal opening is readily visible transorally.

SURGICAL TREATMENT: EVERTED LARYNGEAL SACCULES AND LARYNGEAL COLLAPSE

Resection of the everted laryngeal saccules is relatively simple, however whether resection of the saccules is needed in dogs with brachycephalic syndrome can be debated. Since complications are resection are possible (e.g., laryngeal swelling, laryngeal webbing, regrowth), it has been recommended that saccules be removed only when believed to contribute significantly to obstruction.

Resection of the everted laryngeal saccules is relatively simple. Each saccule is grasped with Allis tissue forceps and then sharply transected with Metzenbaum scissors. Suturing is not necessary. The difficulty of this technique lies is getting good visualization of the larynx and glottis. Often these dogs have redundant pharyngeal tissue that swells rapidly with minimal handling. The presence of an endotracheal tube can also make visualization difficult.

Laryngeal collapse is the end-stage component of brachycephalic obstructive airway syndrome. Weakened laryngeal cartilages become displaced medially, severely obstructing the airway. Options for treatment at this stage are limited. First, all other underlying conditions (stenotic nares, elongated soft palate, everted laryngeal saccules) are addressed. Unilateral arytenoid lateralization has recently been reported to have reasonable long-term outcomes, but this technique should be used with caution as the opposite cartilage may continue to collapse medially. Bilateral arytenoid lateralization techniques are considered unacceptable due to the high risk for aspiration pneumonia. Partial arytenoidectomy procedures have also been associated with a high rate of complications and perioperative mortality. Permanent tracheostomy is the recommended treatment for stage 3 laryngeal collapse, although many owners consider this an unacceptable option.

PROGNOSIS

Surgical correction of brachycephalic airway syndrome will alleviate signs of respiratory distress and improve quality of life in most dogs. The degree of improvement is usually dependent on how severely the dog is affected preoperatively. Dogs corrected for stenotic nares and elongated soft palate had a better postoperative response than dogs with elongated soft palate alone. The most recent large retrospective study describes a good to excellent long-term outcome in 94%. English bulldogs have been found to have a worse response to surgery when compared to all other breed combined and are far more likely to develop aspiration pneumonia postoperatively. Without surgery, prognosis for dogs with elongated soft palate and everted laryngeal saccules is guarded, as respiratory signs and laryngeal collapse will progress over time.

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Michael A. Rossi, DVM, MNS, Dip. ACVD

7. Michael A. Rossi Basic diagnostics of the dermatology patient

Michael A. Rossi, DVM, MNS, Dip. ACVD

Coastal Veterinary Dermatology & Ear Clinic

11320 Space Center Blvd, Houston, TX 77059

Introduction

Dermatological examinations can be very informative and rewarding, but they have the potential of becoming very frustrating. Skin disease is among the most common reasons as to why an owner presents their pet to a veterinary clinic. After all, it is the largest and most visible organ of the body! The skin can be affected by a wide variety of ailments and many diseases can present with a similar clinical appearance. It is imperative to adopt a systematic approach to managing dermatology cases. This approach should include a good dermatology history, a thorough physical examination, and basic dermatological sampling. The dermatologic diagnostic minimum database should include cutaneous cytology, deep skin scrapings, and potentially an otic preparation at the bare minimum. In many instances, we miss more diagnoses by not looking for the obvious and most common cause for the clinical lesions. The overall goal of doing basic diagnostics is to identify secondary infections, such as Malassezia dermatitis, and then proceed to formulate an effective, practical plan for the pet owner to implement. The bottom line is that these fundamental steps are mandatory and not optional as part of an effective patient assessment. The skilled veterinary clinician who can perform these tests and then provide practical, effective treatment will find managing dermatological conditions very rewarding.

History and physical examination

The first step when a new patient is presented for skin lesions is the dermatology history. This should help to guide the veterinary clinician in what the next steps of the evaluation should be. In many cases, the dermatological history can be very complex and confusing which may lead it to become time consuming. The veterinary nurse should be trained in collecting the necessary information to help in guiding the history taking. They should have access to previous records, when available, to determine what has been performed in the past and which treatment options proved to be effective. Many clinics have constructed a dermatology questionnaire focusing on main areas of concern to facilitate the history taking process. Key points to address should include age of onset, seasonality, pruritus level, and which therapeutics have succeeded in the past. It is imperative to scrutinize the answers that the owner provides. It is often the case that when more than one owner is present that the answer is different for each family member. Nevertheless, the veterinary clinician and veterinary nurse should try to collect as much historical data as possible to begin assessing the patient.

Once a good dermatological history has been taken, a physical examination must be performed. Again, this will help in completing the full picture for the patient. The veterinary clinician should be able to identify primary lesions, such as papules and

pustules, as well as more chronic lesions, such as hyperpigmentation and lichenification. Finding lichenification, for example, often points to a long history of dermatological issues, sometimes despite the owner's recollection. In many cases, lesions that were previously unknown to the pet owner may be realized through physical examination. As allergic conditions are common in dogs, areas associated with their clinical course should be systematically evaluated. These areas include the flexor surface of the elbows, the interdigital regions, and axillary regions. Even if a patient is brought in for skin lesions affecting a solitary paw, the entire body should be surveyed for other signs of allergic disease and/or secondary infections.

Cutaneous cytology

The cutaneous cytology, in the author's opinion, is the most common and most valuable diagnostic test that the veterinary clinician can perform. One can determine the presence and morphology of infectious organisms, type and number of inflammatory cells, and even a microbial biofilm in a matter of minutes. The materials needs are minimal: a microscope, a stain, a microscope slide, a sample collection means, and potentially a cover slip. There is no other single dermatological test that could provide as much information as a cutaneous cytology from the skin and/or the ear.

There are several methods for collecting a cutaneous cytology, each for a relatively unique presentation. The direct impression cytology is best used when there is a moist exudate present with a lesion. An example of this would be an intact pustule that could be lanced with a sterile needle. This test is performed by identifying the lesion and applying the distal portion of a clean microscope slide repeated on the targeted area. The slide can then be allowed to air dry or it can be heat fixed before staining. A fine needle aspirate is another form of a cutaneous cytology that is best utilized for nodular lesions or masses. An example of where this would be useful would be a newly identified mass that has recently concerned the owner enough to have the patient presented. In the author's opinion, this is best performed using a 3cc syringe and a 22 gauge needle. The mass in question should be immobilized between the fingers while proper restraint of the patient is maintained. The needle is then inserted into the mass and gentle suction is applied via the plunger. Alternatively, the needle can be repeatedly removed and inserted into the lesion until the sample is subsequently expelled onto the microscope slide. Ideally, these samples should be allowed to air dry, but gentle heat fixing can be performed with care. An acetate tape preparation is also a common means of sample collection. This is best used when diffuse, dry lesions are identified. A good example of this would be multiple epidermal collarettes when a rim of fine scale is present. This test can be performed with cut packing tape or any other strong, clear, acetate tape. The sticky portion of the tape is repeatedly pressed on and removed from the area of interest. This is a process known as tape stripping. It should remove superficial cells and any suspected organisms. The tape does not need to be thermally or chemically fixed, but rather can be directly stained before examination. An otic cytology is a specific type of cutaneous cytology directly from the external ear canals. An example for this type of sample would be a patient presenting with a unilateral, exudative otitis externa. Again, proper patient restraint is necessary to collect a quality sample. Visual examination of the area in question should be attempted first with a handheld otoscope. Typically, long, cotton-topped applicators are used to gently insert into the external ear canals and the sample is collected in this manner. It is best to adopt a routine on how the sample is then

applied to a clean microscope slide so that the left ear and the right ear are not confused by anyone examining the sample.

Deep skin scraping

A deep skin scraping is also a very common type of diagnostic sampling and should be included in the dermatologic diagnostic minimum database. This is especially important if an ectoparasite (most commonly some form of demodicosis) is suspected to be the cause of the clinical presentation. If a more superficial ectoparasite is suspected, for example Sarcoptes sp., then a wide, superficial skin scraping should be performed. Essentially, any case presenting with hair loss, scale, crusting, papules, or pustules should receive a deep skin scraping. The tools necessary to perform this test are minimal: a microscope, a clean microscope slide, a cover slip, mineral oil, and a dull scalpel blade. The clinician should collect at least two samples from affected areas. The targeted skin should be squeezed gently, but firmly, between the thumb and index finger to help in extruding mites from the hair follicles. A drop of mineral oil should be applied to the area to be scraped. This will provide lubrication and help the material to adhere to the scalpel blade. The blade should be held at a 90 degree angle to the skin and, again, firm but gentle pressure should be applied as the blade is passed repeatedly over the region. The goal with a deep skin scraping is to, with repeated scrapings, produce capillary bleeding. This signifies access to the dermis where the hair follicles are typically located. Care should be taken to collect as much of the material and oil as possible to apply to the slide. Once the material is collect onto the slide, a cover slip should be applied. If the area to be sampled is sensitive to the patient or is in a difficult area (eg, interdigital space), a trichogram can be performed to assess for follicular mites. Small hemostats are used to grasp the hair shaft near the base before slightly twisting the instrument and lifting hairs out of the follicle. One of the most important aspects of the deep skin scraping is the microscopic examination. This is performed with a low-power objective (4x or 10x), the light source at low intensity, and the iris diaphragm mostly closed. Development of a systematic review of the slide is key. The veterinary clinician should begin at one corner of the slide and scan the entire slide looking for evidence of ectoparasites or eggs. The probability of finding evidence of Demodex sp. from a lesion in an otherwise normal dog is extremely low.

Fungal culture

A fungal culture for a dermatophyte is easily performed by the veterinary clinician in a general practice setting. The most important aspect of this diagnostic test is the collection of the sample to maximize probability of good dermatophyte growth. This is often performed with the help of a good screening test. The goal of the screening test is to identify the hairs that can then be removed and utilized with the dermatophyte culture. This is often achieved with the aid of a Wood's lamp. This is an ultraviolet light with a specific wavelength and filter that allows for identification of suspect infected hair shafts. When exposed to this light, hairs infected with Microsporum canis will fluoresce 30-80% of the time. It should be noted that the sensitivity and specificity of this screening test are rather low. The Wood's lamp should be allowed to warm up for a minimum of 5 minutes to allow for the wavelength to stabilize. It should be kept in mind that other material, such as purulent debris and scale, may also fluoresce. The Wood's lamp should never be used to diagnose a patient with dermatophytosis. The confirmatory test should be the

dermatophyte culture and/or dermatophyte PCR, the latter of which cannot be done in-house and, in the author's opinion, is often less rewarding. When collecting samples, those hairs that are positive with a proper screening test should be removed for culture. In certain instances it may be important to also collect scale from the epidermis as some dermatophytes may only be present in the stratum corneum. Samples should be collected from the margins of new lesions. Preparation of the area to be sampled should include gentle patting with gauze or cotton balls soaked in 70% alcohol and allowed to air dry. This should reduce the growth of contaminants. Many, if not all, distributors will carry some form of dermatophyte medium for cultures. The author recommends one of the double plate tests, such as Derm-Duet. This consists of a culture plate with two different forms of growth medium. Almost all will contain a dermatophyte test medium (DTM) and an enhanced sporulation agar. The DTM will contain a color changing indicator to alert the veterinary clinician of potential dermatophyte growth. Once hair/scale has been collected, it should be applied to the test medium and gently imbedded. The test should be stored in a warm, dry, dark location for the duration of the culture. The plate should be examined daily for the first 10 days with a total incubation period of roughly 14 days. Once growth can be appreciated on the culture medium, colonies should be evaluated for color and texture. This will become important when identifying the type of dermatophyte. The sticky side of acetate tape should be applied to the top of the mycelial surface to help in removing macroconidia for identification. Several drops of basophilic stain, such as lactophenol cotton blue, can then be applied to the sample surface before affixing it to a clean microscope slide. Basic knowledge of macroconidial and mycelial morphology can then be used to identify the dermatophyte.

Bacterial culture

The worldwide spread of strains of bacteria resistant to virtually all antimicrobials available in veterinary medicine, namely methicillin-resistant Staphylococcus pseudintermedius, has certainly complicated how bacterial infections are managed. It is imperative that the bacteria be identified rapidly and that the appropriate antimicrobial is implemented at the correct dose and for a proper duration. While a bacterial culture may not be a cost-effective diagnostic test at an initial visit for infection, it should be performed if any antimicrobial resistance is suspected. The owner should be made aware of the value of this test in helping to arrive at the correct treatment protocol for their pet and help to minimize potential adverse events. When collecting a bacterial culture sample, it would be best to avoid open wounds if possible as they may be contaminated from the environment. It is ideal to find intact papules and/or pustules for the culture sample. These can be easily ruptured using a sterile needle and then the serous or purulent discharge can be collected on the sterile culture swab. In cases where crusts are evident, the veterinary clinician should be able to lift the edge of the crust away from the skin using a sterile needle and material can be collected this way. As with any diagnostic test, the reported results should be interpreted in light of the clinical presentation. A cutaneous cytology is always recommended prior to a culture to ensure that there are in fact bacteria associated with the lesions.

Conclusion

Basic diagnostics obtained from patients who present with dermatological conditions are a fundamental tool for the veterinary clinician. These tests provide a significant amount

of extremely valuable information in a relatively short period of time. The pet owner should be counseled on these diagnostics and their clinical value should be emphasized to aid in compliance. The veterinary clinician should also not discount other valuable basic diagnostic tests, such as increased flea prevention in those patients suspected of having flea allergy dermatitis or a diet elimination trial in those patients suspected of having an adverse food reaction. The systematic identification of those factors leading to clinical disease should allow for proper and timely treatment of the patient's condition and should be satisfying to both the veterinary clinician and the pet owner.

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7.1.2. Clinical management of staphylococcal skin infections

Michael A. Rossi, DVM, MNS, Dip. ACVD

Coastal Veterinary Dermatology & Ear Clinic

11320 Space Center Blvd, Houston, TX 77059

Introduction

Canine superficial pyoderma remains one of the most common dermatology conditions in dogs. The bacterium known as Staphylococcus pseudintermedius (SP) was first described in 1976 and has been found to be a commensal organism of the oral, nasal, genital, and mucocutaneous sites of several veterinary species. It has been identified as the primary pathogen isolated from canine pyoderma, a bacterial infection that is typically isolated to the superficial portion of the hair follicle. The presence of this pyogenic infection can often present as a diagnostic challenge, even to the most seasoned veterinary clinician. Systematic identification of the offending organisms using clinical and laboratory diagnostic tests, along with a comprehensive treatment approach can often lead to favorable outcomes and prevention of future infections.

Superficial infections with SP are often secondary to local trauma, parasitic infections, endocrine disease, or allergies to name a few. Consequently, this bacterium is also the leading cause for antimicrobial use in canine patients. These infections are often spread from colonization sites via licking or grooming. In general, these organisms are considered opportunistic pathogens and take advantage of the various predisposing factors of the host leading to clinical disease.

Clinical signs and diagnosis

The diagnosis of a superficial pyoderma is typically very straightforward given its clinical appearance. That being said, care should be taken through the examination and diagnostic process to ensure that conditions leading to similar presentations aren't overlooked. Follicular inflammation can also be noted in cases of demodicosis, dermatophytosis, and a myriad of immune-mediated skin disorders. In some cases, a superficial bacterial folliculitis may lack obvious inflammation and appear as a patchy, "moth-eaten" hair coat, especially in short-coated dogs.

Superficial pyoderma can affect dogs of any age. The condition can range anywhere from nonpruritic to extremely pruritic. The most common clinical findings consistent with a superficial pyoderma are erythematous, folliculocentric papules and pustules. These will often progress into secondary lesions consisting of alopecia, scale (epidermal collarettes), crusts, hyperpigmentation, and lichenification. In cases of surface pyoderma, there may be a lack of these clinical findings and the patients may simply present with diffuse erythema.

A thorough history will help in identifying the chronic and/or recurrent nature of the condition for the canine patient. As mentioned, there are several conditions that can predispose to a superficial pyoderma, such as hypersensitivity dermatitis, parasitic skin infection, and/or endocrinopathies. In one study by Bensignor et al., atopic dermatitis

was identified in 60% of the canine patients with recurrent superficial pyoderma. This is due to the increased adherence of SP to atopic skin, an altered skin barrier function, and an altered surface immunity.

Cutaneous cytology is a rapid, inexpensive procedure and is the diagnostic test of choice in all cases of inflammatory skin conditions. The ultimate goal of a cutaneous cytology is to examine the surface area in question for pathogenic organisms, such as bacteria, and to note any host immune response via inflammatory cells. There are several techniques described for collecting samples in various situations. A direct impression cytology works well in most cases where moist exudate is noted. This can be obtained by simply pressing a glass slide against the area in question. The slide should be allowed to dry before heat fixing. An acetate tape preparation is another efficient way to sample surface areas when exudate is not present. This is often done using clear, acetate tape pressed repeated onto the skin in a process known as tape stripping. In all instances, use of a modified Wright's stain (Diff-Quik) provides sufficient data for a clinical diagnosis.

Interpretation of a cutaneous cytology is an art form that all veterinary clinicians should be proficient in, as it is likely the most common diagnostic test performed in the clinic. Once stained, samples are reviewed using the oil immersion lens (1000x magnification) with ample illumination. Several areas of the slide should be scanned to collect useful data. Two of the most important points of a cutaneous cytology are the morphology and number of microorganisms. The number should be approximated using a 0 (none) to 4+ (too numerous to count) scale for repeatability and consistency. The morphology of bacteria noted may also help to guide antimicrobial selection and if an aerobic culture and sensitivity should be performed. In addition to the bacterial morphology and number, the presence of inflammatory cells is an important part of the cutaneous cytology. In most cases, neutrophilic inflammation predominates in superficial pyoderma.

An aerobic culture and sensitivity should be performed for any bacterial lesion which has failed to respond to first-line antimicrobials. In general, it is never wrong to culture a lesion where cutaneous cytology has shown the presence of bacterial organisms and inflammatory cells. This test is used to select the appropriate systemic antimicrobial for treatment and/or to investigate treatment failures. In the case where there is observation of the presence of neutrophils within an inflammatory lesion containing an abundance of bacterial cells (ineffective, host immune response), the suspicion of microbial resistance and/or microbial biofilm formation should be suspected, both of which can greatly complicate therapeutic intervention.

Bacterial resistance and biofilm

There are several factors that one must take into consideration when discussing bacterial resistance, specifically methicillin-resistant Staphylococcus pseudintermedius (MRSP). In general, this bacterium follows similar resistance patterns to Staphylococcus aureus in humans although the mechanisms of the resistance are different. Staphylococcus pseudintermedius prefers transposon-borne resistance genes which are then incorporated into the chromosomal DNA. Additionally, not only must the bacterium have phenotypic oxacillin resistance, but the gene mecA must be present to classify an isolate as MRSP.

While the transfer of DNA is an important aspect of microbial resistance, one must not forget about other mechanisms of survival in the face of inflammation. For most of the

history of microbiology, bacteria have been readily known as freely moving cells. These planktonic cells remained solitary and were thought to simply float about. Antoine von Leeuwenhoek, the Dutch microscopist, was the first to describe that these microorganisms could attach and grow on exposed surfaces. This eventually led to the concept of the microbial biofilm. It was later determined that these sessile colonies of microbes were the predominant form that microorganisms would take in an effort to enhance their own survival.

It was not until the 1980s that it was first recognized that microbial biofilms played a pathogenic role during the infection process. Today, the almost ubiquitous involvement of biofilm formation during acute and chronic infection has been noted in both the human and veterinary medical communities. These resistant organisms have been indicated in chronic otitis media, endocarditis, superficial wounds, and dental plaque formation just to name a few examples. Thus, biofilm formation leads to persistent infections that appear resistant to conventional antimicrobial treatment and is today a major cause of treatment failure.

There are several species of common microbes in veterinary medicine that have been shown to produce a biofilm. This has been seen with such bacteria as SP, Pseudomonas aeruginosa, and Escherichia coli. Recent studies have shown that up to 90% of isolates of SP from the canine species are capable of producing a microbial biofilm. Microbes that have formed a biofilm will be phenotypically different from their planktonic counterparts. This is done in response to several factors, such as nutritional cues, host defense peptides, or in some cases, by exposure of planktonic cells to subinhibitory concentrations of antimicrobials.

Pyoderma management

Once a superficial or surface pyoderma has been identified utilizing the appropriate diagnostic test(s), the veterinary clinician must formulate an effective treatment plan for the condition. Treatment can be divided into two categories: systemic therapy and topical therapy.

I. Systemic therapy

In general, systemic therapy is initiated when success using a topical approach alone seems unlikely. There are several factors to keep in mind when selecting a systemic antimicrobial agent. One must consider if the potential benefits of a specific medication outweighs the risk of possible adverse events. The vast majority of antimicrobials have the ability to induce gastrointestinal upset. Therefore, selection of a parenteral formulation may be desirable. Age- or breed-related complications must also be considered with certain drug classes, such as flouroquinolones. Drug cost and frequency of administration may also be factors that can contribute to owner compliance when treating infections.

Choosing an empiric antibiotic based on cytology alone is common practice and is acceptable when resistance is not suspected. It would be ideal to avoid antibiotics where intrinsic resistance of staphylococcal bacteria is known, such as ampicillin, amoxicillin, and nonpotentiated sulfonamides. Commonly used antibiotics for superficial pyoderma are: cephalexin 22-30 mg/kg every 12 hours, cefpodoxime 5-10 mg/kg every 24 hours, and clindamycin 9-11 mg/kg every 12 hours. Treatment should continue one week past

clinical cure of the superficial infection. These will generally clear with a 3-4 week course of medication.

Selection of a second line antibiotic class should always be based on a bacterial culture and sensitivity profile. These drugs fall into several classes, such as cycline antibiotics, flouroquinolones, and chloramphenicol. Many of these require routine blood chemistry and complete blood count panels for monitoring. The following are recommended once empirical choice has failed and a bacterial culture has been performed: doxycycline 5-10 mg/kg every 12 hours and enrofloxacin 5-20 mg/kg every 24 hours. Again, these medications should be administered at least one week past the clinical resolution. In either case, regular re-evaluations are an important part of the treatment plan, as this will allow for improved compliance and adjustments of the treatment plan.

II. Topical therapy

Topical therapy is best used when: i. the infection is focal, ii. the infection is identified as a surface pyoderma, and/or iii. used in conjunction with systemic antimicrobials. In most cases today, the veterinary clinician should be emphasizing the importance of topical therapy as part of good antimicrobial stewardship practice. This may allow for slower resistance development and reserve antimicrobials for more severe, life threatening cases. It is almost never wrong to use topical therapy in all forms of surface and superficial pyoderma. Not only does this form of therapy help to rid the patient of infection, but it also will help in removing crusts, debris, and dead bacteria from the skin.

If an infection is localized, the use of a topical, antimicrobial ointment or cream may be of increased benefit. Silver sulfadiazine cream can be applied daily to an infection with good success. Similarly, the topical antibiotic mupirocin in a 2% formulation works very well at focal bacterial infections when confined to the surface. Neither of these work well for deeper infections. When infections are more widespread, addition of topical, antimicrobial shampoos or mousse applications may help to resolve these cases. Chlorhexidine-containing products are widespread and are often used as first-line topical therapy. Bathing or mousse application depends of the case and situation, but it is generally performed at least twice weekly in conjunction with systemic therapy. Bathing with an antimicrobial shampoo three times weekly may be sufficient to kill a surface pyoderma in the author's experience. A minimum contact time of 10 minutes should be stressed to the owner to allow for good efficacy and luke warm water should be used. For patients with recurrent pyoderma, maintenance therapy with weekly bathing and twice weekly application of antimicrobial mousse should be performed.

Conclusion

Managing a superficial staphylococcal infection can be a daunting task for the veterinary clinician and pet owner alike. The worldwide spread of strains resistant to virtually all antimicrobials available in veterinary medicine, namely MRSP, has certainly complicated how bacterial infections are treated. This has shifted the focus of management away from strictly systemic antimicrobial agents and put more pressure on the development of topical applications. While the problem of antimicrobial resistance is increasing with alarming speed in both animals and humans, there has been a striking reduction in the

number of new antimicrobial products for both of these species. For the veterinary clinician, the most effective way to prevent recurrence of superficial infections is to identify and manage the primary, underlying condition in a time sensitive manner. When presented with a case where superficial infection is suspected, utilizing a cutaneous cytology along with a potential bacterial culture and sensitivity should be paramount. Prevention with routine bathing or mousse application may help to prevent recurrence of infection and can potentially lessen the likelihood of the patient developing a resistant infection.

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7.1.3. Feline atopic-like skin syndrome: understanding cause and therapy

Michael A. Rossi, DVM, MNS, Dip. ACVD

Coastal Veterinary Dermatology & Ear Clinic

11320 Space Center Blvd, Houston, TX 77059

Introduction

Feline atopic-like skin syndrome (FASS) is a relatively common presentation in the veterinary clinic. The feline patient often presents as a very challenging and frustrating case to the veterinary clinician. The clinical signs of the disease are often confusing and are not pathognomonic for any single underlying etiology. It is for these reasons that an accurate, timely diagnosis and a successful, comprehensive treatment plan are essential, but can be difficult to manifest. Many pet owners seek out immediate relief, but fail to understand that this condition is a life-long struggle for their pet. It should be paramount that the veterinary clinician be able to identify clinical signs consistent with FASS and then determine which treatment plan is best for the individual case.

Cutaneous reaction patterns in felids

The veterinary clinician should be able to distinguish between the more common reaction patterns seen in cats with FASS. While none of these patterns are indicative of the exact underlying etiology, they should suggest that the individual patient has a hypersensitivity disorder and that further investigation into this is warranted. What all four common reactions have in common is that the patient is experiencing some degree of inflammation and pruritus. The four cutaneous reaction patterns in cats are: i) self-induced alopecia, ii) head/neck/pinnal pruritus, iii) eosinophilic granuloma complex (indolent ulcers, eosinophilic plaques), and iv) miliary dermatitis.

Underlying etiologies in FASS

There are three main allergic dermatoses found in the feline species: flea bite hypersensitivity, cutaneous adverse food reactions, and environmental allergies. Clinically, these three conditions can present identically. It is for this reason that a good history and clinical examination are imperative. The data collected with these two activities will help to lay the foundation of the treatment plan for the patient. Feline patients differ from their canine counterparts in that there is substantially more study information documented in dogs. The following information is broken down into the individual etiologies:

I. Flea bite hypersensitivity

Flea bite hypersensitivity (FBH) has been implicated as the trigger in the vast majority of cases of FASS. The incidence of FBH in patients exhibiting at least one of the cutaneous reaction patterns described above has been reported to be as high as 70% in one study. This is often dependent on the area of the country where the patient resides, as FBH is more common in flea endemic regions. It is often difficult to find evidence of fleas on the feline patient as they are meticulous groomers. The production of pro-inflammatory

cytokines seen with FBH in cats is due to a salivary protein termed flea salivary antigen 1. The introduction of this protein into a sensitized individual will lead to a type I (immediate-type) and/or type IV (delayed-type) hypersensitivity reaction. Treatment should be focused around preventing exposure to the antigen and reduction of inflammation. The isoxazoline class of drugs works by antagonizing ligand-gated chloride channels and is the author's prevention of choice. These products are often applied topically and on a monthly basis to provide sustained protection against the reintroduction of antigens. It is important to treat all animals in contact with the patient as they could be asymptomatic carriers of fleas. Environmental decontamination could also be considered. Glucocorticoids, such as prednisolone administered at 1 mg/kg once daily or a methylprednisolone injection administered as 20-40 mg/cat, or oclacitinib 0.7-1.2 mg/kg every 12 hours (extra-label use) are effective at reducing pruritus and providing comfort in these patients and should be used short-term.

II. Cutaneous adverse food reactions

The incidence of cutaneous adverse food reactions (AFR) in cats varies greatly in the reported literature. In general, the reported incidence is between 1-6% of feline patients. It is the author's opinion that this condition is likely under-reported and/or under diagnosed. As with canine patients, the pathogenesis of AFR in cats in not completely understood. There are varying reports of allergen-specific IgE involvement, as well as the exact type of hypersensitivity reaction identified. The patient will present with a non-seasonal pruritus in the case of strict AFR. Again, there may be the presence of one or more of the previously noted cutaneous reaction patterns. Clinical signs may include gastrointestinal disturbances in up to 33% of feline patients presenting for AFR. Unusual clinical signs have been noted in these patients, including plasma cell pododermatitis, conjunctivitis, and respiratory abnormalities. The diagnostic of choice for this condition is a strict elimination diet trial. The most commonly reported food allergens in cats with AFR are beef, dairy products, chicken, and fish. Together, these groups account for roughly 90% of documented cases of AFR in cats from various reports. Once the patient has been fed the strict elimination diet trial and clinical resolution of lesions has been obtained, the patient is then fed a provocation diet to confirm suspicion of the underlying cause. Serum allergy testing, intradermal allergy testing, and gastroscopic testing have all been shown to be inaccurate in the cat. The elimination diet trial should be kept strict throughout the duration. It is cited in the literature that more than 80% of cats with known AFR showed resolution within 6 weeks of beginning a strict elimination diet. That percentage increased to almost 90% by the 8 week time point. It is generally recommended that an elimination diet last between 8-12 weeks. There are many commercially available diets containing limited ingredients and novel proteins that can be utilized. A home-cooked diet may also be used provided that the owner works with a veterinary nutrition expert to ensure that the diet is balanced. As the diet trial may last several weeks, control of pruritus is paramount and consideration should be given to treatment options that are safe for that time period. Glucocorticoids and/or modified cyclosporine at 7 mg/kg once daily are effective at controlling the pruritus for the initial phases of the diet trial. Oclacitinib may also be attempted, but is not very effective for this condition in the author's experience.

III. Environmental allergies

Environmental allergies in the feline patient can present with either a seasonal or non-seasonal course. The terms "feline atopy" and "feline atopic dermatitis" are now defunct and have been replaced with the term non-flea, non-food hypersensitivity dermatitis. This

is due to the fact that there is a lack of conclusive allergen-specific IgE involvement, which is the hallmark of true atopic dermatitis as seen in both the dog and man. While it has been noted that there is an increase in CD4+ T cells in the skin of allergic cats, the cytokine profile that accompanies this condition is still under investigation. The vast majority of these patients present with varying degrees of pruritus surrounding the times of allergen exposure. As previously discussed, the feline patient may present with at least one of the cutaneous reaction patterns. Environmental allergies are typically a diagnosis of exclusion, so it is often arrived at once flea bite hypersensitivity and adverse food reactions are ruled out. Along with the cutaneous manifestations of the disease, the patient may also present with signs of feline small airway disease, such as allergic rhinitis or sinusitis. Sneezing may be a prominent finding in cases of environmental allergies in cats with some reports approaching nearly 50% of cats with the condition. Unlike the canine patient, bacterial and/or fungal infections of the ears and skin are uncommon to rare in the feline patient with environmental allergies. This may be related to the reduction in adherence of the microbes to the feline corneocytes.

The goal with therapy for feline patients with environmental allergies is to decrease the frequency and severity of the allergic flares as safely as possible. A cure should not be expected and this should be relayed to the owner early in the treatment plan. Treatment should be evaluated on a case-by-case basis to determine which modality is best for that individual. Conservative treatment plans should revolve around antihistamines, although success rates remain relatively low with this modality. Medications, such as cetirizine 5 mg per cat given once every 24 hours, should be tried for a minimum of two weeks to determine efficacy. More aggressive systemic therapy may consist of glucocorticoids (prednisolone 1-2 mg/kg every 24 hours and then tapered) and/or modified cyclosporine (Atopica 7 mg/kg every 24 hours). These therapies should be used at as low of a dose and for as briefly as possible to provide comfort. Allergen-specific immunotherapy (ASIT) remains the treatment of choice for feline patients with environmental allergies. Allergens are identified using intradermal allergy testing and/or serum allergy testing and then formulated into either a subcutaneous injection or a sublingual drop. Response rates vary, but most of the literature places them between 70-80%. ASIT should be given for at least 12 months to determine if it will be effective and administration may be tapered at that point.

Conclusion

There is still much that is unknown when evaluating the pathogenesis of FASS. There also appears to be considerable overlap of clinical signs amongst the known etiologies, making the determination of the underlying cause difficult and frustrating for the veterinary clinician. The cause of the cutaneous manifestations of the condition should be ruled out in a consistent, methodical manner until the correct diagnosis is discovered. Treatment should focus on the underlying issue(s) while providing relief through systemic medications. It is important that the treatment not be made worse than the disease itself. The goal of the comprehensive treatment plan is to improve the quality of life for the feline patient and the pet owner.

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7.1.4. Proactive, multimodal therapy: improving the management of allergic disease

Michael A. Rossi, DVM, MNS, Dip. ACVD

Coastal Veterinary Dermatology & Ear Clinic

11320 Space Center Blvd, Houston, TX 77059

Introduction

Hypersensitivity conditions in the canine patient, specifically atopic dermatitis (AD), can be frustrating to manage for both the pet owner and for the veterinary clinician. Canine AD is defined as a genetically predisposed inflammatory and pruritic skin condition with characteristic clinical features associated with IgE antibodies most commonly directed against environmental allergens. It affects roughly 10% of the canine population. Despite there being decades of research, investigation into several aspects of AD remain of significant importance to researchers as advancements may allow for a more accurate diagnosis and a more rapid formulation of a comprehensive treatment plan that can effectively control this condition.

The pathogenesis of AD is very complex and involves several factors, some of which vary from patient to patient. It is for these reasons that the condition should not be considered a single entity, but rather a syndrome with different clinical and molecular endotypes and phenotypes. Because of its familial involvement and strong breed predilection in dogs, human and canine AD is considered to have a genetic basis. In addition, the pathogenesis of the condition appears to have many similarities between the human and canine patient. Taking into consideration the many new discoveries about this syndrome, the veterinary clinician now has a multitude of management options that can be combined to optimize efficacy in the individual patient.

Pathogenesis

Atopic dermatitis has a multifactorial, incompletely understood pathogenesis in both dogs and humans. In the past, it was thought that AD was primarily a type-I hypersensitivity reaction. It was hypothesized that environmental allergen exposure led to production of allergen-specific IgE antibody production and subsequently their adherence to mast cells. Future challenges with the offending allergens would then cross-link the IgE and lead to mast cell degranulation and the release of inflammatory mediators. More recently, research has shifted some of its focus to investigate the role that a dysfunctional epidermal barrier plays in AD. These considerations are not mutually exclusive and it is likely a combination of multiple factors that lead to clinical disease, the so-called “outside-inside-outside” theory. The basis of this theory is that the primary defect of the epidermal barrier leads to increased penetration of percutaneous allergens and micro-organisms that over-stimulate the local immunity. This inflammation, in turn, causes increased damage to the epidermis. There are a number of abnormalities which have been identified in the formation of the dysfunctional epidermis in the atopic individual. These include a truncated filament aggregating protein, filaggrin, and a decrease in natural moisturizing factors called ceramides. All of these components work

in harmony to create a complete, intact epidermis. It is also noted that with the disrupted barrier found in patients with AD there is an increased adherence of bacterial and/or fungal organisms. These can act as flare factors for the underlying condition and may stimulate a considerable number of lymphocytes in a non-specific manner resulting in additional inflammatory responses. The complete, detailed pathogenesis of canine AD is very complex and is beyond the scope of this article. The take home message for the veterinary clinician is that without addressing the multiple factors that affect the epidermis we often find that it is difficult to manage patients with canine AD syndrome.

Diagnosis and clinical signs

Atopic dermatitis in dogs was first described several decades ago. Since that time, there have been several studies published that focused on the clinical signs of the syndrome and if they could be reliably used as diagnostic criteria by the veterinary clinician. We now know that there is significant variability amongst individuals with this condition. In 2010, one of the more recent sets of diagnostic criteria was proposed for canine AD patients. This list has been termed “Favrot’s criteria” after one of the authors and it has 85% sensitivity and 79% specificity when 5 of the 8 criteria are met:

1. Age at onset less than 3 years
2. Dog living mostly indoors
3. Glucocorticoid-responsive pruritus
4. Chronic or recurrent yeast infections
5. Affected front paws
6. Affected ear pinnae
7. Non-affected ear margins
8. Non-affected dorsolumbar area

One should keep in mind that AD is a clinical diagnosis based upon a compatible history and clinical signs. It should be noted that in the past an AD diagnosis was reserved for environmental allergens. There have been several more recent publications that now group environmental and food-induced AD together, as either etiology can lead to negligible clinical differences.

In general, AD will typically begin between the ages of 6 months and 3 years. Dogs diagnosed with food-induced AD tended to be younger (< 1 year) or older (> 6 years) than those with aeroallergen-induced AD. As mentioned previously, canine AD has been shown to have a genetic basis. This has also led to the realization that several breeds are at an increased risk. Predisposed breeds include West Highland white terriers, Labrador retrievers, golden retrievers, boxers, French bulldogs, German shepherds, and cocker spaniel dogs. There does not appear to be an overwhelming sex predilection for

canine AD with the exception of male golden retrievers and female boxers being slightly overrepresented.

The most common clinical sign seen with canine AD is pruritus. The veterinary clinician should keep in mind that pruritus can manifest in several ways in the canine patient, including excessive grooming, licking, rubbing, and head shaking. The distribution of lesions associated with the canine AD syndrome characteristically affects specific body areas, such as the flexor aspect of the elbow, the interdigital region, the axillary region, the inguinal region, and the face. In the early stages of this condition, primary lesions (e.g. erythema, papules) are predominantly found over these areas. As the syndrome becomes chronic, secondary lesions (e.g. excoriations, lichenification, alopecia) are noted with the same distribution. The owner may note that the clinical signs can be seasonal or non-seasonal depending on the offending allergen levels in the environment.

The proactive, multimodal approach

The proactive, multimodal approach takes into consideration the heterogenicity of the canine AD syndrome. There are often various factors that, when combined, may lead to exacerbation of the atopic patient. This approach addresses the realization that there is not a single modality that will work optimally for every patient, every time. Aside from the advancements in our knowledge, cutting-edge scientific discoveries, and standardizations of clinical diagnoses, there are varying patient needs, differences in owner budgets and feasibilities, and inconsistencies in patient response to therapy. Each patient is an individual and therefore they will require an individualized treatment plan. The astute veterinary clinician should not adopt a “one plan fits all” mentality. This often leads to substantial treatment failures and poor control of the atopic patient. What follows are general guidelines for a practice termed the “proactive intermittent approach” to canine AD. This approach should address several known areas where patients require intervention. The ultimate goal of this therapy is to reduce the frequency and severity of atopic flares as safely and effectively as possible. It should be noted that this approach does not address those patients with active atopic flares, as that would fall under the term “reactive therapy”.

I. Ectoparasite control

Ectoparasites have the potential of causing a considerable amount of pruritus on their own and may either complicate or exacerbate an underlying AD diagnosis. When addressing ectoparasites as part of the proactive, multimodal approach, the veterinary clinician must take into consideration the geographic location of the patient and the likelihood of exposure. One of the most common ectoparasites affecting dogs across the United States is Ctenocephalides felis, the cat flea. Flea salivary antigen 1 is a salivary protein that is potent enough to sensitize the canine patient, a condition termed flea bite hypersensitivity (FBH). The reintroduction of this protein into a sensitized individual will lead to a type I (immediate-type) and/or type IV (delayed-type) hypersensitivity reaction. The results can be a considerable level of pruritus. Canine FBH is characterized by a

pruritic and papular dermatitis with, in chronic cases, alopecia, crusts, hyperpigmentation and lichenification. Lesions are typically localized to the lumbosacral area, base of the tail, and caudomedial thighs. That being said, the clinical signs of FBH and canine AD may have some overlap. It should be noted that housemates not suffering from FBH may harbor a considerable number of fleas without displaying any clinical signs.

The proper control of ectoparasites may lead to substantial improvement in sensitized patients and help to prevent future flares. This may also negate the need for immunomodulatory therapy in the future, a point that many pet owners find highly desirable. It is for this reason that the veterinary clinician should help the owner to see the value in quality, continuous flea control. Management should focus on preventing exposure to the offending antigen by eliminating the potential for flea bites. The isoxazoline class of drugs works by antagonizing ligand-gated chloride channels and is the author's prevention of choice. These products are often administered via the oral route on a monthly basis to provide sustained protection against the reintroduction of antigens. Additionally, there are several high quality topical flea preventatives containing newer generation molecules that are available. One such class, the neonicotinoids, works by binding irreversibly to the nicotinic acetylcholine receptor leading to a cessation of neurotransmission at the postsynaptic cleft of neurons. This ultimately results in paralysis and death of insects. There are several members of this class and the author often uses either dinotefuran or imidacloprid. It is important to treat all animals in contact with the patient as they could be asymptomatic carriers of fleas. Environmental decontamination could also be considered should the situation warrant this.

II. Allergen avoidance

One of the most important points in preventing flares of AD is to avoid those factors that contribute to the disease in the individual patient. This includes dietary antigens to which the patient is sensitive to. As easy as it sounds, this is often difficult and can lead to a certain level of anxiety for the pet owner. The most common environmental allergens involved in the pathogenesis of canine AD are house dust and storage mite antigens, along with pollens from grasses, trees and weeds. The house dust mites Dermatophagoides farinae and D. pteronyssinus are the main environmental allergens responsible for flares in dogs with AD. In theory, reduction of environmental house dust mite antigens would help to prevent future flares of AD, however, there is a scarcity in published data surrounding this topic. One study did point to the benefit of house dust mite control with an acaricidal benzyl benzoate spray used in homes with house dust mite sensitive dogs. There are several other feasible options that the pet owner can institute through instruction from the veterinary clinician for mite avoidance. The best results may be realized where more than one of these measures are implemented. There are a variety of impermeable pet mattress covers that can be utilized to prevent collection of dust mite allergens in the bedding. These should be removed weekly and washed in water with a temperature in excess of 130 degrees Fahrenheit. House dust mites are not as populous in arid environments. The utilization of a dehumidifier to maintain a relative humidity of less that 50 percent may help to control their numbers. As their name implies, dust mites are often found in areas with excess surface dust. It is important to attempt to reduce as mush dust as possible within the home. Using a damp cloth when wiping surfaces may help to prevent the dust from scattering and becoming airborne. The utilization of a vacuum to remove surface dust is also effective. The vacuum should have a double-layered microfilter bag or a high-efficiency particulate air (HEPA) filter to help decrease house-dust emissions. It should be emphasized to the pet owner that these countermeasures alone will not lead to a rapid cessation of clinical signs as dust mite

antigens may remain in the environment. Nevertheless, the pet owner should be encouraged to continue with the routine maintenance as part of the proactive approach to lessening flares.

III. Allergen-specific immunotherapy

Allergen-specific immunotherapy (ASIT) has been practiced for several decades in both human and veterinary medicine and remains the preferred method to aid in the control of clinical signs associated with canine AD. It remains the only treatment option available that can modify or reverse the pathogenesis of AD syndrome. Allergens are identified using intradermal allergy testing (IDAT) and/or serum allergy testing (SAT) and then formulated into either a subcutaneous injection or a sublingual drop. The IDAT is an indirect measurement of cutaneous mast cell reactivity due to the presence of allergen-specific IgE bound to their surface, while the SAT measures the levels of circulating allergen-specific IgE in the patient's serum. It should be noted that neither of these tests are "screening" tests and should only be performed once a clinical diagnosis of canine AD has been made. It is also important to consider that there is no literature to support that either IDAT or SAT can reliably identify dietary allergens that may lead to a flare of canine AD. It is for this reason that food allergy testing is discouraged and the veterinary clinician should rather focus efforts to educate the client on the need for an elimination diet trial. Lastly, when evaluating results from SAT, the veterinary clinician should keep in mind that this form of testing only measures circulating allergen-specific IgE. This does not take into account other allergic pathways and often shows positive reactions in non-allergic dogs. In the author's opinion, the combination of both the IDAT and SAT should be taken into account when formulating ASIT for a patient with canine AD.

Once offending allergens have been identified, the patient can initiate ASIT. Here, the patient is administered gradually increasing concentrations of an allergen extract to ameliorate the clinical signs associated with subsequent exposure. This form of therapy can be used to reduce the activity of mast cells and eosinophils while, with time, shifting the pro-inflammatory response to a T helper 1 cell response, which is anti-inflammatory. There is also good evidence that ASIT helps to encourage a healthy T regulatory cell population and production of regulatory cytokines. There are two forms of immunotherapy currently available for the canine patient. The first is a subcutaneous injection administered on a regular basis and the second is a sublingual drop placed under the tongue. An important consideration is that there is a tremendous lack in a standardized protocol for the administration of ASIT. This includes the amount and frequency of administration. Response rates vary, but most of the literature places them between 50-80% of patients showing improvement within the first year of therapy using ASIT alone. In the author's opinion, this rate is much higher when ASIT is used a part of the proactive, multimodal approach. The pet owner should be counseled on the use of ASIT as part of a comprehensive treatment plan. Points should be made to include its proven track record and safety from severe reactions (e.g., anaphylaxis). When used appropriately, ASIT can be one of the most cost-effective treatment options for canine AD. As it may take some time for this form of therapy to become effective, the utilization of an alternate anti-inflammatory protocol should be used in the initial stages. Lastly, ASIT should be given for at least 12 months to determine if it will be effective and administration may be tapered at that point.

IV. Anti-inflammatory therapy

Aside from ASIT, there are other anti-inflammatory therapies that can be utilized to prevent flares of canine AD, most of which have good supporting evidence in the

literature. The two recommended forms are proactive topical glucocorticoid therapy and injectable biologicals. When looking at proactive topical glucocorticoid therapy, the veterinary clinician should first determine if both the client and the patient would be amenable to this form of treatment. That being said, it should be encouraged due to its high efficacy in keeping lesions in remission. The areas to be treated are often those seen in cases of canine AD, such as the flexor surface of the elbow. This therapy revolves around pushing lesions into remission with daily application followed by twice weekly application of a potent, local steroid on two consecutive days. This protocol will help to keep lesions in remission by inhibiting the subclinical inflammation and preventing it from escalating. A recent European study examined this approach using a topical hydrocortisone aceponate spray (Cortavance). This spray was applied to lesional skin until remission was achieved and then twice weekly on consecutive days. The authors noted that it took almost four-times as long for those well-controlled patients to flare compared to placebo subjects. While this product is not available in the United States, the author has seen similar success with a topical triamcinolone acetate spray (Genesis) that is available. It is of utmost importance to educate the pet owner on proper application of this product emphasizing the meager time commitment leading to a significant benefit in their pet.

When considering injectable biologicals as a means of proactive therapy, the optimal time to begin this would be at the initiation of ASIT. This form of therapy should be considered once the patient is devoid of clinical signs and to aid in the prevention of flares while utilizing other means of controlling the underlying AD syndrome. If the patient is not in complete remission prior to beginning this form of therapy, then a short course of systemic glucocorticoid therapy should be used to initiate remission. One recent publication assessed a small number of dogs being proactively treated with lokivetmab prior to allergen challenge. These subjects showed almost no evidence of pruritus following allergen challenge, although clinical lesions persisted in these dogs. In the same study, 21 dogs with spontaneous canine AD were given an injection of lokivetmab every 4 to 8 weeks to assess the ability of this treatment as monotherapy to keep flares controlled. The median time-to-flare in this population was 63 days. The more frequent need for this therapy should be relayed to owners as roughly 75% of dogs included in this study had flares at the recommended administration. It is the author's opinion that administration of injectable biologicals should be reserved for the initial phases of a long-term control plan (e.g. ASIT) or when patients have predictable times of the year when they do flare.

V. Topical therapy

While the complete pathogenesis of AD in both dogs and humans has yet to be realized, it is known that there are multiple factors that play important roles in this syndrome's onset and perpetuation. One of the most studied aspects of this condition is the skin barrier defect. It is relatively well proven that aberrations in the cutaneous barrier allow for environmental and microbial allergens to interact with the epidermal immune cells. This interaction often leads to a cascade effect that ends in the production of pro-inflammatory cytokines. As this is a significant area of concern when managing the AD syndrome, one could imagine that improving this facet may lead to improvement in the general condition. In fact, there are a multitude of products on the veterinary market today that aim to restore the skin barrier's integrity.

It is recommended that the patient with canine AD be bathed once weekly in a mild nonirritating shampoo using lukewarm water. This process is soothing to the patient, while at the same time it helps to remove excess environmental allergens and pro-inflammatory mediators from the surface of the skin. Many of the available products also contain moisturizing factors that benefit the damaged, dry skin. If a patient is prone to microbial overgrowth, a shampoo with antimicrobial properties should be utilized. A moisturizing conditioner may also be used following a bath if warranted. A more recent addition to topical therapy is the mousse product. These applications are easy to apply and can be focused on areas that are affected. These are typically easier to apply to areas of glabrous skin, such as the inguinal or axillary regions. They should be used between baths and can be applied multiple times each week for best results. Another type of application that is gaining merit is the application of topical essential fatty acid-containing (EFA) formulations. This is related to their ease of use and recent evidence supporting that they may help to normalize existing stratum corneum lipid barrier defects. In fact, a more recent small trial showed that application of an omega-6 EFA and essential oil-containing topical formulation (Dermoscent Essential 6 spot-on) had a modest effect on reducing clinical signs of AD in affected dogs. While these products are generally very safe for the affected patient, the veterinary clinician should keep in mind that topical therapy aimed at improving skin and coat quality is often insufficient as monotherapy at controlling patients with canine AD and that these applications are best used as part of a comprehensive treatment plan.

Conclusion

There is still much that is unknown about the pathogenesis of canine AD and it remains the center of a considerable amount of research. That being said, there are a multitude of studies that evaluate single treatment modalities and their success rates in managing this condition. In many cases, these individual modalities should be combined for a proven benefit. It is imperative that the veterinary clinician remember to develop a treatment plan for the individual patient that centers on the prevention of flares. No plan is perfect and flares of the AD syndrome should be expected. The pet owner should be counseled on the expected progression of the AD syndrome and the means on which to control it without panic. It is important that the treatment not be made worse than the disease itself. The goal of the proactive, comprehensive treatment plan is to improve the quality of life for the canine patient and improve the human-animal bond. In summary, the veterinary clinician should remember to evaluate and then discuss with the pet owners the benefit of each recommended intervention, its side effects, its ease of administration, and its cost as a single or combined modality.

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7.1.5. Cutaneous adverse food reaction doesn't mean a life of bland, unbalanced diets

Michael A. Rossi, DVM, MNS, Dip. ACVD

Coastal Veterinary Dermatology & Ear Clinic

11320 Space Center Blvd, Houston, TX 77059

The human-animal bond is the treasured connection between a pet and the pet owner. There are several factors that contribute to the quality of this bond in regards to companion animals. One of the most important aspects of this integral connection is the quality and type of nutrition in the pet's diet. It is often said that if one is concerned about the well-being of the family dog, then one should look no further than what is in his or her stomach. Dietary nutrition plays several crucial roles in the development of young dogs and the maintenance of health throughout life. There are several disease processes that have been associated with poor nutrition. For example, feeding methods, feed consumption, specific nutrients, and electrolyte balances within the diet have all been shown to influence hip dysplasia in dogs. Therefore, it should be noted that diseased dogs may have different nutritional requirements from generally healthy dogs and specific diets should be fed.

The pet owner can sometimes become overwhelmed with the selection of dietary options available for their beloved pets. Thankfully, dogs display considerable dietary flexibility to accommodate this fact. There are roughly 400 distinct dog breeds recognized worldwide. These different breeds represent a large variation in body size and weight. Dogs have the ability to consume and utilize energy from both animal-based products and a variety of edible plant-based foods. Within the various breeds, the behavior of an individual is controlled by numerous factors. Diet should be considered an important contributor to the social interactions and mental wellbeing of both humans and dogs. Studies have shown that diets rich in vitamins and minerals may decrease anti-social behavior in animals. When fed a diet containing poorly balanced nutrition, dogs can develop similar cognitive deficits and neuropathology as seen in aging humans and elderly suffering from dementia. Research studies focused on this topic have shown that dog food enriched with antioxidants decreased the rate of cognitive decline in aged beagle dogs.

Proper nutrition also plays a pivotal role in canine hypersensitivity disorders. These conditions, specifically atopic dermatitis (AD), can be frustrating to manage for both the pet owner and for the veterinary clinician. It affects roughly 10% of the canine population making it a common underlying condition. Atopic dermatitis in the canine patient is often due to environmental allergens, but can be a manifestation of cutaneous adverse food reaction (CAFR). This means that a patient presenting with AD due to a dietary allergy can appear clinically identical to one with AD due to aeroallergens. It is up to the veterinary clinician to differentiate between the two by means of history and exclusion. There have been several recent studies examining different aspects of CAFR and its importance as an underlying condition. Once diagnosed, management of this condition with commercially available diets and treats may be a welcomed realization for millions of pet owners and pets alike.

In general, CAFR can manifest at any age. AD will typically begin between the ages of 6 months and 3 years. Dogs diagnosed with food-induced AD tended to be younger (< 1 year) or older (> 6 years) than those with aeroallergen-induced AD. As mentioned previously, canine AD has been shown to have a genetic basis. This has also led to the realization that several breeds are at an increased risk. Predisposed breeds include West Highland white terriers, Labrador retrievers, golden retrievers, boxers, French bulldogs, German shepherds, and cocker spaniel dogs. There does not appear to be an overwhelming sex predilection for canine AD with the exception of male golden retrievers and female boxers being slightly overrepresented.

The most common clinical sign seen with canine CAFR is pruritus with greater than 90% of affected dogs experiencing this. In some cases, owners may report this as being an intense pruritus that may or may not respond to anti-inflammatory doses of glucocorticoids. The veterinary clinician should keep in mind that pruritus can manifest in several ways in the canine patient, including excessive grooming, licking, rubbing, and head shaking. Many patients will experience a generalized pruritus, but specific areas, such as the paws, ventrum, or ears may be focal points of discomfort.

The distribution of lesions associated with the canine AD syndrome characteristically affects specific body areas, such as the flexor aspect of the elbow, the interdigital region, the axillary region, the inguinal region, and the face. In the early stages of this condition, primary lesions (e.g. erythema, papules) are predominantly found over these areas. As the syndrome becomes chronic, secondary lesions (e.g. excoriations, lichenification, alopecia) are noted with the same distribution. The owner may note that the clinical signs can be seasonal or non-seasonal depending on the offending allergen levels in the environment.

There is still much that is unknown about the pathogenesis of CAFR and it remains the center of a considerable amount of research. It is imperative that the veterinary clinician remember to develop a treatment plan for the individual patient that centers on the prevention of flares. No plan is perfect and flares of the CAFR should be anticipated. The pet owner should be counseled on the expected flares and the means on which to control them without panic. The goal in managing CAFR is to improve the quality of life for the canine patient and improve the human-animal bond.

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Renato C. Costa, DVM, MSc

8.1.1. CLIENTS WANTS MUCH MORE FROM YOU THAN YOR TECHNICAL SKILLS

Renato C. Costa, DVM, MSc

Pet Care Animália, Rio de Janeiro, Brazil

During their time at the university veterinarians are very well trained to treat sick animals. This is essential for a good technical performance but there are other challenges in the professional's routine to be successful. Veterinarians' clients are humans, not animals. These clients, currently called tutors, do not just want their animals to be cured. They are looking for competent professionals, of course, but also for those who can offer much more than that. Punctuality, understanding, availability, good communication, affection are some of the skills desired by clients. These abilities are not taught in universities. The modern veterinarian needs to be aware of this to offer a complete veterinary service to his clients.

8.1.2. HOW TO DEAL WITH DISSATISFIED CUSTOMERS

Renato C. Costa, DVM, MSc

Pet Care Animália, Rio de Janeiro, Brazil

Veterinarians typically choose their profession because they love animals. Over the years, they learn to deal with aggressive animals, emergency situations and even the pain of their patients' death. None of this scares a good professional because he understands that this is his job, his mission. What usually terrifies a veterinarian is having to deal with those who bring animals to their clinics and hospitals. Humans! Situation gets even worse when customers, humans, are dissatisfied with something. Veterinarians are not trained to handle these moments. There are basic rules that can help a lot to guide these conflicts in search of a good understanding. By following them, with a little training, veterinarians no longer need to be afraid of people.

8.1.3. TAILORED SERVICE: THE KEY FOR YOUR CLIENTS' HEARTS

Renato C. Costa, DVM, MSc

Pet Care Animália, Rio de Janeiro, Brazil

The mission of veterinarians is to promote animal health but their clients are tutors and not pets. Pets are their patients and veterinarians must be technically competent to save their lives whenever possible. Clients are the human beings who have the power to choose which would be the best professional to treat their beloved pets. As laypeople, clients typically do not have the ability to measure the technical skills of a professional. There is nothing wrong with that. Normally clients are not experts in veterinary medicine and therefore tend to evaluate veterinarians based on subjective emotional perceptions. A successful professional must be aware not only of the animal's treatment but also of his relationship with his clients.

Ernie Ward, DVM, CVFT

9.1.1. BEATING BURNOUT: RESTORATIVE REST AND HEALTHY HABITS FOR LONG-TERM SUCCESS AND SATISFACTION IN VETERINARY PRACTICE

Ernie Ward, DVM, CVFT

E3 Management, LLC

Ocean Isle, North Carolina USA

The happiest people are those following their hearts. Take time to discover your inner motivations and mission and apply them to your work. Use your principles to guide you and your team to be the best you can be for your patients and clients. You'll unlock incredible energy and excitement and maybe lead a revolution.

In an online study of 1,915 employees, 87 percent said they felt overworked, but more than 1/3 of them didn't feel overloaded. What do these numbers really mean?

According to the study, 42 percent felt they kept a good work life balance, 11.5 felt overworked rather often and the remainder felt overworked from time to time. 50.8 percent of team members felt absolutely satisfied with their work life balance, and the research showed that satisfaction decreased the more invested the person was in the business. (i.e. practice owners vs team members).

(source: http://www.adviseamerica.com/19-great-work-life-balance-statistics/)

How satisfied are you with your life currently?

The answer to this essential question may hold the key to longevity in your career, quality of interpersonal relationships, and overall life satisfaction. Not to mention how long – and how well – you'll live. You only have one life. Live the best life you can.

Make a Life Chart

One of the easiest, and most meaningful, exercises you can do to begin your journey to your best life is to write it down. Begin by making a 1) current and 2) ideal Life Pie Chart. How much time do you want to give to the things that are important to you, and how much time do they currently get? Creating visuals for you to put your time priorities into

perspective can be helpful in identifying areas that are taking up too much of your time or energy, or areas that you need to give more time and energy.

Regularly self-check the areas of your life. Are you getting closer to your ideal distribution of time, or further away from living your best life? A wise person once said, “The secret to happiness and meaning in life is doing more of what you love and less of what you don’t.” How much time are you engaged in doing what you love? Loving your work doesn’t mean it’s easy or without strife; it means challenging tasks are fulfilling and overcoming obstacles are meaningful.

What areas in your work or personal life need improvement and what areas are you excelling? Think about the steps you took to create each movement toward balance and recreate it in the areas of your life where you still want to see more time or balance created. Are you using your time to the fullest in each of the areas? Seconds add up to minutes which lead to years and decades. Use each precious moment wisely.

Making a Balance-Action Plan

When the time comes to finally create work life balance in your life, making a Balance-Action Plan can be a great first step. This is a plan to decide where you need to focus your time and energy to improve your self-satisfaction in your balance. Start by creating a vision.

- Visualize life how you would like it to be. Write down what life would be like if it was “perfect.” Don’t focus on the “how” so much as the what. Now write down how you see life now, and then focus on the contrasts. Look for areas you can make small daily improvements or steps toward the “perfect” image you created. Life is a journey, so creating an action plan with daily improvements on life can never be a bad thing!
- Examine what is important to you. We only have one life, so what are the most important things to be in your life for you to be happy? Achievement, recognition, adventure, fun. Write down the words associated with the things that truly make you happy. Use these words to guide your areas to focus one.
- Think about the reasons you want to have a more balanced life. The benefits that will come with following through with your commitments. Focusing on the “why” can help prevent you from creating an internal dialogue of the reasons you think of reel that you can’t or won’t achieve balance. Focusing on the benefits to come and the positive can help to keep you motivated.
- Practice presence in your activities. Be 100-percent involved in all that you do. This will create quality, even when quantity is not what you want it to be. Checking emails during dinner may seem like multitasking, but the lack of presence in the time and interaction with your family may not be worth it in the long run.

- Find your “space”. Where can you have physical or mental space that allows you daily quiet, peace, and reflection. Focus daily on your balance, your goals and reasons for balance as well as what this commitment means to you.

Be prepared for obstacles.

Be ready for the things that might get in your way, temporarily, or permanently. Work, family obligations, volunteer projects, holidays. Plan for how you will work into these times balance, have a plan for a “comeback” when life gets unbalanced. When you come prepared, overcoming these times will be easier and less overwhelming.

Know your limits.

Recognize each of us has limits to what we can accomplish, our time, and desires. Don’t be afraid to set boundaries for self-care and development, and stick to them. Don’t be afraid to be “selfish” with your time and make your needs a priority.

Set up support.

Identify those around you who can help you and encourage you to meet your balance goals. Life coaches, partners and friends can help if you let them!

Some of My Best Life Hacks

Along the way, I have picked up tips and tricks for creating balance in life. So, just a few from me to you:

▪ Change clothes immediately upon arriving home from work. This creates the mental image of leaving the day behind and changing your mindset.

▪ Schedule your down time. Literally. On your calendar. Use technology such as online calendars, Siri, Alexa, and Google Assistant, and others to take notes, create reminder lists, schedule to-do dates, and reserve down time to charge for your self-care time.

▪ Do three enjoyable things for yourself every day. They don’t have to be big things. They will help you to recognize the joy in your everyday life, practice presence in the moment by bringing awareness, and bring positivity to your everyday thinking. Try it, it works!!

▪ Work smarter not harder. There are apps, widgets, gadgets, and heck even full-blown robots that get us through our daily lives (I love my two robotic vacuums!). Utilize the technology available to reduce work times and hours.

▪ Enjoy your days off. Plan small, fun outings or events for the weekend. Try to break up house chores and errands during the week so that you don't have to spend your whole weekend catching up on housework, homework, or laundry. We know these things will always exist in life, we need to figure out how to be more efficient and redistribute tasks to create the balance we are seeking.

▪ Ask for help. Seriously. Right now.

Important Things to Remember

▪ While it is easy for me to offer this advice, it really is how we create balance. It is also important to keep in mind that balance is managing and anticipating imbalance. Life is going to happen, and we have to be ready to work with it, not against it. Things will not always be perfect. This is life.

▪ Remember to check in with yourself every now and again. Make sure that you are still working on the right priorities, acknowledge the advancements and achievements you make, and acknowledge areas to improve without self judgment.

"Balance is not something you find, it's something you create." ~ Jana Kingsford

9.1.2. THE HOTTEST GLOBAL PET CARE TRENDS AND ISSUES EVERY VETERINARY PROFESSIONAL NEEDS TO KNOW IN 2022

Ernie Ward, DVM, CVFT

E3 Management, LLC

Ocean Isle Beach, North Carolina

USA

What are some of the hot veterinary topics and pet trends pet owners will be talking about in 2022?

1. Impact of corporatization and consolidation on veterinary practices.

In the US, it's estimated that about 25% of all practices are now owned by a corporate consolidator, accounting for approximately 50% of all client visits (December 2021, Brakke Consulting).

In December 2021, the current corporate veterinary ownership was:

2,500 - Mars (Banfield, VCA, Blue Pearl, etc.) (US)

2,000 - IVC Evidensia (UK)

1,200 - National Veterinary Associates (NVA) (US)

500 - CVS (UK)

450 - Vets4Pets (UK)

400 - Thrive Pet Healthcare (US)

350 - Medivet (UK)

300 - Southern Veterinary Partners (SVP) (US)

In human medicine, according to the Modern Healthcare 2018 Report, 47% of physicians in 2016 had an ownership stake in a medical practice, down from 53% in 2012. Hospital acquisition of physician practices have shown to increase prices and funnel more care through hospitals.

Potential Benefits of Veterinary Consolidation / Corporatization

- Exit strategy for retiring veterinarians

- Better data collection and analysis
- Technological advancements at scale
- Upward mobility of veterinary professionals
- Increased pay and benefits for veterinary professionals
- Potential to standardize and improve patient standards of care and client service
- Increased accessibility to veterinary care
- Political and organizational influence

Potential Risks of Veterinary Consolidation / Corporatization

- Competition for veterinary support staff
- "The decline of independent medical practice and lack of physician-owned hospitals have negative implications for continuity of patient care, quality and innovation and cost." Modern Healthcare Report 2018
- Long-term price increases? Decreases?
- Loss of autonomy and independent treatment decisions?
- Referral pressure and increased reliance on specialty-care?
- Decreased pharmaceutical and therapeutic innovation and diversification?
- Political and organizational influence?

What about the cost of veterinary care? Will consolidation improve access and reduce costs to pet owners? According to the Access to Veterinary Care Coalition December 2018 report:

- 29 million dogs and cats live in households that relay on SNAP
- Average 2.2 pets per household
- Households with lower income more likely to have only one pet
- 80% of lower income families viewed the pet a "family member"
- 75% of Americans working full-time "lived paycheck-to-paycheck"
- 58% households either have less than $1,000 in their account or no savings account at all – slightly up from the 57% in 2017. 32% have no savings at all. (December 2018 survey from GOBankingRates)
- Pet owners in higher income classes said finances are the reason they don't pursue certain types of veterinary care (i.e. specialty)

- 23% of pet owners reported they had trouble obtaining preventative care in the past
- 80% cite finances as a barrier to preventative care
- 44% who couldn't afford "preventative care" had trouble affording "sick care"
- 74% of all respondents reported not being able to afford "sick care" (no difference between middle class and lower income participants)
- 59% in the highest income bracket did not pursue "sick care" due to finances
- 56% of pet owners stated they could not afford "emergency care" for their pets

2. Humanization of pets and opportunities for better veterinary client communications.

Pet Humanization & Millennials

- Approximately 23 million US households added a pet between March 2020 and May 2021
- Millennials (born between 1981 and 1994) are the generation most likely to own pets, accounting for 32% of all pet owners
- Born 1981-1996
- 73% of Millennials own pets
- 89% of home-owning Millennials also own pets
- 35% of all pet owners are Millennials
- 32% of pet owners are Generation X, born between 1965 and 1981
- 27% of pet owners are Baby Boomers, born between 1946 and 1964
- Just 6% of pet owners are in the Silent Generation

- Tech-Dependent
- Rely heavily on Vet Guidance for Pet Product Purchases - For NOW
- Trust in Brand Integrity & Smaller Pet Product Companies
- Internet Reviews & Purchases
- Millennials Delaying Having Children
- 60% of US pet owners are Female
- 67% U.S. Dog Owners: 1 Dog
- 43% U.S. Cat Owners: Multiple Cats

- Birthday Parties, Pet Sitters/Walkers, Treats, Travel, Toys, Clothes
- Demand for Specialty Care

Humanization Opportunities - Senior pets (Packaged Facts U.S. Pet Market Outlook, 2021):

- 55% of dog families and have 53% of cat families have pets over age 7
- Older pets need age-related care and products, including for the diagnosis and management of these conditions:
- Joint/mobility problems
- Cardiac issues
- Cognitive problems
- Immune system issues
- Diabetes
- Cancer

Adherence to recommendations and treatments is key to successful outcomes with aging pets.

- Soft chews
- Flavored medications and supplements
- Powders, pastes
- Extended duration, less-frequent administration
- Multi-functional treats, foods, medications

Humanization Opportunities – Smaller dogs (Packaged Facts Pet Industry Outlook: Veterinary Services and Pet Product Retailing, 2021.):

Percentage of U.S. households reporting to own:

- 11.3% have toy/very small dogs (less than 10 pounds / less than 5 kg)
- 17.4% percent of U.S. households have small dogs (11-20 pounds / 5-10 kg)
- 24.5% have medium dogs (21-60 pounds / 10-28 kg)
- 17% have large dogs (61+ pounds / 28+ kg)

“Everywhere Pets”

- Social training
- Breed-specific care protocols
- Individualized care
- Pet owner concerns about size difference:
- Vaccines, medications, food, nutraceuticals, treats, boarding
- Surgery, anesthesia, dentistry and oral care
- Exercise and physical activities
- Toys and accessories
- Subscriptions, on-demand, in–home
- Less about brand, more about quality and ingredients
- Pet food, massages, physical therapy, alternative therapies (acupuncture, class 4 laser, supplements, etc.)
- Differentiated services for brick and mortar
- Website reviews impact decisions

3. Telemedicine and telehealth developments in veterinary practice.

Telemedicine and telehealth continue to be hot button topics for the veterinary profession around the world. This is largely due to:

- Public Demand
- Technological Progress
- Regulatory Challenges
- Public Safety
- Professional Liability

4. Social media changes and opportunities for veterinary practice marketing.

The continued popularity and progress of social media platforms pose both opportunities and challenges for veterinary practices. Email, text messages, and social media platforms present considerable growth opportunities. Most veterinary practices should begin by critically assessing their website functionality for demand capture. SEO, location, hours, and other basic business data should be routinely monitored and updated. Regular content posting in the form of blog posts, videos, and images should be a priority followed by social media outreach. Google, Yelp, and Bing continue to dominate the US search market and are the primary drivers of business growth. Practice and veterinarian online reviews, particularly Google and Yelp in the US, are the single

biggest factor in attracting and capturing new clients. Most practices should hire an SEO firm and have them:

- Optimize your site's keywords
- Optimize your listings on all key search engines, including Yelp and Facebook
- Implement an automated customer review prompt

- Email communication:
  - REMINDERS! We're still far from optimizing our current client base.
  - POSTCARDS are alive and well.
  - EMAILS continue to serve as both the primary mode of connection as well as a backstop to text messages.
  - Our client admission forms ask in what order they prefer to be contacted: Phone, Email, or Text?

5. Veterinary student debt, worker shortages, and solutions for lean processes within veterinary clinics.

9.1.3. BRINGING PET FOOD AND NUTRITION BACK INTO YOUR CLINIC: WHY YOU SHOULD DISCUSS PET FOOD IN (NEARLY) EVERY EXAM!

Ernie Ward, DVM, CVFT

E3 Management, LLC

Ocean Isle, North Carolina USA

Consistency creates credibility. Those three words pack a powerful punch that can propel your success in pet nutrition and beyond.

When something is logical and dependable, it becomes more believable and trustworthy. In other words, repeatedly showing up and delivering what you promise builds staff and client loyalty. I forged a large part of my veterinary practice philosophy around this principle. For over twenty years, I've encouraged colleagues to follow this simple tenet to elevate their clinical practice. I've applied it to staff training, education, patient care, client services, personal habits, and more.

When applied to pet nutrition, having a consistent message allows your team and clients to clearly understand your feeding philosophy and promotes compliance. Without uniform pet food principles, your staff and clients are left to hack together impulsive suggestions that may differ from visit to visit, if they happen at all. That certainly doesn't create credibility or trust. It also doesn't help enhance the quality of life for the pets we serve.

Clinical consistency is constructed by developing a pet food philosophy, gaining consensus, training your team to assess patients and educate clients, and motivating staff to pursue advanced knowledge and expertise.

Step #1: Developing your Feeding Philosophy

Developing a pet food philosophy can be as simple or complicated as you like, but it's something you need to do. Promoting a healthy diet is essential for our profession's continued success and domain authority, and I believe being proactive in recommending pet food is an opportunity to remain relevant in a variety of pet care sectors. Unfortunately, few practices give their feeding philosophy much thought and fail to succeed in pet nutrition, leaving them vulnerable to losing a variety of opportunities to online retailers.

As pet parents seek help choosing pet food, they inevitably find answers online. When veterinarians ignore pet food and impart little guidance, any information is more than

their vet provided. Regardless of the veracity of internet information, these searches can lead to habits that are hard to break.

Online retailers understand this, and once they secure the first pet food order, it's incredibly easy to add monthly flea and tick preventives, supplements, supplies, and prescription medications. As I've warned over the past 15 years, pet food is the gateway to all pet product sales. If you're wondering where your pharmacy sales have gone, "chew on" the "amazing" sites that sell pet food.

Veterinarians need to develop a feeding philosophy that transcends brands. For the past 50 years, most vets settled on supporting two or three major brands and called it gospel. Today there are hundreds of brands and scores producing excellent foods. Modern pet parents want more than just a brand recommendation (although they need that, too) and demand the principles behind our suggestions.

For example, let's say you believe higher protein kibble is the best way to feed your patients. Instead of leading with a brand recommendation ("You should feed Gracie Brand X."), explain to pet parents your position and let the brand follow organically. "For my patients and personal pets, I've found a higher-protein, lower-calorie formulation to provide the most health benefits, especially in promoting lean muscle mass. I also prefer a dry kibble because of its convenience, reasonable cost, and my two dogs love it. For Gracie, I believe the best diet for her age, breed, and condition would be Brand X. What do you think?" You'll come across less "sales-y" and more "doctor-y" by framing your advice in science and evidence. Whatever feeding philosophy you choose, just choose one and promote it to your team and clients.

Step #2: Gaining Consensus

The most successful and happy practice teams share a few common traits. The first is they share the same vision and mission. When it comes to pet nutrition, they agree that certain foundational principles are preferred. Some teams may prefer higher protein and fiber formulations of dry kibble, others prefer lower protein canned diets, and some may support fresh or home-prepared meals. The specifics matter, but the common denominator is the commitment to educate clients about their unified feeding philosophy. It's one thing to have consensus, but the attribute that tips these teams toward greatness is acting on their shared standards. Veterinary teams should be committed to educating every pet parent about the best diet for their dog or cat during nearly every visit.

Another trait of successful teams is civility and desire to collaborate. Consensus is earned not by defeating an adversary's idea, but by merging competing concepts into a blend of the best. This process needs to be respectful, thoughtful, and guided by the leadership. It is up to the practice owners and leaders to determine the ultimate protocol or policy and shepherd it into acceptance. When teams lack clarity in purpose and

consensus in policies, poor or undefined leadership is often to blame. That forces pet parents to ask the internet what to feed their pet.

Not everyone is expected to agree with everything all of the time; however, team members are expected to promote clinic policies consistently. If you have an employee unwilling to collaborate or support your consensus views and their ideas fail to change them, then you have to ask if this person is a good fit with your mission and vision.

Willingness to change and iterate is another characteristic of collaborative and unified teams. Consensus is an infinitely dynamic process, always open to exploring progress and improvement. This is especially pertinent to pet nutrition. I appreciate colleagues who offer opposing opinions and are willing to courteously discuss differences. If their ideas improve a policy or procedure, that's progress. If they fail to shift our position, they must be willing to support team solidarity.

Passion is the final feature of unified workplaces. Once consensus is gained, the team enthusiastically shares the concept or policy. In fact, if your team isn't excited to share something as important to pet health as diet, then you probably aren't unified on it. Passion is key, because lukewarm recommendations fail to inspire staff or clients. Your team wants leaders to "be on fire" with fervor for their beliefs. Pet parents want your team to "really feel it" if you're advising them to follow along, especially with pet food. Enthusiasm generally signals authenticity, authenticity emanates from consistency, and the flywheel of trust keeps spinning.

If you're struggling to gain consensus, try this exercise. Begin by writing down your desired policy, procedure, or vision. Writing forces you to critically evaluate your idea, and helps refine the message. Next, ask a couple of trusted colleagues to review it. After revision, take it to your team. Give them a few days to process the information. Ask for feedback to accommodate those more comfortable writing than speaking publicly.

Hold a team meeting and begin by inviting any opening thoughts, then be quiet. Be careful not to jump in too soon, potentially limiting an open discussion. If your team isn't giving you much insight, ask them to rate the idea on a scale of 1 to 10. Few will give it a "10," so when they say "8," ask what it would take to get it to "10." Be supportive of all suggestions, but don't hesitate to politely point out differences. Send out a final version for approval and consider another brief meeting before moving to training.

Step #3: Staff Training

Once you've established your clinic's pet food philosophy and earned consensus, it's time to train. Begin by organizing the evidence behind your choices. Staff members need to understand the science behind your recommendations, so teach them the details.

Next, script out common client questions and scenarios. You're building a toolkit that will guide conversations and address major concerns. Don't hesitate to incorporate resources from brands or companies that support your feeding philosophy. After all, you need to give clients specific brands that align with your beliefs. I encourage you to personalize these materials so the messages reflect your practice personality and don't come off as "company-speak." Be sure to enlist eager employees to help you craft these staff training tools to encourage ownership of the program.

Next, teach your team to use the body condition score (BCS) during each visit. Using visual charts can help pet parents understand that obesity is more than a number on a scale. Body fat assessment and muscle condition score (MCS) are also useful in convincing clients a diet change is needed. Offer to provide copies or email BCS or food information. Many pet parents will want to fact check your info, so be proactive and steer them toward reputable online resources. While you're at it, remind them you offer online food sales and home delivery. If you don't, now is perhaps the last-most-excellent time to begin.

Train your staff to quickly calculate basic daily caloric recommendations (see sidebar). Computing calories not only aids clients in more precise feeding, but also demonstrates your team's expertise and experience in nutrition, inspiring trust.

Staff training is arguably the most time-consuming - and important - step in pet nutrition success. It takes effort to produce instructional resources and drive to teach staff the knowledge and communication skills needed to succeed. It also requires persistence and grit, because any change is accompanied by challenge. Stick with it. This process applies to nearly every aspect of practice, so as you hone your skills in one area, everything else lifts. In no time you'll have a proven template you can apply to any new product or service.

Follow these three steps and you'll discover that as your recommendations become consistent, creating credibility and trust, your compliance increases. Pet nutrition is too important to our pet patient's health for veterinary professionals to ignore. Pet parents depend on us to help them provide long, healthy, happy lives for the dogs and cats they love, and that often begins at the food bowl. We won't let them down.

Calculating Resting Energy Requirements (RER):

Calculating a pet's estimated daily caloric needs isn't hard. There are two formulas commonly used, and one doesn't require any fancy math. I'll let you in on a secret: You'll

quickly memorize the common sizes you see and won't have to fire up the calculator much of the time! You may then reduce these Resting Energy Requirements (RER) daily caloric estimates by 70% to 90%, depending on the pet's needs. You can also visit www.PetObesityPrevention.org for detailed lists of caloric requirements.

Caloric Calculation #1: This simplified formula works great on most pets except very small (less than 5 lbs) and large dogs (over 60 lbs) when it may overestimate calories.

Resting Energy Requirements (RER) in kcal/day: 30 x (ideal body weight in kilograms) + 70

Caloric Calculation #2: The more precise "exponential" calculation. Works great in all sizes, shapes, and breeds.

RER in kcal/day = (ideal weight in kg ^ 0.75) x 70

or (ideal weight in kg) to the ¾ power) x 70

9.1.4. THE NEUROSCIENCE OF VETERINARY CLIENT SERVICE: HOW OUR SUBCONSCIOUS DETERMINES OUR PRACTICE SUCCESS

Ernie Ward, DVM, CVFT

E3 Management, LLC

Ocean Isle, North Carolina USA

"What do you mean 'the neuroscience of customer service'? My job is to treat sick animals, perform surgery, and prevent disease, not worry about 'the customer experience.' My clients are more interested in my medical expertise than in my business skills."

These words were being hurled at me from an agitated veterinarian after a recent lecture. This wasn't the first time I'd encountered criticism from my colleagues. The tension between "medicine" and "business" is real for many veterinarians. I never understood the friction between therapeutic and financial success; I only knew my strong desire to serve my patients, clients, and healthcare team. When I began sharing my professional experiences in the 1990s, many were baffled by my weekly staff training sessions and extensive use of veterinary nurses to increase and optimize client and patient contact time. In 1998 I wrote a book and video called "Creating the Veterinary Experience" that emphasized client service, earning me the reputation as a "business vet." It was meant as an insult, but by then I understood that "client service" and "marketing" would always be controversial. Around 1999 I puzzled the profession by opposing production-based pay for veterinarians as a potential threat to patient care, fair charges, and, you guessed it, client service. I argued that if pet owners knew their veterinarian was being paid a percentage of what they charged the client, they might get upset or at least have their trust shaken. By 2000, many objected to my mandatory pre-anesthesia diagnostics, long-term medication monitoring protocols, and call for extended-duration vaccination strategies. Opponents argued these changes created additional cost and time burdens and that clients would discontinue returning for annual visits, but pet owners appreciated the honest discussion about the preventive care that was best for their pet, not a generic protocol applied to all pets. By 2010 my work in pet nutrition and obesity had earned me adversaries from veterinarians abandoning pet food sales, makers of therapeutic diets clinging to outdated approaches, and a swelling army of raw meat devotees, yet I persevered in the name of patient care and client service. Suffice to say I was prepared, and perhaps a bit bored, by this current "customer service" mugging.

Today's pet owners, especially technologically savvy and instant-access Millennials, demand more than medical and surgical expertise from their veterinarian. They expect high levels of personal attention, frictionless appointment experiences, and extensive information and education. I can distill my customer service philosophy to three core elements: physical environment, emotional connection, and intellectual satisfaction. While those concepts are perfect for a self-help book, let's break it down into your clinic, your staff, and your communication interfaces. And neuroscience.

Customer service and parking lot neuroscience

A trusted friend once referred me to an attorney for help with a traffic ticket. As I pulled up to the derelict-looking office building, parking lot buckled and errant weeds escaping their asphalt oppression, I couldn't help but wonder what kind of lawyer would work there. The office was neat and tidy, but echoes of 1978 filled the reception area. The attorney was direct, economical with his words, and spared the pleasantries and small talk. The attorney performed his duty competently and respectfully, I paid a lower fine, and I never spoke of him again. It's that last bit that should worry you. While this attorney certainly accomplished my desired outcome for a fair fee, the experience wasn't referral-worthy. The reason is basic neuroscience.

Neuroscience teaches us that the parking lot is usually the first "physical priming element" your clients encounter. A priming element is anything that "primes" your thoughts, feelings, or opinions. In this case, the appearance of your parking lot, signage, and clinic exterior prime the pet owner toward an expectation. A well-kept, well-lit, and clearly marked parking area tilts the person favorably, while a neglected exterior tilts toward dissatisfaction. "Hogwash! My clients care more about my veterinary abilities than my parking lot!" This is where aspirations crash into cold neurotransmission. Humans evolved with a basic survival instinct that endures today: is it safe or dangerous? Our brains process about 400 billion data points each second, and the vast majority go directly to the limbic system's amygdala to filter out danger. We are primed to detect danger above all else. What makes it out of the amygdala is usually, "Hang on cortex, we need to verify if that's okay first." This is why neuroscientists say we're aware of six to nine negative stimuli for each positive. Regardless of what you or your customers believe they're thinking, there are protective subconscious systems that influence what they actually perceive. Negative primes are valued more than positives. Neuroscience proves it's not hogwash that your parking lot, waiting area, exam rooms, and all environmental aspects of your clinic are essential components of client service. My first rule of client service is pay attention to your physical environment.

The neurochemistry between clients and us

Have you ever met someone and felt at ease, as if you'd been friends your entire life? Maybe you encountered a stranger that gave you the creeps and later found out they were actually a creep. If so, you can thank neurochemicals and perhaps electrophysiology. Comfort and fear are a bouillabaisse of brain chemicals, pheromones, and hormones simmered in electrical pulses. While we often think of these encounters as serendipitous, and many are, there are things you can do to improve the chance to create great chemistry between you and your clients. Behavioral science teaches us that clients are motivated by things they find enjoyable. You don't need a doctorate in neurology to understand that, but too often we fail to apply this basic principle in our daily practice. Some simple examples of positive stimuli that prime the appointment for success include" 1) greeting the client immediately with direct eye contact and a smile, 2) using both the client's and pet's names, and 3) acknowledging the reason for visit. These data points inform the client's subconscious that you pose no threat, are eager to

help, and knowledgeable. The first few minutes of a client's interaction with us is guided almost exclusively by these self-preservation subconscious systems. The rational or cortical brain is largely inactive until it gets the "all clear" signal from the amygdala, anterior cingulate, and subcortical pathway.

By training your staff to follow these three steps when greeting each client, you create habits that become part of your clinic culture and personality. These physical and verbal actions also help your staff maintain a positive attitude and may help calm anxious pets. Dogs and cats are incredibly empathetic and appear able to detect a myriad of human microexpressions, chemicals, and electrical impulses associated with mood. Research also indicates that dogs mirror our emotional states, emphasizing the importance of all team members maintaining calmness and conveying compassion.

Once a client's rational brain is activated, we need to maximize our own medial prefrontal cortex. This region, roughly located in the space behind and between our eyes, is often referred to as our "social brain." This area is also key to influence. If you're trying to influence someone else, or are being influenced yourself, this is the region responsible. The prefrontal cortex synthesizes emotional information from the amygdala and limbic system into reasoning and rational decision-making. These two interlinked systems allow you to be physically startled during a horror film and not flee the theater. One of the easiest ways to optimize our social brains and more effectively communicate with clients is to focus on observing and listening. Too often veterinary professionals enter "lecture mode" in order to share a tremendous amount of information quickly. This approach is risky because if we fail to actively engage the client, we fail to engage their prefrontal cortex allowing them to make cogent decisions. It's as simple as pausing every 30 to 90 seconds and asking the client if they agree, understand, or have questions. This break also allows your limbic system to interpret the client's nonverbal communication signals, leading to the "gut feelings" veterinarians often report whenever a client is uncomfortable with a prescribed course of action.

Another simple tactic is to consciously connect the emotional and rational "brains" by inquiring about how the condition makes the pet owner or pet "feel," verbally acknowledging the human-animal bond, and involving the client in decision-making. It's essential we verbalize the most important information and ask the client to repeat or expand the ideas. Verbalizing serves to activate neurolinguistic pathways that trigger mental metaphors and can enhance comprehension and compliance. For example, when you say to a client with a dog suffering from a skin allergy, "How do you think Bosco feels when his allergies flare up?" you're typically activating mental pathways of discomfort, restlessness, helplessness, and frustration. "I think he's miserable! I can't stand to see him licking and scratching all night!" These conversations help directly link clinical decisions with the patient's quality of life. Pragmatically, these conversations also provide clinical benchmarks to use when evaluating treatment in the future. "How's Bosco feeling today? Did both of you get some sleep last night?" Recollections of clinical severity and urgency tend to evaporate over time and recalling an emotional timestamp can help reinforce successful outcomes with forgetful clients. My second rule of client service is pay attention to everyone's thoughts, feelings, and body language.

Neural networks and the internet

Up until this point, our discussion on client service has been limited to physical, in-person interactions. In today's technological world, most of the information we interact with is virtual, broadcast from tiny screens we carry or sit in front of and hosted in "the cloud." Most people report they prefer text over telephone, citing convenience and "less hassle" to type a quick text or emoticon instead of, you know, talking to someone. Young pet owners are demanding communication interfaces that utilize mobile devices and online resources instead of printed handouts and, well, telephone calls. This is forcing neuroscientists to rethink the role of neurotransmitters when staring at a display.

In the world of social media, the scroll is king. Users tirelessly flick their thumbs past an infinite parade of interesting faces, places, and things. A double-tap takes less than half-a-second and then it's on to the next amygdala acquaintance. Buried in those two sentences is both the appeal and danger of the current generation of social media: exposure to diversity and potential to educate while barely registering with the limbic system to generate a "feeling." This is why you often feel depressed, angered, or someone inferior after even a few minutes on social media. The information is flowing so quickly that only the emotional brain has time to register anything. This leads to the brain dumping dopamine, a feel-good neurotransmitter, whenever it recognizes itself in hearts, thumb up's, and favorable comments. It's also why we tend to overreact at the slightest provocation or criticism. It's primal, baby.

These social media habits are impacting all forms of virtual communication. People are becoming conditioned to quickly scan and draw near-instant conclusions, regardless of the content's complexity. In fact, the first rule of veterinary communication interfaces is simplicity. While many people believe young pet owners want more information to make their own decisions, I believe they want guided communication and collaborative decision-making. Pet owners want transparency and reject any perception of "hiding the truth" or not being in charge of their pet's care. This isn't to be confused with abandoning assistance. In fact, I think the trend toward using online reviews to aid in decisions is an obvious demonstration that most people desperately want to hear other's opinions and advice.

This means veterinarians need to do two things to improve their communication interface: 1) provide as much information as possible (or necessary) in the format the client prefers (printed, digitized, email, text, etc.), and 2) be willing to explain and engage in a meaningful manner, often in-person or on the phone. Wait, did I say communicate IRL (in real life)? In my opinion, text and email are fine for routine veterinary communications such as appointment reminders, minor medical conditions, and can improve clinic efficiency. Plus, most pet owners don't want to be bothered to talk to someone if it's not important to them. IRL is critical for major medical discussions, end-of-life and complicated treatment decisions, and issues that a client has expressed concern about. A veterinarian recently complained to me that she'd lost a long-time client after a recent dental cleaning. During the dental, she discovered three teeth that needed extraction. She texted the owner, including pictures, and the client approved. The

following week the client requested her records be transferred to a nearby clinic, citing, “I wish she’d called me before pulling those teeth.” The veterinarian thought everything was understood when the client was very uncomfortable. The veterinarian complained to me, “If it was so important to the client, why didn’t she call me?” I responded that her former client had said the same thing.

Because we’re being conditioned to hastily scroll through the massive data overload, we need to know when to slow down. This is why I continue to believe the medical profession will never be completely replaced by artificial intelligence and robotics; we need human interaction when facing difficult health choices. We’re still figuring out the how, what, and why of virtual communication interfaces. I recommend our profession continue to embrace these evolving modalities but urge thoughtful evaluation and issue restraint when warranted.

Customer service and neuroscience; you could argue this is nothing new, and you’d probably be right. I’ve always taught my staff that “tech without touch” would never help us grow or improve the lives and well-being of the pets we served. Instead, we strived to provide “high-tech with high-touch” service, and I think this strategy is more relevant today than ever before. As neuroscience continues to uncover the foundations of emotions, behaviors, and actions, we will end up drawing many of the same conclusions: how we treat people directly affects our success, both professionally and personally. Neuroscience simply validates that basic principle and enhances our interactions. Serving others is what humans do best, and by applying scientific principles to our actions, we can better serve all living beings.

9.1.5. THE NEW CLIENT ENGAGEMENT: USING REMINDERS AND SOCIAL MEDIA MEANINGFULLY

Ernie Ward, DVM, CVFT

E3 Management, LLC

Ocean Isle, NC USA

Have you ever played the telephone game? One person whispers a message to an adjacent person in a group. The communiqué is passed along until the last player reveals the message to everyone. Inevitably, and this has apparently been studied by academic types, the final version of the message varies significantly, sometimes almost unrecognizably, from the start. “Mary is wearing a green dress to the dance with Bill.” morphs into “Mary wore a green dress while dancing with Phil.” I fear veterinarians have literally been playing the telephone game with our clients. We’ve been relying on outdated and outmoded telephone conversations, faxes, and mail while the rest of the world whisks away at the speed of electrons. We pass information slowly by word-of-mouth, often creating confused conversations and mixed messages while politicians move millions with 140 characters and Millennials modify their life by memes. It’s time veterinarians get serious about winning social media for practice success. It’s time to hang up the phone and tap that app.

How Did We Get Here?

Over the past decade, it’s become increasingly apparent to me that many of my colleagues aren’t keeping up with communication technology. For most of our profession’s existence, we thrived simply by sending postcards. A pet owner received a notice in the mail it was time for her pet’s vaccinations, and, voila, she booked an appointment. No more. For starters, few check their mail and when they do, tend to toss anything suggestive of marketing. Secondly, young pet owners may not have a mailbox, at least not a physical one. Finally, who has the time to read a postcard, dial a number, talk to someone and haggle over a date and time that works with everyone’s schedule? And we wonder why visits and revenues are plunging and pet owners are increasingly skeptical and unimpressed with our services? Check your mailbox.

It’s not that veterinarians are incapable of changing or taking action; it’s more often our inability or stubbornness to take appropriate action. I gave my first “social media and text message” lecture at the 2007 North American Veterinary Conference (now VMX). I may have been the first veterinarian to advise clinics to join Facebook and monitor this new thing I thought would be important to the profession. I also touted text as the next “postcard” and urged owners to pressure software developers to implement these features in their reminder systems. I was roundly laughed at and ignored for several years. It’s okay; I’m over it.

When our profession finally began approaching social media, email and text, we were hampered by our postcard postscript. Emails weren't much more than mailers mated to a screen. Text messages became intrusions screaming "Discount day!" or "How's it going, client!" instead of brief, personal interactions. Social media became a mess for the few daring to dip into its murky waters. Without a meaningful vision, strategy, or comprehension, social media and digital communications became haranguing hinterlands to be avoided or minimally appeased. Thankfully, we're emerging from those dark days, and, although the electronic glare can be overwhelming at first, progressive clinics are seeing growth in revenue, patient care, and client satisfaction by embracing Client Communication 2.0.

Where Are Clients Listening?

The first step toward transitioning to Client Communication 2.0 is understanding where your clients are talking. This is important because a recent McKinsey Report concluded that businesses who utilize social media and electronic communication experienced 20 percent more revenue and 60 percent higher profit growth. Over half of all U.K. adults use Facebook on a regular basis with an estimated 78 percent of over 18's checking their status routinely. 20 to 29-year-olds comprise the largest group of Facebook users followed by 30 to 39's and 40 to 49's. Over 14 million Britons Tweet, 36 million watch YouTube, and 40 percent of the nearly 20 million Instagram addicts log in daily. About 15 percent of the estimated 10 million U.K. Pinterest participants eyeball their boards every day.

For most veterinary clinics, this means focusing your social media efforts on Facebook and Instagram and dabble in YouTube, Twitter, Pinterest, SnapChart, and TikTok. I suggest securing clinic profiles on all social media platforms (I'm talking to you, TikTok, Snapchat, WeChat and the like), but concentrate on connecting with your Facebook and Instagram family.

How Are Clients Listening?

Facebook, Twitter, YouTube, Instagram, texting and email each attract a unique audience and establish specific expectations. You can think of it in terms of planning to attend a concert; the musical genre and venue will largely determine how you dress and behave. Iron Maiden fans will typically look a bit different than those attending an Adele performance. It's fair to say there are general expectations and tendencies worth noting to prevent you from showing up at the Spandau Ballet reunion clad in leather and safety pins. The lesson is you need to dress your online content appropriately for the show.

Dressing Your Presence Based on Platform

A common 'dress code' mistake I see is applying the same branding, messaging, and strategy across all social media platforms. Because each platform operates in a distinctive manner, here are a few tips when creating content on the major social media outlets:

Facebook

Facebook is the modern pub crawl. People check their Facebook feed to get the latest gossip, trending news, and entertainment. Facebook is where most funny cat videos are viewed. A simple rule of thumb I follow is that about 80 percent of content should build your brand, educate, and add value to the veterinary profession and 20 percent can promote a service, product, or promotion. Creating a weekly or monthly schedule can help balance your strategy. If you post daily, consider four or five posts per week consisting of: breaking pet news, reposts of feel-good animal stories, and advances in veterinary medicine. One or two posts each week can highlight your senior pet care program, a weight loss promotion, or seasonal emphasis on flea and tick products. You can further build your brand when sharing other posts by adding, “ABC Veterinary loves research demonstrating the powerful human-animal bond! Check this out!” Show your personality and passion in your posts.

An easy way to ignite engagement and educate on Facebook is by sharing pictures. After obtaining permission, nothing sparks a smile and a conversation more than a picture or video of a cuddly puppy or a pet combating a challenging condition. “We were all hugs today with these cuties in for an intestinal parasite check and immunizations!” or “Mabel is a 15-year old kitty beating the odds. Diagnosed with kidney failure six months ago, her owners are proof that love, compassion, and commitment can make a difference. That’s the face of a fighter! If your older cat is drinking or urinating more, losing weight or acting tired, let us check them out. Way to go, Mabel!” Entertain, inspire, and educate.

Instagram

Pictures. Beautiful pictures. And videos. Shorter videos. I consider Instagram for clinics as an excellent platform to reveal ‘behind the scenes,’ ‘wow,’ and ‘gorgeous’ sides of practice. Messages that pop on other platforms can fall flat unless fabulously framed for Instagram. What’s in it for us? Showing your softer side and lots of heroic pictures.

YouTube

YouTube is a search engine run by Google. That’s critical to remember when creating YouTube content for your clinic. Users subscribe to channels to learn from or they find entertaining and interesting. Most veterinarians should use YouTube to provide virtual hospital tours, how-to videos, and information their clients are searching for. Video production is rapidly improving on YouTube; shaky smartphone video with faint audio is a no-no. Be sure to link to your clinic’s website and other social media in each video’s description and optimize end screens and cards.

Twitter

If Facebook is the neighborhood pub, Twitter is a cruise ship. Loads of anonymous people climb aboard hashtags and hurl clever quips and offensive oratory over cyberspace cocktails. For most clinics, Twitter isn’t incredibly helpful. Use it to share

hospital blog posts, a special event, or breaking news. I discourage tweeting discount codes, product sales, and other blatant promotions. Social media backlash can be brutal, particularly around perceived “advertising.” Tweet compassionately, cleverly, and carefully.

TikTok and Snapchat

TikTok brought viral music videos to the masses while Snapchat Stories brought business potential, but current demographics skew awfully young for most veterinary clinics. In March of 2022, 57% of TikTok users were female and 43% male. Roughly 43% of TikTok's global audience is between 18 and 24 years old. 32% of TikTok users are aged between 25 and 34. Only 3.4% of the TikTok audience is older than 55.

For SnapChat, 21.1% of Snapchat’s total ad audience was aged 13 to 17, 38.9% aged 18 to 24, 22.0% 25 to 34, 13.5% 35 to 49, and 3.6% aged 50 and above.

My advice is get onboard and monitor for now. Big changes are promised that should help small businesses connect with the next generation of pet owners.

Live streaming

Facebook, Instagram, and YouTube have evolved into excellent live streaming services. While these are the early days of live video, watch this space closely. Try hosting a 30-minute live Q-and-A, offer a five-minute highlight of a new product or service, or announce an event. The live events are automatically archived for later viewing. With a little planning and promotion, you could reach scores of clients and potential new clients with little effort.

Pinterest

What happened to Pinterst? A widely-publicized Pinterest stat is that 80 percent of its users are female. That looks great on paper, but I’ve found using Pinterest as a standalone or primary social media marketing platform to significantly underperform. Besides, Pinterest growth has plateaued and appears to be on the decline. Share original blog posts and infographics along with how-to’s and YouTube videos. Showing up seems to be half the battle for Pinterest.

Today’s texting and email are like yesterday’s phone call and postcards in many ways. Each represents a different communication opportunity than social media. Understanding how people use, and want to use, text and email is critical for Client Communication 2.0.

Text messages

This is my preferred way to remind clients and check on patients. Five texting caveats: 1) If you're requesting to schedule an appointment, the mechanism to make that appointment needs to be embedded in the text. No dialing or texting back-and-forth. Click here or reply to book an appointment. No more. 2) If confirming an existing appointment, same rules. 3) If checking on a patient, make it personal and be prepared to discuss. Texting creates a sense of urgency and when a client responds; they expect you to be available to reply. If the client responds after hours, have an autoresponder with what to do in an emergency in place. 4) Text checkups are best for minor medical conditions and routine visits. Call after surgery, anesthesia, and major diagnoses. 5) Limit text messages to only when necessary. You don't want your number blocked because you sent a cat owner a generic sales pitch for a dog product.

Emails

Emails continue to serve as both the primary mode of connection as well as a backstop to text messages. Our client admission forms ask in what order they prefer to be contacted: phone, email, or text. Use emails to remind about appointments (see text rules about incorporating 'single-click solutions'), new blog posts, announcements, seasonal educational messages, and surveys. I've found occasionally asking clients for their opinion on adding new products or services to be an effective way to gauge interest and build awareness. Monthly clinic update emails are ideal for most accompanied by personalized reminders. Embedding a quick video summary is a bonus.

Who's in Charge of Your Practice's Social Media?

Nearly everyone on your team should be a part of creating social media content, snapping photos, writing blogs. Creating isn't the same as posting. Before you press publish, an administrator should verify, clarify, and proofread every message bearing your brand. This is another reason I encourage you to use a calendar to guide your outreach and solidify your strategy. Simply posting cute kitten pics, lost dog posters, and homeless pets isn't a plan and won't grow your business.

What's the ROI on all this?

Does social media make business sense for your clinic? I'll repeat what I've been saying since 2007: Return on investment (ROI) on social media is hard to measure and perhaps the traditional ways to calculate it don't apply. Internet conversations about you are happening with or without you. It's far better to insert yourself in these discussions than pretending they aren't real. It's even better to influence the conversations and control your image and protect your reputation. Many veterinarians get interested in social media after discovering a poor review or negative post. That's great, but it's always better to be proactive with communications than reactive.

Social media and electronic communications are also important to elevate the bond you share with clients and patients. We often mistake a client's desire for increased access

with extending office hours. What many want is a richer, more frequent method to interact with us. Social media, texts, and apps provide a contemporary way to connect with clients that an increasing number of other professionals offer. My own physician has an app and online portal through which I can access my medical information, test results, and chat with a medical professional around the clock. Systems for veterinarians are just beginning to appear and I expect them to be universal within two to three years. Apps and websites won't replace social media and texts; they'll augment each other.

Finally, determining ROI is a challenge because social media allows you to expand your reach farther and more focused than traditional marketing. Sure, you need to boost a Facebook post to get it in front of your audience, but boosting allows you to precisely target pet lovers within your professional perimeter. Even better, it's possible to showcase your personality, passion, and expertise in ways we could only imagine a decade ago. Go ahead, turn up the volume on your social media and be prepared for the celebration of the century!

Boosting Your Clinic Management Software

Veterinary practice management systems continue to serve as the mixing board and amplifier for our client communications. To get the most out of your clinic software, make sure you're dialing up the volume by following these simple tips:

Optimize email reminders: Link services and products to a specific email reminder that reminds pet owners not only that something is due, but why it's important to do it. For example, an immunization or preventive reminder should be coupled with a few sentences explaining why fleas are a problem in your geography, any prevalence data, and consequences of flea bites. Vaccinations should include a short statement detailing why their pet is at risk of a specific infectious disease (what I call "individualized immunizations" based on a "Lifestyle risk assessment"), why the immunization is given at a certain frequency, and disease dangers. For the past decade, we've been sending out at least two email reminders scheduled one to two weeks prior to the due date, a week following the deadline, and then a final email ten to fourteen days later before resorting to mail. Use pet name, age, gender, and any other pertinent information to make your outreach as personal as possible.

Text Messages: In addition to email reminders, ask clients if they prefer SMS reminders and updates. I've had success with monthly medication refills and preventives, weekly weight and progress updates, and daily critical care check-in's over text. Be respectful of your client's preferred communication platform and crank up your software's text features to be heard above the email crowds.

Social Media: Your management software can also help grow your social media by adding Facebook or Twitter links to all correspondence, generating survey contacts to conduct client satisfaction research, and connecting with your blogs and breaking news. I recommend your management system to send a monthly electronic newsletter highlighting hot social media posts or stories, embedded with direct signup and shareable links.