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September 2015 abstracts

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Hypercalcemia: Pathophysiology, Clinical Signs, and Emergent Treatment
Erin Daniels, DVM\textsuperscript{*,†}, Catherine Sakakeeny, DVM, DACVECC

Hypercalcemia is uncommonly encountered in veterinary patients. When it does occur, the effects can be severe, resulting in significant morbidity and mortality if not recognized and addressed in a timely manner. Causes of hypercalcemia are varied and include pituitary-dependent and pituitary-independent causes. A diagnosis of hypercalcemia should be made based on documentation of ionized hypercalcemia. The mainstay of emergency treatment usually involves aggressive IV fluid diuresis, the use of diuretics, and, often, glucocorticoids. The use of bisphosphonates has become increasingly more common in veterinary medicine.

Agreement Between Doppler and Invasive Blood Pressure Monitoring in Anesthetized Dogs Weighing <5 kg
Martin J. Kennedy, DVM, Michele Barletta, MS, PhD, DVM, DACVA\textsuperscript*.

The objectives of this study were to determine if Doppler (DOP) blood pressure measurements more closely estimate either invasive systolic or invasive mean arterial blood pressures (ISAP or IMAP, respectively) in small dogs under general anesthesia and to assess the ability of DOP to detect anesthesia-related hypotension in small dogs. Blood pressure measurements (n = 203) were obtained from 10 client-owned dogs. DOP, ISAP, and IMAP were recorded simultaneously, and the data were categorized into two groups: hypotensive (ISAP <90 mm Hg) and normotensive (ISAP ≥90 mm Hg and ≤160 mm Hg). DOP overestimated ISAP and IMAP in both the normotensive and hypotensive groups. The DOP was highly specific (97%) but poorly sensitive (56%) for detecting hypotension. The smallest bias was achieved when using DOP as an estimate of systolic arterial blood pressure in both normotensive and hypotensive dogs, suggesting that DOP measures systolic arterial blood pressure in dogs <5 kg. For dogs with hypotension, DOP met all of the performance criteria for noninvasive blood pressure monitors recommended by the American College of Veterinary Internal Medicine. DOP is an acceptably accurate and highly specific means of detecting hypotension in small dogs under general anesthesia.

Sensitivity and Specificity of Histoplasma Antigen Detection by Enzyme Immunoassay
Lauren Cunningham, DVM, DACVIM\textsuperscript*, Audrey Cook, BVM&S, DACVIM, DECVIM, Andrew Hanzlicek, MS, DVM, DACVIM, Kenneth Harkin, DVM, DACVIM, Joseph Wheat, MD, Carla Goad, PhD, Emily Kirsch, BS\textsuperscript{†}.

The objective of this study was to evaluate the sensitivity and specificity of an antigen enzyme immunoassay (EIA) on urine samples for the diagnosis of histoplasmosis in dogs. This retrospective medical records review included canine cases with urine samples submitted for Histoplasma EIA antigen assay between 2007 and 2011 from three veterinary institutions. Cases for which urine samples were submitted for Histoplasma antigen testing were reviewed and compared to the gold standard of finding Histoplasma organisms or an alternative diagnosis on cytology or histopathology. Sensitivity, specificity, negative predictive value, positive predictive value, and the kappa coefficient and associated confidence interval were calculated for the EIA-based Histoplasma antigen assay. Sixty cases met the inclusion criteria. Seventeen cases were considered true positives based on identification of the organism, and 41 cases were considered true negatives with an alternative definitive diagnosis. Two cases were considered false negatives, and there were no false positives. Sensitivity was 89.47% and the negative predictive value was 95.35%. Specificity and the positive predictive value were both 100%. The kappa coefficient was 0.9207 (95% confidence interval, 0.8131–1). The Histoplasma antigen EIA test demonstrated high specificity and sensitivity for the diagnosis of histoplasmosis in dogs.

Mucinous Pleural Effusion in a Dog with a Pulmonary Adenocarcinoma and Carcinomatosis
Melissa Tropf, DVM, Rance Sellon, PhD, DVM, DACVIM, Kathleen Paulson, DVM, Danielle Nelson, PhD, DVM, DACVP

An 11 yr old castrated male greyhound presented to the Washington State University's Veterinary Teaching Hospital (WSU VTH) for evaluation of a 4 day history of pleural effusion. The pleural effusion had a gelatinous appearance, suggestive of mucus, and was characterized cytologically as a pyogranulomatous exudate with some features suggestive of a carcinoma. Postmortem examination identified a pulmonary mass with evidence of carcinomatosis. Pulmonary papillary adenocarcinoma with carcinomatosis was the histologic diagnosis. Abundant mucin production was present, consistent with a mucinous pulmonary adenocarcinoma. To the authors' knowledge, this is the first report of a mucinous pulmonary adenocarcinoma with mucus pleural effusion in a dog.

Extraskeletal Osteosarcoma Induced by a Foreign Body Granuloma

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A 9 yr old cat was presented with a mass in the cranial abdomen. Preliminary evaluation of the dog revealed a large, cavitary, irregularly shaped mass with no definitive association with any abdominal organs. During an exploratory celiotomy, a 16 cm \times 12 cm \times 6 cm mass was removed. On subsequent histopathology, extraskeletal osteosarcoma induced by a foreign body granuloma was diagnosed. The foreign body granuloma, based on histopathological findings, was suspected to be secondary to a retained surgical sponge from her routine ovariohysterectomy performed 7 yr prior to presentation. Animals with granulomas induced by foreign bodies can remain asymptomatic for years; however, those granulomas can progress to extraskeletal osteosarcomas, which carry a poor prognosis.

**Angiostrongylus vasorum Causing Severe Granulomatous Hepatitis with Concurrent Multiple Acquired Portosystemic Shunts**

Simon Cook, BSc, BVSc, MRCVS, Simon L. Priestnall, BSc, BVSc, PhD, PGCert(VetEd), DACVP, FRCPay, MRCVS, Damer Blake, BSc, MSc, PhD, PGCVetEd, FHEA, Richard L. Meeson, MA, VetMB, MVetMed, DECVS, MRCVS

A 14 mo old female Jack Russell terrier presented with a 12 hr history of vomiting and inappetence. She was subsequently diagnosed with multiple acquired portosystemic shunts during an exploratory celiotomy. Gross and histopathological hepatic abnormalities were consistent with chronic disease, including features suggestive of portal hypertension that was potentially caused by migrating and resident Angiostrongylus vasorum larvae. Fecal analysis and polymerase chain reaction of hepatic tissue confirmed the presence of Angiostrongylus vasorum. The dog recovered clinically following empirical treatment and supportive care. A lack of parasite burden was confirmed 9 wk postdiagnosis; however, serum biochemical analysis at that time was suggestive of ongoing hepatic dysfunction.

**Removal of an Airway Foreign Body via Flexible Endoscopy Through a Laryngeal Mask Airway**

Manuel Martin-Flores, MV, DACVAA, Catherine C. Cortright, MS, DVM, DACVIM*,†, Samantha J. Koba, LVT, VTS, CCRA

A Silky terrier weighing 4.7 kg was presented with an airway foreign body after having aspirated a fragment of an orotraceal tube that was identified on radiological examination. Due to the small size of the patient, flexible endoscopy could not be performed through the lumen of a tracheal tube. Following IV induction of general anesthesia, the airway was instrumented with a laryngeal mask airway that was attached via a three-way connector to an anesthesia breathing circuit. A flexible endoscope was passed through the free port of the connector. That arrangement allowed for the passage of an endoscope through the lumen of the laryngeal mask airway and into the trachea without interrupting the continuous supply of O2 and sevoflurane.

**Severe Pit Viper Envenomation with Extended Clinical Signs and Treatment Complications in a Dog**

Michael Schaefer, DVM, DACVIM, DACVECC, Gareth J. Buckley, MA, VetMB, MRCVS, DACVECC, Bobbi J. Conner, DVM, DACVECC, Laura C. Cuddy, MS, MVB*,**, Alessio Vigani, PhD, DVM, DACVA††, Allison E. Vansickle, DVM, James G. Coisman, DVM**,†††, Deanna R. DeVuyst, DVM, Carsten Bandt, DVM, DACVECC

This manuscript describes the extended clinical abnormalities that can occur in severe snake envenomation and the clinical signs associated with antivenom hypersensitivity in a 3 yr old dog. Treatment consisted of IV fluid therapy, analgesics, a vasopressor, cardiac antiarrhythmia drugs, and polyvalent pit viper antivenom. Following initial response to treatment, relapse of clinical signs occurred. Most interesting was the recrudescence of clinical signs on day 7 that may have been caused by the release of deposited venom during surgical debridement of necrotic skin. The resulting extensive clinical signs required multiple vials of antivenom (22 vials over a 7 day period). Both F(ab′)2 antivenom and antivenin (Crotalidae) polyvalent were used in this dog because of availability logistics. It is thought that this large amount of antivenom resulted in type I (anaphylaxis) and type III hypersensitivity (serum sickness) reactions. The dog made a complete clinical recovery. This description of extended, fluctuating clinical abnormalities that were associated with envenomation together with the development of hypersensitivity reactions that were presumably secondary to antivenom administration is information that can be useful for the management of patients afflicted with severe pit viper envenomation.

**Urinary Aldosterone/Creatinine Ratio After Fludrocortisone Suppression Consistent with PHA in a Cat**

Christos K. Koutinas, PhD, DVM, Nektarios C. Soubasis, PhD, DVM, Sylvia C. Djajadiningrat-Laann, PhD, DVM, DECVO, Eliassav Kolia, DVM, Konstantina Theodorou, DVM

A 9 yr old cat was presented with clinical signs and laboratory abnormalities attributed to arterial hypertension (mean systolic arterial pressure, 290 mm Hg). Plasma aldosterone concentration was increased at the time of admission (651 pmol/L), but serum creatinine and potassium concentrations were within the reference range. A
second increased aldosterone (879 pmol/L) and normal plasma renin activity (1.85 ng/mL/hr) resulted in an increased aldosterone/renin ratio, which was suggestive of primary hyperaldosteronism (PHA). To further support the diagnosis of PHA, the urinary aldosterone/creatinine ratio was calculated both before and after oral administration of fludrocortisone acetate (0.05 mg/kg q 12 hr for 4 consecutive days). The urinary aldosterone/creatinine ratio was $92.6 \times 10^{-9}$ before fludrocortisone administration and $155.8 \times 10^{-9}$ 4 days later. Absence of suppression was typical of PHA. The cat had a limited response to antihypertensive medication and died before treatment for PHA could be instituted. A necropsy was not permitted by the owner.

**Ectopic Intrathoracic Hepatic Tissue and Accessory Lung Lobe Aplasia in a Dog**
Rachel Lande, DVM, Laura Dvorak, MS, DVM, DACVS, David W. Gardiner, MS, DVM, DACVP, Anne Bahr, DVM, DACVR
A 6 yr old male Yorkshire terrier was presented for an ~6 yr history of progressive cough and dyspnea. Thoracic radiographs revealed a 6 cm diameter mass within the right caudal thorax. Thoracic ultrasound identified an intrathoracic mass ultrasonographically consistent with liver tissue and a chronic diaphragmatic hernia was suspected. Exploratory laparotomy was performed, but no evidence of a diaphragmatic hernia was identified. Thoracic exploration identified abnormal lung parenchyma. The accessory lung lobe was removed using a stapling devise near its base. The consolidated mass had the gross appearance of liver and was histologically identified as ectopic hepatic tissue. Ectopic hepatic tissue, unlike ectopic splenic and pancreatic tissue, is rare and generally has a subdiaphragmatic distribution. This solitary case report demonstrates that ectopic intrathoracic hepatic tissue should be considered a differential diagnosis for a caudal mediastinal mass.

**Regional Nodal Metastasis of Humeral Chondrosarcoma in a Dog**
Mandy Meindel, BS, DVM*, Lisa Pohlman, MS, DVM, DACVP, Brad DeBey, PhD, DVM, DACVP, Mary Lynn Higginbotham, MS, DVM, DACVIM, Rachel Moon, DVM**
A 6 yr old castrated male English springer spaniel was evaluated with a 1 mo history of progressive right forelimb lameness with recent swelling around the elbow joint. Physical examination findings included lameness of the right forelimb, muscle atrophy around the right shoulder, grade 2/6 heart murmur, and moderate dental disease. Results of a complete blood cell count and serum biochemical analysis were unremarkable with the exception of a mildly increased alkaline phosphatase (368 U/L; reference range, 128–328 U/L). Radiographs of the right elbow revealed a mixed lytic and proliferative osseous lesion most consistent with either neoplasia or infection. Thoracic radiographs and the echocardiogram were unremarkable. Fine-needle aspiration of the bone lesion was performed. The cytological diagnosis was chondrosarcoma. The right forelimb was amputated and the axillary lymph nodes were collected. Histopathological examination of the bone lesion and axillary lymph nodes revealed chondrosarcoma with metastasis to the lymph nodes. Lymph node metastasis of chondrosarcoma is rare and needs to be further evaluated as a prognostic indicator.

**Pierre Robin Sequence: A Familial, Clinical, and Pathoanatomical Record of an Affected Dachshund**
Enio Moura, BVSc, MSc, José L. Wagner, BVSc, Silvana M. Cirio, BVSc, MSc, DSc, Cláudia T. Pimpão, BVSc, MSc, DSc
This study describes a spontaneous case of Pierre Robin sequence in a nonhuman animal species. A miniature dachshund with micrognathia developed glossoptosis, respiratory distress, dysphagia, temporomandibular ankylosis, and a misaligned upper jaw. The severity of this condition resulted in death by obstructive apnea at the age of 8 mo. Dogs with Pierre Robin sequence can provide further knowledge and a greater understanding of this abnormality, leading to better management of affected individuals and improvement of therapeutic methods.

**Veterinary Clinics of North America (Sep/Oct)**

**Perioperative Monitoring**
Lori S. Waddell

**Assessment of Fluid Balance and the Approach to Fluid Therapy in the Perioperative Patient**
Elise Boller, Manuel Boller
Perioperative patients can be highly dynamic and have various metabolic, physiologic, and organ system derangements that necessitate smart monitoring strategies and careful fluid therapy. The interplay between changing patient status, therapeutic interventions, and patient response makes effective monitoring crucial to successful treatment. Monitoring the perioperative patient and an approach to fluid therapy are discussed in this text.

**Anemia and Oxygen Delivery**
Stuart Bliss
Clinical assessment of tissue oxygenation is challenging. Anemia reflects a decreased oxygen carrying capacity of the blood and its significance in the perioperative setting relates largely to the associated risk of insufficient oxygen delivery and cellular hypoxia. Until meaningful clinical measures of tissue oxygenation are available in veterinary practice, clinicians must rely on evaluation of a patient’s hemodynamic and ventilatory performance, along with biochemical and hemogasometric measurements. Blood transfusion is used commonly for treatment of perioperative anemia, and may improve tissue oxygenation by normalizing the rheologic properties of blood and enhancing perfusion, independent of increases in oxygen carrying capacity.

**Oxygenation and Ventilation**

Elizabeth A. Rozanski

Perioperative complications commonly include oxygenation and ventilation abnormalities. The best outcome is associated with prevention. Ventilation impairment may be due to either neurologic compromise such as cervical intervertebral disk disease or severe parenchymal disease, while oxygenation failure may result from either the underlying disease or severe complications such as aspiration pneumonia, volume overload, pulmonary thromboembolism, or acute respiratory distress syndrome. This article reviews the approach to the patient with perioperative complications and provides recommendations on the management approach.

**Perioperative Acid-Base and Electrolyte Disturbances**

Kari Santoro Beer, Lori S. Waddell

Obtaining and interpreting blood gas and electrolyte levels is essential in the management of perioperative veterinary patients. Metabolic and electrolyte alterations are common in critically ill surgical patients, and can lead to alterations in cardiovascular function, neurologic status, respiratory function, and even response to various drug therapies. Several common perioperative conditions are discussed in this article, including metabolic disturbances, electrolyte abnormalities (hyponatremia and hypernatremia, hyperkalemia), and respiratory abnormalities.

**Perioperative Monitoring of Heart Rate and Rhythm**

Mark A. Oyama

Perioperative disorders of heart rate and rhythm are common and can contribute to patient morbidity and mortality. Management of perioperative arrhythmias is facilitated by understanding the basic mechanisms of arrhythmia formation and the role of transient imbalances. The decisions of when and how to treat perioperative arrhythmias are based on whether or not hemodynamic signs are present and the assumed risk of sudden arrhythmic death. Perioperative arrhythmias warrant careful monitoring and consideration of potential complications associated with antiarrhythmic therapy.

**Perioperative Blood Pressure Control and Management**

Tanya Duke-Novakovski, Anthony Carr

Blood pressure monitoring and management is a vital part of the perianesthetic period. Disturbances in blood pressure, especially hypotension, can have significant impacts on the well-being of small animal patients. There are a variety of mechanisms present to control blood pressure, including ultra-short-, short-, and long-term mechanisms. Several conditions can contribute to decreased blood pressure, including anesthetics, tension pneumothorax, intermittent positive pressure ventilation, hypoxemia, hypercapnia, surgical positioning, and abdominal distension. If hypotension is encountered, the initial response is to provide appropriate fluid therapy. If this is inadequate, other interventions can be used to increase blood pressure and thereby increase perfusion.

**Inadvertent Perianesthetic Hypothermia in Small Animal Patients**

Stuart Clark-Price

Inadvertent perianesthetic hypothermia is one of the most common complications in anesthesia of dogs and cats. Hypothermia during anesthesia can lead to altered pharmacokinetics of anesthetic and analgesic drugs, dysfunction of organ systems, increased patient susceptibility to infection, reduced wound healing, altered coagulation, hypotension, and delayed recovery. An understanding of the pathophysiology, complications, and techniques to minimize hypothermia during anesthesia can help veterinarians optimize care of patients. This article provides an overview of inadvertent perianesthetic hypothermia.

**Postoperative Hemostasis Monitoring and Management**

Lisa J. Bazzle, Benjamin M. Brainard

Although postoperative hemorrhage is an understood sequela, surgery also elicits an inflammatory response that may result in a hypercoagulable state and risk for venous or arterial thromboembolism. Postoperative venous thromboembolism is well documented in humans and is multifactorial in nature; however, evidence for its presence in veterinary medicine remains sparse. There is no consensus on the ideal type, dose, and duration of
thromboprophylactic therapy in the perioperative period. Regardless, coagulation perturbations secondary to surgical stress are important considerations for the perioperative patient to reduce the possible fatal risks of hemorrhage or thrombosis.

**Analgesia in the Perioperative Period**
Stephanie H. Berry

Untreated or undermanaged perioperative pain has systemic effects that may negatively impact a patient’s welfare and return to function. A consistent analgesic plan that assesses a patient’s pain and comfort at regular intervals during the perioperative period should be incorporated into practice. Validated pain assessment tools are available for use in dogs and cats. Multimodal analgesic plans should be created for individual patients and modified according to pain assessments. These plans, based on a thorough history, physical examination, and knowledge of the expected pain, should be combinations of an opioid, a nonsteroidal anti-inflammatory drug, a local anesthetic, and nonpharmacologic analgesic techniques.

**Nursing Care: Care of the Perioperative Patient**
Harold Davis

This article provides a general overview of nursing care principles including an approach to developing a nursing care plan using the nursing process as its foundation. The nursing process is a problem-solving approach used in planning patient care. This article also focuses on nursing care as it pertains to the respiratory, cardiovascular, and renal systems (fluid balance) as well as care of the recumbent patient. Knowledge of nursing care techniques and risk factors for complications puts the care provider in a position of being proactive rather than reactive to patient care needs.

**Wound Care**
Ingrid M. Balsa, William T.N. Culp

Wound care requires an understanding of normal wound healing, causes of delays of wound healing, and the management of wounds. Every wound must be treated as an individual with regard to cause, chronicity, location, and level of microbial contamination, as well as patient factors that affect wound healing. Knowledge of wound care products available and when negative pressure wound therapy and drain placement is appropriate can improve outcomes with wound healing. Inappropriate product use can cause delays in healing. As a wound healing progresses, management of a wound and the bandage material used must evolve.

**Peri-Surgical Nutrition: Perspectives and Perceptions**
Christopher W. Frye, April E. Blong, Joseph J. Wakshlag

Peri-surgical nutrition of veterinary patients is in its infancy, with considerable research to be performed to help improve quality of life in our small animal patients. Clues from human immunonutrition may be starting places for investigation. Considerations for future investigations should include essential nutrients, the underlying disease process, therapeutic goals, and species (dog or cat). There are guidelines for caloric requirements. Planning for nutritional support before surgery takes place is likely to be beneficial to patient outcomes. Taking into account case history, method of feeding, metabolic abnormalities, and possible immunonutrition should be part of a complete surgical nutritional plan.

**Australian Veterinary Practitioner**

**A chronic, linear foreign body in a 1-year-old male Dachshund**
DA McCarthy, JJ Biskupa and SK Crain

CASE REPORT A 1-year-old Dachshund was evaluated for intermittent vomiting and chronic weight loss. After failure of empirical therapy over a 6-month period, ultrasonography was performed and suggested a gastrointestinal foreign body. An exploratory celiotomy was performed. During a gastrotomy, a linear foreign body was identified extending orally into the oesophagus, attached to the base of the tongue, and extending aborally into the duodenum. In the duodenum and jejunum, tissue had surrounded the foreign body, which was removed with resection and anastomosis. The remainder of the material was removed through the gastrotomy after being released from the base of the tongue. The dog recovered from surgery without significant complications. DISCUSSION This case reflects the importance of conducting an oral examination and abdominal imaging in cases of gastrointestinal disease, because a linear foreign body can cause chronic gastrointestinal signs.

**Computed tomographic features of thymoma in the dog: a case report and review of eight cases**
M Patsikas, S Jakovljevic, L Papazoglou et al.
CASE REPORT A well-demarcated 18 x 13 x 16 cm (H x W x L) mediastinal mass with lobulated contour and heterogeneous attenuation was demonstrated on computed tomographic (CT) images of an 11.5-year-old female Labrador Retriever crossbred dog admitted with a history of coughing, polyuria and polydipsia. After intravenous contrast administration, faint, non-uniform enhancement of the mass was noted. The mass was in contact with the parietal pleura, aortic arch, pulmonary trunk and right atrium, but no signs consistent with invasion of the adjacent structures were evident. The mass was surgically excised and absence of any intrathoracic visceral invasion was confirmed. Histopathologically, the mass was reported to be a thymoma.

DISCUSSION CT findings and invasiveness of thymomas in eight other cases found in the literature are included and discussed in the present report. CT is useful for demonstrating the invasiveness of a thymoma in dogs. Invasion of the mediastinal blood vessels should be considered a CT feature of invasiveness, but false-positive and false-negative diagnoses do occur.

**Relay pentobarbitone toxicosis in an American Bulldog**

**JB King**

CASE REPORT An 8-year-old male neutered American Bulldog presented acutely obtunded. Routine haematology and biochemistry were normal. A urine snake venom detection kit was negative. The owners then reported that the night before presentation the dog had dug up the remains of their other dog, which had been euthanased 6 months prior using pentobarbitone. Phenobarbitone concentrations in blood and urine were requested to use as possible surrogate markers of pentobarbitone intoxication. This test returned with a detectable concentration of phenobarbitone in serum and urine despite no history of therapeutic use. A qualitative urine toxin screen also returned positive for barbiturates. Finally, pentobarbitone was confirmed in the serum using gas-chromatography mass spectrometry. The dog recovered quickly and was discharged the following day. DISCUSSION This case illustrates that pentobarbitone has prolonged persistence in the environment and can result in intoxication despite appropriate burial. Veterinarians have a responsibility to warn owners of the potential risks associated with burial of pets at home.

**Fracture of the os penis in five dogs**

**M Kouki, P Papadopoulou, V Angelou et al.**

CASE REPORTS Records of five dogs that were presented with fracture of the os penis secondary to trauma were reviewed. All dogs presented with stranguria and dysuria, and the urethra was unable to be catheterised in three of them. Other clinical abnormalities noted were one dog each with haematuria, crepitus and mobility on penile palpation, thickened fracture site on palpation and wounds close to the prepuce with urine leakage. Plain radiography confirmed the fracture in all dogs. Contrast retrograde urethrography showed urethral narrowing in two dogs and contrast extravasation through the preputial wound in one dog. Treatment included a scrotal urethrostomy (3 cases), placement of an indwelling catheter (2 cases) and a partial penile amputation (1 case). Complications included haemorrhage in all dogs and urethral obstruction in one dog, which was managed successfully with a scrotal urethrostomy. CONCLUSION All dogs had a favourable outcome after follow-up of almost 18 months.

**A simple ultrasound-guided approach for intra-articular injection of the canine hip joint**

**BGJ Wernham, D Tyrrell, T Whittem and S Ryan**

AIMS To describe the sonoanatomy of the canine hip joint and determine the feasibility of an ultrasound-guided technique for intra-articular hip injection. METHODS Six fresh-frozen canine cadavers and five live dogs were used to describe the sonoanatomy of the hip and develop an ultrasound-guided intra-articular injection technique of the hip joint. The hip joints of five canine cadavers were injected with 1 mL of coloured liquid latex under ultrasound guidance. The results of injection were determined via dissection after injection and the injection technique modified and refined. Once an appropriate technique had been developed, a single cadaver was frozen, sectioned and the anatomical and sonoanatomical landmarks compared. RESULTS The regional sonoanatomy of the canine hip joint could be easily determined and correlated well with cryosections. The hip joint could be accurately injected under ultrasound guidance using a caudoventrolateral approach. Initial imaging of the hip joint was achieved by placing the transducer immediately proximal to the palpable greater trochanter, perpendicular to the spine. Appropriate transducer positioning for targeting the hip joint was then achieved by rotating the transducer approximately 30 degrees clockwise or anticlockwise to inject the left or right hip, respectively. CONCLUSIONS Ultrasound-guided hip injection using a caudoventrolateral approach is feasible in the canine cadaver. CLINICAL RELEVANCE Although this technique remains to be performed in
clinical cases, it has the potential to facilitate the diagnosis of coxofemoral pain, septic arthritis and the accurate delivery of intra-articular therapeutic agents.

**Journal of Feline Medicine & Surgery**

**Progestins to control feline reproduction: Historical abuse of high doses and potentially safe use of low doses**
Stefano Romagnoli

Relevance: The high fertility rate of cats means that methods to control feline reproduction are a requirement for cat breeders and pet owners, as well as for those involved in the management of feral cat populations. Progestins continue to be used to prevent queens from cycling, and also as an adjunct or alternative to surgical sterilization within trap–neuter–return (TNR) programs. Evidence base: A considerable body of information exists on megestrol acetate (MA) and medroxyprogesterone acetate (MPA), thanks to the many studies and case reports published in the scientific literature over the past 50 years documenting their clinical use in cats. Comparatively less is known about the use in cats of more recent progestins such as levonorgestrel, proligestone, delmedimone, chlormadinone and altrenogest. Dosing, safety and efficacy: Based on a combination of dose, frequency and duration of treatment, MA can be categorized into low (0.625 mg/kg/week for up to 30 weeks), medium (0.625 mg/kg q24h for 1 week or q48h for up to 2 weeks) and high (0.625 mg/kg q24h or q48h for several weeks, or weekly for months or years) dosages. Studies suggest that low dosages can be used relatively safely in cats, while higher dosages increase the risk and severity of adverse reactions. Early work showing that an oral MPA dosage of 0.01 mg/kg administered q24h for 12 months suppresses oestrus in queens effectively and safely has not been considered, and much higher MPA dosages (>6.25 mg/kg q24h) have been used in cats over the past 40 years. Recommendations: Progestins should always be used with caution. Using the lowest possible dosages, MA and MPA may, however, continue to be used safely in pet queens as well as (in conjunction with TNR programs) for the control of feral cat colonies. More recent progestins appear to be effective and safe, albeit their efficacy and safety need to be further investigated.

**Alternative methods for feline fertility control: Use of melatonin to suppress reproduction**
Michelle A Kutzler

Practical relevance: Reversible contraceptives are highly desired by purebred cat breeders for managing estrous cycles and by scientists managing assisted reproduction programs. A variety of alternative medicine approaches have been explored as methods to control feline fertility. Scope: In the field of veterinary homeopathy, wild carrot seed and papaya have been used for centuries. Both appear to be safe, but their efficacy as feline contraceptives remains anecdotal. In contrast, the use of melatonin in cats has been investigated in a number of studies, findings from which are reviewed in this article. Rationale: Cats are seasonally polyestrus (they cycle several times during their breeding season) and are described as long-day breeders because endogenous melatonin negatively regulates estrous cyclicity. Exogenous melatonin administered parenterally also suppresses ovarian activity in cats, and long-term oral or subcutaneous melatonin administration is safe. Challenges: The therapeutic use of melatonin is limited by its short biological half-life (15–20 mins), its poor oral bioavailability and its central effects in reducing wakefulness. Research is required to determine whether higher doses, longer-release formulations, repeated administration or combination implants might overcome these limitations.

**Vaccines for feline contraception: GonaCon GnRH–hemocyanin conjugate immunocontraceptive**
Valerie A W Benka and Julie K Levy

Vaccine: GonaCon™ is the trade name of a GnRH–hemocyanin conjugate immunocontraceptive vaccine formulation shown to prevent reproduction and inhibit production of sex hormones in numerous mammalian species for extended durations. GonaCon is currently registered with the US Environmental Protection Agency (EPA) for contraception of female white-tailed deer, and GonaCon™-Equine for female wild horses and burros. Multiple formulations of this GnRH-hemocyanin conjugate immunocontraceptive vaccine have been developed at the National Wildlife Research Center in the United States. Evidence base: Three studies employing an early generation vaccine formulation indicated its potential for multi-year contraception of female cats (median duration of effect in excess of 39.7 months). The contraceptive effect for male cats was less predictable and of shorter duration (median duration of effect 14 months). Since these initial feline studies there have been formulation composition changes, and further investigation of the safety, efficacy and duration of this contraceptive vaccine for cats is warranted. Future prospects: Individual country regulations will determine if GonaCon could be registered for unowned, free-roaming and/or pet cats.
Long-term contraception in a small implant: A review of Suprelorin (deslorelin) studies in cats
Christelle Fontaine
Rationale: Deslorelin (Suprelorin®; Virbac) is a gonadotropin-releasing hormone (GnRH) agonist licensed in select countries for the long-term suppression of fertility in adult male dogs and male ferrets. This article summarizes studies investigating the use of deslorelin implants for the long-term suppression of fertility in male and female domestic cats. Evidence base: Slow-release deslorelin implants have been shown to generate effective, safe and reversible long-term contraception in male and female cats. In pubertal cats, a 4.7 mg deslorelin implant suppressed steroid sex hormones for an average of approximately 20 months (range 15–25 months) in males and an average of approximately 24 months (range 16–37 months) in females. Reversibility has been demonstrated by fertile matings approximately 2 years post-treatment in both male and female adult cats. In prepubertal female cats of approximately 4 months of age, puberty was postponed to an average of approximately 10 months of age (range 6–15 months) by a 4.7 mg deslorelin implant. Challenges: The large variability in the duration of suppression of gonadal activity makes the definition of the optimal time for reimplantation quite challenging. In addition, the temporary stimulation phase occurring in the weeks following deslorelin implantation can induce in adult female cats a fertile estrus that needs to be managed to avoid unwanted pregnancy. Longer duration and larger scale controlled field studies implementing blinding, a negative control group and a carefully controlled randomization to each group are needed. Furthermore, the effects of repeated treatment need to be investigated. Finally, the effect of treatment on growth and bone quality of prepubertal cats needs to be assessed. However, the ease of use, long-lasting effects and reversibility of deslorelin implants are strong positive points supporting their use for controlling feline reproduction.

Intratesticular and intraepididymal injections to sterilize male cats: From calcium chloride to zinc gluconate and beyond
Michelle A Kutzler
Aim and rationale: The aim of intratesticular and intraepididymal injections is to provide an inexpensive non-surgical method for sterilizing tom cats. Intratesticular and intraepididymal injections have been studied for decades and warrant continued investigation. While both methods result in azoospermia, intratesticular injection of sclerosing agents induces orchitis, resulting in decreased spermatogenesis, whereas intraepididymal injection blocks sperm transport but does not alter spermatogenesis. Evidence base: Sclerosing agents that have been used effectively for intratesticular injections in cats include calcium chloride dihydrate and zinc gluconate. For sclerosis by intraepididymal injections, chlorhexidine digluconate has been used successfully in cats. The volume, formulation and concentration of sclerosing agents for intratesticular and intraepididymal injections in cats have not been standardized. Challenges: Neither intratesticular nor intraepididymal injections entirely eliminate gonadal testosterone production, which may be undesirable for pet cats and therefore may restrict the application of this method of sterilization to feral cats with limited human contact. In addition, both methods may require sedation or general anesthesia, leading some to support routine castration over these non-surgical methods. Lastly, even if the technique is successful in inducing permanent sterility, normal fertility may persist in treated males for 1–2 months after treatment because of sperm present within the epididymis and vas deferens.

No surgery required: the future of feline sterilization: An overview of the Michelson Prize & Grants in Reproductive Biology
Shirley Johnston and Linda Rhodes
Overview: For many years, researchers have been studying reproduction of cats and dogs, including approaches to non-surgical sterilization, but scant funding has been available for this work. Recognizing the need to fund research and to attract researchers from the biomedical community to apply their expertise to this area, the Michelson Prize & Grants (MPG) in Reproductive Biology program was founded. Since 2009, it has funded 34 research projects in seven countries toward discovery of a safe single-administration lifetime non-surgical sterilant in male and female cats and dogs. Goal: The goal of the MPG program is the reduction or elimination of the approximately 2.7 million deaths of healthy shelter cats and dogs in the US every year. The successful product is expected to be a single-dose injectable product approved by the US Food and Drug Administration as a veterinary prescription item. The most optimistic prediction is that such a product will reach the hands of practicing veterinarians within the next decade. Areas of research: Active research is in progress using approaches such as immunocontraception with a single-administration vaccine against gonadotropin releasing hormone (GnRH). Long-term therapy with GnRH agonists such as deslorelin administered in controlled-release
devices is also being studied. Other scientists are targeting cells in the brain or gonads with cytotoxins, such as are used in cancer chemotherapy. Gene therapy expressing proteins that suppress reproduction and gene silencing of peptides essential to reproduction are further avenues of research. Findings are available at www.michelsonprizeandgrants.org/michelson-grants/research-findings.

Put a label (claim) on it: Getting non-surgical contraceptives approved for use in cats and dogs
Linda Rhodes
Relevance: Non-surgical contraceptives or sterilants need regulatory approval to be sold for that use. This approval process gives veterinarians the information required to assess the benefits and risks of each product, and to provide comprehensive information on the required dose, method and duration of use, safety and effectiveness. Aim: This article reviews the information that must be developed and provided to regulatory agencies worldwide, with a focus on the European Union and the United States, in order to achieve regulatory approval. Processes: The main components of developing a drug include developing extensive information on the safety and effectiveness of the product, and also the safety to the environment and to humans handling and administering the drug. Most importantly, a robust method of manufacturing both the drug itself and the formulated drug product (pill, liquid implant or injection) must be developed to assure quality and consistency in each batch. This information is then compiled and submitted to regulatory agencies; in the United States, this includes the Food and Drug Administration, the United States Department of Agriculture and the Environmental Protection Agency, and, in Europe, the European Medicines Agency. Challenges: Because of the unique nature of non-surgical contraceptives for use in cats and dogs, particularly the desire to have these products last over multiple years, there are special challenges to their regulatory approval that are discussed in this review.

Methods of fertility control in cats: Owner, breeder and veterinarian behavior and attitudes
Jane K Murray, Jill R Mosteller, Jenny M Loberg et al.
Overview: Fertility control is important for population management of owned and unowned cats, provides health benefits at the individual level and can reduce unwanted sexually dimorphic behaviors such as roaming, aggression, spraying and calling. This article reviews the available evidence regarding European and American veterinarian, owner and pedigree cat breeder attitudes toward both surgical sterilization and non-surgical fertility control. It additionally presents new data on veterinarians’ and pedigree cat breeders’ use of, and attitudes toward, alternative modalities of fertility control. Proportion of cats that are neutered: Within the United States and Europe, the proportion of cats reported to be sterilized varies widely. Published estimates range from 27–93% for owned cats and 2–5% for cats trapped as part of a trap–neuter–return (TNR) program. In some regions and populations of cats, non-surgical fertility control is also used. Social context, cultural norms, individual preferences, economic considerations, legislation and professional organizations may all influence fertility control decisions for cats. Non-surgical methods of fertility control: Particularly in Europe, a limited number of non-surgical temporary contraceptives are available for cats; these include products with regulatory approval for cats as well as some used ‘off label’. Non-surgical methods remove the risk of complications related to surgery and offer potential to treat more animals in less time and at lower cost; they may also appeal to pedigree cat breeders seeking temporary contraception. However, concerns over efficacy, delivery methods, target species safety, duration and side effects exist with current non-surgical options. Research is under way to develop new methods to control fertility in cats without surgery. US and European veterinarians place high value on three perceived benefits of surgical sterilization: permanence, behavioral benefits and health benefits. Non-surgical options will likely need to share these benefits to be widely accepted by the veterinary community.

Better trap–neuter–return for free-roaming cats: Using models and monitoring to improve population management
John D Boone
Overview: Trap–neuter–return (TNR) for cat management is transitioning from an enterprise driven mainly by an urge to ‘help’ into an enterprise that draws useful guidance and precedent from the fields of population biology and wildlife management. This transition is in its infancy, however. At the present time many TNR programs do not produce substantial and persistent reductions in cat populations, and those that do often fail to effectively document this achievement or to publicize their success. Challenges: As a result, TNR has become increasingly controversial, with TNR advocates and wildlife conservationists often staking out fundamentally incompatible positions. This may ultimately prove to be an unproductive debate, since public opinion in developed countries is unlikely to support a total abandonment of TNR in favor of widespread cat management using lethal methods, and since wildlife advocates are unlikely to support TNR as it is typically practiced.
Advancements: In contrast, improving the effectiveness of TNR as a population management tool can benefit both cats and wildlife, potentially on a broad scale. Making these advancements requires the diligent promotion, dissemination, and adoption of tools like population modeling, population monitoring, and adaptive management. By virtue of their training and exposure to the scientific method, veterinarians are uniquely well positioned to translate the more technical aspects of these approaches to TNR practitioners, and to facilitate their wider use. Aim: The purpose of this review is to describe for a veterinary audience how to facilitate more effective sterilization-based management of outdoor cats, using a combination of theoretical knowledge derived from population modeling and empirical knowledge derived from population monitoring. Using both of these information sources synergistically can offer a viable pathway to better management outcomes.

**Ear tips to ear tags: Marking and identifying cats treated with non-surgical fertility control**  
Valerie A W Benka

Current approaches: Trap–neuter–return (TNR) introduced a humane means of managing free-roaming and feral (‘community’) cats; it also necessitated a method of marking and identifying these cats as sterilized. Although multiple identification methods have been studied or attempted in the field, ear tipping (or, less commonly, ear notching) has proven to be the best option and is used internationally. However, ear tipping must be performed under general anesthesia, and it conveys only binary information: yes, a cat has gone through a TNR program (and is sterilized); or, no, a cat has not gone through a TNR program (and may or may not be sterilized). Future requirements: Future non-surgical feline fertility control options will require an alternative to ear tipping for identifying community cats, one that does not require anesthesia in order to mark the animal as treated. Long-term contraceptives (vs permanent sterilants) will also require a marker that can denote the time when a cat was last treated. Objectives and progress: To address this need, the Alliance for Contraception in Cats & Dogs is working with an interdisciplinary team from Cornell University, USA, to develop an effective, humane marking method. Their focus is a new generation of ear tag. The prototype design uses different shapes and materials, and a different application process, than tags used to date. The objective is to minimize tag weight, application discomfort, and likelihood of blood loss and infection, while simultaneously allowing for coding of information, including treatment time period.

**American Journal of Veterinary Research**

**Effect of ascorbic acid on storage of Greyhound erythrocytes**  

OBJECTIVE To assess changes in biochemical and biophysical properties of canine RBCs during cold (1° to 6°C) storage in a licensed RBC additive solution (the RBC preservation solution designated AS-1) supplemented with ascorbic acid. SAMPLE Blood samples from 7 neutered male Greyhounds; all dogs had negative results when tested for dog erythrocyte antigen 1.1. PROCEDURES Blood was collected into citrate-phosphate-dextrose and stored in AS-1. Stored RBCs were supplemented with 7.1mM ascorbic acid or with saline (0.9% NaCl) solution (control samples). Several biochemical and biophysical properties of RBCs were measured, including percentage hemolysis, oxygen-hemoglobin equilibrium, and the kinetic rate constants for O2 dissociation, carbon monoxide association, and nitric oxide dioxygenation. RESULTS Greyhound RBCs stored in AS-1 supplemented with ascorbic acid did not have significantly decreased hemolysis, compared with results for the control samples, during the storage period. CONCLUSIONS AND CLINICAL RELEVANCE In this study, ascorbic acid did not reduce hemolysis during storage. Several changes in stored canine RBCs were identified as part of the hypothermic storage lesion.

**Attenuation of the pressor response to exogenous angiotensin by angiotensin receptor blockers and benazepril hydrochloride in clinically normal cats.**  
Tiffany L. Jenkins, Amanda E. Coleman, Chad W. Schmidt, Scott A. Brown.

OBJECTIVE To compare the attenuation of the angiotensin I–induced blood pressure response by once-daily oral administration of various doses of angiotensin receptor blockers (irbesartan, telmisartan, and losartan), benazepril hydrochloride, or lactose monohydrate (placebo) for 8 days in clinically normal cats. ANIMALS 6 healthy cats (approx 17 months old) with surgically implanted arterial telemetric blood pressure–measuring catheters. PROCEDURES Cats were administered orally the placebo or each of the drug treatments (benazepril [2.5 mg/cat], irbesartan [6 and 10 mg/kg], telmisartan [0.5, 1, and 3 mg/kg], and losartan [2.5 mg/kg]) once daily for 8 days in a crossover study. Approximately 90 minutes after capsule administration on day 8, each cat
A preliminary study on the use and effect of hand antiseptics in veterinary practice.

Use of a formalised method for consensus and guideline development should be considered for other topics in veterinary medicine. To stimulate interest in and advancement of the understanding and management of cardiovascular disorders (CvRD) in veterinary medicine, the authors hope to formulate consensus statements regarding CvRD. Of the 13 candidate statements regarding CvRD in dogs and cats, 11 achieved consensus and 2 did not. The modified Delphi approach worked well to achieve consensus in an objective manner and to develop initial guidelines for CvRD. Among drug treatments, telmisartan (3 mg/kg dosage) attenuated ΔSBP to a significantly greater degree than benazepril and all other treatments. At 24 hours, telmisartan was more effective than benazepril (mean ± SEM ΔSBP, 15.7 ± 1.9 mm Hg vs 55.9 ± 12.42 mm Hg, respectively). 

CONCLUSIONS AND CLINICAL RELEVANCE Results indicated that telmisartan administration may have advantages over benazepril administration for cats with renal or cardiovascular disease.

Characteristics of canine platelet-rich plasma prepared with five commercially available systems.

Samuel P. Franklin, Bridget C. Garner, James L. Cook.

OBJECTIVE To characterize platelet-rich plasma (PRP) products obtained from canine blood by use of a variety of commercially available devices. SAMPLE Blood samples from 15 dogs between 18 months and 9 years of age with no concurrent disease, except for osteoarthritis in some dogs. PROCEDURES PRP products were produced from blood obtained from each of the 15 dogs by use of each of 5 commercially available PRP-concentrating systems. Complete blood counts were performed on each whole blood sample and PRP product. The degree of platelet, leukocyte, and erythrocyte concentration or reduction for PRP, compared with results for the whole blood sample, was quantified for each dog and summarized for each concentrating system. RESULTS The various PRP-concentrating systems differed substantially in the amount of blood processed, method of PRP preparation, amount of PRP produced, and platelet, leukocyte, and erythrocyte concentrations or reductions for PRP relative to results for whole blood. CONCLUSIONS AND CLINICAL RELEVANCE The characteristics of PRP products differed considerably. Investigators evaluating the efficacy of PRPs need to specify the characteristics of the product they are assessing. Clinicians should be aware of the data (or lack of data) supporting use of a particular PRP for a specific medical condition.

Journal of Small Animal Practice


OBJECTIVES - There is a growing understanding of the complexity of interplay between renal and cardiovascular systems in both health and disease. The medical profession has adopted the term “cardiorenal syndrome” (CRS) to describe the pathophysiological relationship between the kidney and heart in disease. CRS has yet to be formally defined and described by the veterinary profession and its existence and importance in dogs and cats warrant investigation. The CRS Consensus Group, comprising nine veterinary cardiologists and seven nephrologists from Europe and North America, sought to achieve consensus around the definition, pathophysiology, diagnosis and management of dogs and cats with “cardiovascular-renal disorders” (CvRD). To this end, the Delphi formal methodology for defining/building consensus and defining guidelines was utilised. METHODS - Following a literature review, 13 candidate statements regarding CvRD in dogs and cats were tested for consensus, using a modified Delphi method. As a new area of interest, well-designed studies, specific to CRS/CvRD, are lacking, particularly in dogs and cats. Hence, while scientific justification of all the recommendations was sought and used when available, recommendations were largely reliant on theory, expert opinion, small clinical studies and extrapolation from data derived from other species. RESULTS - Of the 13 statements, 11 achieved consensus and 2 did not. The modified Delphi approach worked well to achieve consensus in an objective manner and to develop initial guidelines for CvRD. DISCUSSION - The resultant manuscript describes consensus statements for the definition, classification, diagnosis and management strategies for veterinary patients with CvRD, with an emphasis on the pathological interplay between the two organ systems. By formulating consensus statements regarding CvRD in veterinary medicine, the authors hope to stimulate interest in and advancement of the understanding and management of CvRD in dogs and cats. The use of a formalised method for consensus and guideline development should be considered for other topics in veterinary medicine.

A preliminary study on the use and effect of hand antiseptics in veterinary practice.
K. P. Sparksman, T. G. Knowles, G. Werrett and P. E. Holt

OBJECTIVES - To assess use and effect of hand antiseptics in veterinary clinical practice. MATERIALS AND METHODS - Veterinary practice nurses were questioned concerning their use of hand antiseptics, in particular waterless hand rubs. Subsequent clinical trials assessed the effect of single applications of alcohol-based and quaternary ammonium compound-based hand rubs at reducing bacterial counts on the hands of theatre nurses in a neutering clinic. RESULTS - The majority of responding practices used waterless hand rubs (alcohol-based, 67.5% and quaternary ammonium compound-based, 9.5%) as their primary hand hygiene agent and believed them to be effective. 23% of practices favoured an antiseptic hand-wash. In clinical trials, alcohol-based rubs were potentially more effective at reducing bacterial counts than quaternary ammonium compound-based rubs especially in the period immediately after application. However, over 3 hours there was no significant change between these and a control group. There were more adverse skin effects in the group using alcohol-based than in the quaternary ammonium compound-based and control groups. The bacterial counts after application were unaffected by variables such as the number of animals contacted. CLINICAL SIGNIFICANCE The studies provide useful baseline data for evaluation of efficacy of more frequent applications of the most common antiseptic hand rubs used in veterinary practice.

Ureteral implantation using a three-stitch ureteroneocystostomy: description of technique and outcome in nine dogs.

K. M. Pratschke

OBJECTIVE - To report the procedure, postoperative outcome and complications of a new technique for ureteral implantation by means of a three-stitch ureteroneocystostomy in dogs. MATERIALS AND METHODS - Clinical records of dogs requiring ureteral implantation between April 2007 and June 2013 were retrospectively reviewed. Data retrieved included signalment, preoperative biochemistry results, details of the surgical procedure, perioperative and postoperative complications, postoperative biochemistry results and outcome. RESULTS - Nine dogs fulfilled the inclusion criteria. Follow-up times ranged from 10 to 79 months (median 30 months), with 8 of 9 dogs having an excellent long-term outcome and no major postoperative complications. One dog with follicular cystitis as a comorbidity developed obstruction from inflammatory granuloma and required revision surgery. CLINICAL SIGNIFICANCE - The three-stitch technique for ureteral implantation compares favourably to previously documented techniques in terms of outcome and complication rates. Reduced tissue handling and a decreased volume of suture material may be beneficial for healing. The technique is also faster than previously described options, which may be of benefit in unstable patients requiring ureteral implantation due to traumatic injury or rupture.

Prevalence of canine infectious respiratory pathogens in asymptomatic dogs presented at US animal shelters.

R. Lavan and O. Knesl

OBJECTIVES - To determine the prevalence of nine canine infectious respiratory disease (CIRD) pathogens in asymptomatic dogs presented at animal shelters across the United States. METHODS - Ocular and oronasal swabs from asymptomatic dogs (n = 503) were tested using qPCR assay for Bordetella bronchiseptica, canine adenovirus type 2 (CAV-2), canine distemper virus (CDV), canine herpesvirus type 1 (CHV), canine influenza virus (CIV), canine parainfluenza virus (CPIV), canine respiratory coronavirus (CRCoV), Mycoplasma cynos and Streptococcus equi subsp zooepidemicus. RESULTS - A total of 240 (47.7%) asymptomatic dogs were PCR-positive for at least one CIRD pathogen. Prevalence of two-, three-, four-, and five-pathogen cases was 12.7, 3.8, 1.8, and 0.4%, respectively. Mycoplasma cynos (29.2%), B. bronchiseptica (19.5%), CAV-2 (12.5%), CDV (7.4%) and CPIV (3.2%) were the most commonly detected pathogens. CLINICAL SIGNIFICANCE The prevalence of traditional and newly emerging pathogens associated with CIRD is poorly defined in clinically healthy dogs. This study determined that a high percentage of asymptomatic shelter dogs harbor CIRD pathogens, including the newly emerging pathogen M. cynos and the historically prevalent pathogen B. bronchiseptica.

Dystrophin-deficient muscular dystrophy in two lurcher siblings.

C. Giannasi, S.W. Tappin, L.T. Guo, G.D. Shelton and V. Palus

Two cases of dystrophin-deficient muscular dystrophy in 16-week-old male lurcher siblings are reported. The myopathies were characterised by regurgitation, progressive weakness and muscle wastage. The dogs had generalised weakness in all four limbs, with more pronounced weakness in the pelvic limbs. Reduced withdrawal in all limbs, muscle contracture and lingual hypertrophy were noted. Serum creatine kinase activities
were markedly elevated. Electromyographic abnormalities included fibrillation potentials. Histopathological and immunohistochemical staining were consistent with dystrophin-deficient muscular dystrophy. Clinical improvement was noted in one of the cases with l-carnitine supplementation and supportive therapy. Genetic transmission of the disease was postulated as the dogs were siblings.

**Spontaneous linear gastric tears in a cat.**
M. Gualtieri, D. Olivero and C. Costa Devoti
An 11-year-old female cat presented for chronic vomiting. Endoscopy revealed an altered gastric mucosa and spontaneous formation of linear gastric tears during normal organ insufflations. The histopathological diagnosis was atrophic gastritis with Helicobacter pylori infection. Medical treatment permitted a complete resolution of clinical signs. The linear tears observed resembled gastric lesions rarely reported in humans, called “Mallory-Weiss syndrome”. To the authors’ knowledge this is the first report of spontaneous linear gastric tears in animals.

**Polycystic kidney disease in four British shorthair cats with successful treatment of bacterial cyst infection.**
R. Nivy, L. A. Lyons, I. Aroch and G. Segev
Polycystic kidney disease is the most common inherited disorder in cats. Renal cysts progressively increase in size and number, resulting in a gradual decrease in kidney function. An autosomal dominant mutation in exon 29 of the polycystin-1 gene has been identified, mostly in Persian and Persian-related breeds. This case study describes polycystic kidney disease in four British shorthair cats, of which two had the same genetic mutation reported in Persian and Persian-related cats. This likely reflects introduction of this mutation into the British shorthair breeding line because of previous outcrossing with Persian cats. An infected renal cyst was diagnosed and successfully treated in one of the cats. This is a commonly reported complication in human polycystic kidney disease, and to the authors’ knowledge has not previously been reported in cats with polycystic kidney disease.

**Journal of the American Veterinary Medical Association - Sep 15**

**Transfusion practices for treatment of dogs hospitalized following trauma: 125 cases (2008-2013).**
Lynch AM, O'Toole TE, Respess M.
Objective-To describe transfusion practices for treatment of dogs hospitalized because of traumatic injuries.
Design-Retrospective case series. Animals-125 client-owned dogs. Procedures-Medical records of dogs that sustained trauma and were hospitalized for ≥ 24 hours after emergency stabilization were reviewed. Admission characteristics and transfusion-specific data were assessed. Receiver operating characteristic curves were plotted to evaluate diagnostic utility of PCV and serum total solids concentration as predictors of transfusion in the study population. Results-45 of 125 (36%) dogs received transfusions. Packed RBCs were the most commonly administered blood product (42/45 [93%]). Common reasons for transfusion included perioperative hemodynamic support and treatment of shock or worsening anemia. Dogs that underwent transfusion had higher mean heart rate, blood lactate concentration, and animal trauma triage scores, with lower mean PCV, serum total solids concentration, and rectal temperature at admission than dogs that did not undergo transfusion. Total solids concentration and PCV at admission were specific but insensitive predictors of subsequent transfusion. Most (109/125 [87%]) dogs survived to hospital discharge. Significantly fewer dogs that had transfusions survived, compared with dogs that did not have transfusions. Seven of 10 dogs that received massive transfusions survived to discharge. Conclusions and Clinical Relevance-Apparent clinical triggers for the decision to perform blood transfusion in dogs hospitalized following traumatic injury included evidence of shock or worsening anemia on admission and requirement for perioperative hemodynamic optimization. Although dogs that received transfusions had a lower survival rate than dogs that did not, this was likely attributable to greater severity of injuries in the transfusion group.

**Transfusion practices for treatment of dogs undergoing splenectomy for splenic masses: 542 cases (2001-2012).**
Lynch AM, O'Toole TE, Hamilton J.
Objective-To describe transfusion practices for treatment of dogs undergoing splenectomy for splenic masses.
Design-Retrospective case series. Animals-542 client-owned dogs. Procedures-Medical records of dogs that underwent splenectomy for splenic masses at 2 referral institutions were reviewed. Variables of interest were
compared between dogs that did and did not undergo transfusion. Multiple logistic regression analysis was performed to assess associations of transfusion with death during hospitalization and with 30- and 180-day survival rates. Results—Transfusions were administered to 240 of 542 (44%) dogs; packed RBCs were the most frequently administered blood product. On admission, dogs that subsequently received transfusions had higher mean illness severity score, heart rate, respiratory rate, blood lactate concentration, and prothrombin time, with lower mean PCV, platelet count, serum total solids and albumin concentrations, and base deficit than dogs that did not receive transfusions. Hemoperitoneum and malignancy, especially hemangiosarcoma, were more common in the transfusion group. Overall, 500 of 542 (92%) dogs survived to discharge. Dogs that received transfusions had higher odds of death or euthanasia while hospitalized and lower odds of surviving to 30 or 180 days after hospital discharge than dogs that did not. Conclusions and Clinical Relevance—Evidence of shock, anemia, and hypocoagulability were apparent triggers for the decision to perform blood transfusion in dogs undergoing splenectomy for splenic masses and were likely attributable to hemoperitoneum and related hypovolemia. Dogs undergoing transfusion more commonly had malignant disease and had greater odds of poor long-term outcome, compared with dogs that did not undergo transfusion.

Prevalence and underlying causes of histologic abnormalities in cats suspected to have chronic small bowel disease: 300 cases (2008-2013).
Norsworthy GD, Estep JS, Hollinger C, Steiner JM, Lavallee JO, Gassler LN, Restine LM, Kiupel M.
Objective—To determine prevalence of histologic abnormalities in cats suspected, on the basis of compatible clinical signs and ultrasonographic findings, to have chronic small bowel disease; identify the most common underlying causes in affected cats; and compare methods for differentiating among the various causes of chronic small bowel disease. Design—Retrospective case series. Animals—300 client-owned domestic cats suspected to have chronic small bowel disease. Procedures—Medical records were reviewed to identify cats evaluated because of chronic vomiting, chronic small bowel diarrhea, or weight loss that also had ultrasonographic evidence of thickening of the small intestine. Cats were included in the study if full-thickness biopsy specimens had been obtained from ≥3 locations of the small intestine by means of laparotomy and biopsy specimens had been examined by means of histologic evaluation and, when necessary to obtain a diagnosis, immunohistochemical analysis and a PCR assay for antigen receptor rearrangement. Results—Chronic small bowel disease was diagnosed in 288 of the 300 (96%) cats. The most common diagnoses were chronic enteritis (n = 150) and intestinal lymphoma (124). Conclusions and Clinical Relevance—Results indicated that a high percentage of cats with clinical signs of chronic small bowel disease and ultrasonographic evidence of thickening of the small intestine had histologic abnormalities. Furthermore, full-thickness biopsy specimens were useful in differentiating between intestinal lymphoma and chronic enteritis, but such differentiation was not possible with ultrasonography or clinicopathologic testing alone.

Journal of the American Veterinary Medical Association - Sep 1

Evaluation of total dietary fiber concentration and composition of commercial diets used for management of diabetes mellitus, obesity, and dietary fat-responsive disease in dogs.
Farcas AK, Larsen TA, Owens TJ, Nelson RW, Kass PH, Fascetti AJ.
Objective—To determine total dietary fiber (TDF) concentration and composition of commercial diets used for management of obesity, diabetes mellitus, and dietary fat-responsive disease in dogs. Design—Cross-sectional study. Sample—Dry (n = 11) and canned (8) canine therapeutic diets. Procedures—Insoluble and soluble dietary fiber (IDF and SDF), high-molecular-weight SDF (HMWSDF), and low-molecular-weight SDF (LMWSDF) concentrations were determined. Variables were compared among diets categorized by product guide indication, formulation (dry vs canned), and regulatory criteria for light and low-fat diets. Results—SDF (HMWSDF and LMWSDF) comprised a median of 30.4% (range, 9.4% to 53.7%) of TDF; LMWSDF contributed a median of 11.5% (range, 2.7% to 33.8%) of TDF. Diets for diabetes management had higher concentrations of IDF and TDF with lower proportions of SDF and LMWSDF contributing to TDF, compared with diets for treatment of fat-responsive disease. Fiber concentrations varied within diet categories and between canned and dry versions of the same diet (same name and manufacturer) for all pairs evaluated. Diets classified as light contained higher TDF and IDF concentrations than did non-light diets. All canned diets were classified as low fat, despite providing up to 38% of calories as fat. Conclusions and Clinical Relevance—Diets provided a range of TDF concentrations and compositions; veterinarians should request TDF data from manufacturers, if not otherwise available. Consistent responses to dry and canned versions of the same diet cannot necessarily be expected, and
diets with the same indications may not perform similarly. Many diets may not provide adequate fat restriction for treatment of dietary fat-responsive disease.

**Salmonella bacteriuria in a cat fed a Salmonella-contaminated diet.**
Fauth E, Freeman LM, Cornjoe L, Markovich JE, Janecko N, Weese JS.
Case Description-A 9-year-old castrated male domestic shorthair cat was evaluated because of hematuria and weight loss after an 8-year history of intermittent signs of feline lower urinary tract disease (FLUTD). A complete diet history revealed that the cat was eating a commercial diet that does not undergo the same processing procedures as most pet foods and so might be at increased risk for bacterial contamination owing to a nonstandard industry cooking procedure. Clinical Findings-The cat had a history consistent with FLUTD, but bacteriologic culture of the urine revealed Salmonella organisms. Additional analysis revealed Salmonella enterica serotype I:ROUGH-O:G,M,S:- in samples of urine and feces as well as Salmonella enterica serotype Johannesburg and Salmonella enterica serotype Senftenberg in the diet. Treatment and Outcome-The cat responded positively to antimicrobial treatment for the Salmonella bacteriuria as well as to dietary and environmental management for the clinical signs associated with FLUTD. Clinical Relevance-Findings in this case highlighted an additional health consequence associated with ingestion of Salmonella-contaminated food. Such contamination is of particular concern with raw meat-based diets or diets that have not undergone standard industry cooking practices. Veterinarians should obtain a diet history for every companion animal during every evaluation to help with diagnosis and optimal treatment.

**Respective associations between ureteral obstruction and renomegaly, urine specific gravity, and serum creatinine concentration in cats: 29 cases (2006-2013).**
Bua AS, Dunn ME, Pey P.
Objective-To determine the respective associations between ureteral obstruction and renomegaly, urine specific gravity (USG), and serum creatinine concentration and to assess the reliability of abdominal palpation for detection of renomegaly in cats. Design-Retrospective case series. Animals-89 client-owned cats with (n = 29) or without ureteral obstruction and with (30) or without (30) kidney disease. Procedures-Medical records of cats that underwent abdominal ultrasonography at a veterinary teaching hospital from January 2006 through April 2013 were reviewed. Cats were categorized as having ureteral obstruction (obstructed group) or no ureteral obstruction with (KD group) or without kidney disease (NKD group). Renomegaly and renal asymmetry were defined on the basis of mean renal length for NKD cats. Prevalence of renomegaly and renal asymmetry, mean USG and serum creatinine concentration, and abdominal palpation and ultrasonographic findings were compared among the groups. Results-Renomegaly was identified in 2 obstructed cats and 1 KD cat and was not associated with ureteral obstruction. Renal asymmetry was detected in 18 obstructed cats and 11 KD cats. For obstructed and KD cats, the mean USG was significantly lower and the mean serum creatinine concentration was significantly greater than those for NKD cats. Twenty-eight of 29 cats with ureteral obstruction had hypercreatininemia. Abdominal palpation was not a reliable method for detection of renomegaly. Conclusions and Clinical Relevance-Results indicated renomegaly was not associated with ureteral obstruction in cats, and abdominal palpation was an unreliable method for detection of renomegaly. The most consistent abnormal finding for cats with ureteral obstruction was hypercreatininemia.

**Comparison of foods with differing nutritional profiles for long-term management of acute nonobstructive idiopathic cystitis in cats.**
Kruger JM, Lulich JP, MacLeay J, Merrills J, Paetau-Robinson I, Brejda J, Osborne CA.
Objective-To evaluate the effect of nutrition on recurrent clinical signs of lower urinary tract (LUT) disease in cats with idiopathic cystitis. Design-Randomized, controlled, masked clinical trial. Animals-31 cats with acute nonobstructive idiopathic cystitis. Procedures-Cats were assigned to receive 1 of 2 foods (a cystitis prevention or control food) that differed in mineral (calcium, phosphorous, and magnesium), antioxidant, and fatty acid profiles. Owners documented LUT signs daily for up to 1 year. The primary endpoint was the number of recurrent episodes in which a cat had multiple (≥ 2 concurrent) LUT signs within a day (defined as multiple-sign day). Consecutive days in which a cat had multiple LUT signs were considered as a single episode. Results-4 cats fed prevention food and 2 cats fed control food were excluded from analysis because of noncompliance, gastrointestinal signs, food refusal, or owner voluntary withdrawal. The proportion of cats fed prevention food that had ≥ 1 recurrent episode of multiple-sign days (4/11) was not significantly lower than that of cats fed control food (9/14). However, cats fed prevention food had significantly lower mean incidence rates for recurrent episodes of multiple-sign days (0.7 episodes/1,000 cat-days) and episodes of hematuria (0.3
episodes/1,000 cat-days), dysuria (0.2 episodes/1,000 cat-days), and stranguria (0.2 episodes/1,000 cat-days) as single LUT signs, compared with cats fed control food (5.4, 3.4, 3.1, and 3.8 episodes/1,000 cat-days, respectively). Significantly fewer cats fed prevention food required analgesics (4/11), compared with cats fed control food (12/14). Conclusions and Clinical Relevance—Foods with differing nutritional profiles appeared to impact mean incidence rates of recurrent feline idiopathic cystitis-associated signs.

**Journal of Veterinary Internal Medicine**

**Serial Evaluation of Abdominal Fluid and Serum Amino-terminal pro-C-type Natriuretic Peptide in Dogs with Septic Peritonitis**

L.V.S. Guieu, A.M.E. Bersenas, M.K. Holowaychuk, B.A. Brisson and J.S. Weese

Background Serum N-terminal pro-C-natriuretic peptide (NT-proCNP) has shown promise as a diagnostic biomarker for sepsis. Its sensitivity to detect dogs with septic peritonitis (SP) is reportedly low, perhaps attributable to the compartmentalization of NT-proCNP in the abdominal cavity. Objectives To evaluate the use of an ELISA for the measurement of NT-proCNP in canine abdominal fluid and to describe the peri-operative pattern of abdominal fluid and serum NT-proCNP concentrations in dogs with SP. Animals Five client-owned dogs with nonseptic abdominal effusion of varying etiologies and 12 client-owned dogs with SP undergoing abdominal surgery and placement of a closed-suction abdominal drain (CSAD). Six dogs were included upon hospital admission; 6 were included the day after surgery. Methods Prospective pilot study. A commercially available ELISA kit was analytically validated for use on canine abdominal fluid. The NT-proCNP concentrations were measured in the abdominal fluid of control dogs, and in serum and abdominal fluid of dogs with SP from admission for CSAD removal. Results In dogs with SP, admission abdominal fluid NT-proCNP concentrations were lower than the concurrent serum concentrations (P = 0.031), and lower than control canine abdominal fluid concentrations (P = 0.015). Postoperatively, abdominal fluid NT-proCNP concentrations remained lower than serum concentrations (P < 0.050), except on day 4. Conclusions and Clinical Importance The ELISA kit was able to measure NT-proCNP in canine abdominal fluid. In dogs with SP, low serum NT-proCNP concentrations cannot be explained by abdominal compartmentalization.


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Background Acquired myasthenia gravis (MG) in cats most commonly causes generalized weakness without megaesophagus and is more often associated with a cranial mediastinal mass, compared to dogs. Hypothesis/Objectives To extend the clinical findings described in the report of 2000 on MG in cats (J Am Vet Med Assoc 215:55–57). Animals Two hundred and thirty-five cats with MG. Methods Retrospective case study to evaluate the long-term outcome and incidence of spontaneous remission in myasthenic cats. Information including signalment, clinical presentation, presence of and type of cranial mediastinal mass, treatment including surgical versus medical, survival time, and outcome including spontaneous remissions was collected and analyzed in cats diagnosed at the Comparative Neuromuscular Laboratory, University of California San Diego by detection of acetylcholine receptor antibody titers >0.3 nmol/L by immunoprecipitation radioimmunoassay. Results Acquired MG in cats is associated with a euthanasia rate of 58%. Abyssinian and Somali cats had an increased incidence of MG compared to mixed breed cats or cats of other breeds. A cranial mediastinal mass, most commonly thymoma, was observed in 52% of the cats, which is higher than in the previous report. Spontaneous remission is not a characteristic of MG in cats. Conclusions and clinical importance Myasthenia gravis in cats is a chronic disease associated with a high incidence of a cranial mediastinal mass. Spontaneous remission is not common and clinicians should warn owners of the necessity for long-term treatment. The clinical outcome with a cranial mediastinal mass did not differ between surgical or medical treatment.

**Pathologic Manifestations on Surgical Biopsy and Their Correlation with Clinical Indices in Dogs with Degenerative Mitral Valve Disease**

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Background Evaluation of myocardial function is clinically challenging in dogs with degenerative mitral valve disease (DMVD). Although myocardial dysfunction is caused by pathologic degeneration, histopathologic progression is poorly understood. Objectives To characterize myocardial and pulmonary pathologic changes according to severity in dogs with naturally occurring DMVD, and to investigate whether or not pathologic degeneration is reflected by traditional clinical indices. Animals One hundred and seventeen dogs with naturally
occuring DMVD. Methods Prospective observational study. Biopsied left atrium (LA), left ventricle (LV), and lung were evaluated histologically, and an attempt was made to correlate pathologic findings with clinical indices. Results Severe myocardial changes were observed in all International Small Animal Cardiac Health Council classes. In the lung, heart failure cell levels were significantly increased in class III patients (P < .0001). In a paired comparison, the LA showed significantly more severe degeneration than the LV, including myocardial fatty replacement, immune cell infiltration, and interstitial fibrosis (P < .0001). In contrast, myocardial cells were more hypertrophied in the LV than in the LA (P < .0001). Left ventricular end-diastolic dimension (LVEDD) was associated with fatty replacement (P = .033, R2 = 0.584) and myocardial vacuolization (P = .003, R2 = 0.588) in the LA. Conclusions and Clinical Importance In DMVD, although severe pathologic changes may be evident even in early stages, there may be pathologic discrepancy between the LA and the LV. Myocardial degeneration may be reflected by clinical indices such as LVEDd and EF.

**Effect of a Limited Iodine Diet on Iodine Uptake by Thyroid Glands in Hyperthyroid Cats**

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Background The effect of feeding a limited iodine diet on radioactive iodine uptake in the thyroid glands of hyperthyroid cats is unknown. Objectives To determine how feeding limited dietary iodine affects radioactive iodine uptake by the thyroid glands of hyperthyroid cats. Animals Eight geriatric cats with spontaneous hyperthyroidism. Methods Prospective study of eight client owned hyperthyroid cats fed a commercially available iodine limited diet for 6 months. Clinical signs were evaluated and TT4 and fT4 were measured during consumption of the diet. Results Median serum TSH concentration in the hyperthyroid cats (<0.03 ng/mL) was significantly lower than concentrations in clinically normal cats (0.05 ng/mL) or euthyroid cats with suspected thyroid disease (0.06 ng/mL). Only 18 (2.0%) hyperthyroid cats had measurable TSH concentrations (≥0.03 ng/mL), whereas 114 (69.9%) of the 163 euthyroid cats had detectable concentrations. Combining serum TSH with TT4 or fT4 concentrations lowered the test sensitivity of TSH from 98.0 to 97.0%, but markedly increased overall test specificity (from 69.9 to 98.8%). Conclusions and Clinical Importance Limited iodine diets increase iodine uptake of 131I by the thyroid glands of hyperthyroid cats. Further studies are necessary to determine if consumption of a limited iodine diet changes sensitivity of the thyroid gland to 131I treatment.

**Evaluation of Serum Thyroid-Stimulating Hormone Concentration as a Diagnostic Test for Hyperthyroidism in Cats**

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Background In humans, measurement of serum thyroid-stimulating hormone (TSH) concentration is commonly used as a first-line discriminatory test of thyroid function. Recent reports indicate that canine TSH (cTSH) assays can be used to measure feline TSH and results can help diagnose or exclude hyperthyroidism. Objectives To determine the usefulness of cTSH measurements as a diagnostic test for cats with hyperthyroidism. Animals Nine hundred and seventeen cats with untreated hyperthyroidism, 32 euthyroid cats suspected of having hyperthyroidism, and 131 clinically normal cats. Methods Prospective study. Cats referred to the Animal Endocrine Clinic for suspected hyperthyroidism were evaluated with serum T4, T3, free T4 (fT4), and TSH concentrations. Thyroid scintigraphy was used as the gold standard to confirm or exclude hyperthyroidism. Results Median serum TSH concentration in the hyperthyroid cats (<0.03 ng/mL) was significantly lower than concentrations in clinically normal cats (0.05 ng/mL) or euthyroid cats with suspected thyroid disease (0.06 ng/mL). Only 18 (2.0%) hyperthyroid cats had measurable TSH concentrations (≥0.03 ng/mL), whereas 114 (69.9%) of the 163 euthyroid cats had detectable concentrations. Combining serum TSH with TT4 or fT4 concentrations lowered the test sensitivity of TSH from 98.0 to 97.0%, but markedly increased overall test specificity (from 69.9 to 98.8%). Conclusions and Clinical Importance Serum TSH concentrations are suppressed in 98% of hyperthyroid cats, but concentrations are measurable in a few cats with mild-to-moderate hyperthyroidism. Measurement of serum TSH represents a highly sensitive but poorly specific test for diagnosis of hyperthyroidism and is best measured in combination with TT4 and fT4.

**Evaluation of the Cortisol-to-ACTH Ratio in Dogs with Hypoadrenocorticism, Dogs with Diseases Mimicking Hypoadrenocorticism and in Healthy Dogs**

Background The adrenocorticotropic hormone (ACTH) stimulation test is the gold standard for diagnosing hypoadrenocorticism (HA) in dogs. However, problems with the availability of synthetic ACTH (tetracosactrin/cosyntropin) and increased costs have prompted the need for alternative methods. Objectives To prospectively evaluate the cortisol-to-ACTH ratio (CAR) as a screening test for diagnosing canine HA. Animals Twenty three dogs with newly diagnosed HA; 79 dogs with diseases mimicking HA; 30 healthy dogs. Methods Plasma ACTH and baseline cortisol concentrations were measured before IV administration of 5 µg/kg ACTH in all dogs. CAR was calculated and the diagnostic performance of ACTH, baseline cortisol, CAR and sodium-to-potassium ratios (SPRs) was assessed based on receiver operating characteristics (ROC) curves calculating the area under the ROC curve. Results The CAR was significantly lower in dogs with HA compared to that in healthy dogs and in those with diseases mimicking HA (P < .0001). There was an overlap between HA dogs and those with HA mimicking diseases, but CAR still was the best parameter for diagnosing HA (ROC AUC 0.998), followed by the ACTH concentration (ROC AUC 0.97), baseline cortisol concentration (ROC AUC 0.96), and SPR (ROC AUC 0.86). With a CAR of >0.01 the diagnostic sensitivity and specificity were 100% and 99%, respectively. Conclusion and Clinical Importance Calculation of the CAR is a useful screening test for diagnosing primary HA. As a consequence of the observed overlap between the groups, however, misdiagnosis cannot be completely excluded. Moreover, additional studies are needed to evaluate the diagnostic reliability of CAR in more dogs with secondary HA.

Incidence of Diabetes Mellitus in Insured Swedish Cats in Relation to Age, Breed and Sex
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Background Diabetes mellitus (DM) is a common endocrinopathy in cats. Most affected cats suffer from a type of diabetes similar to type 2 diabetes in humans. An increasing prevalence has been described in cats, as in humans, related to obesity and other lifestyle factors. Objectives To describe the incidence of DM in insured Swedish cats and the association of DM with demographic risk factors, such as age, breed and sex. Animals A cohort of 504,688 individual cats accounting for 1,229,699 cat-years at risk (CYAR) insured by a Swedish insurance company from 2009 to 2013. Methods We used reimbursed insurance claims for the diagnosis of DM. Overall incidence rates and incidence rates stratified on year, age, breed, and sex were estimated. Results The overall incidence rate of DM in the cohort was 11.6 cases (95% confidence interval [CI], 11.0–12.2) per 10,000 CYAR. Male cats had twice as high incidence rate (15.4; 95% CI, 14.4–16.4) as females (7.6; 95% CI, 6.9–8.3). Domestic cats were at higher risk compared to purebred cats. A significant association with breed was seen, with the Burmese, Russian Blue, Norwegian Forest cat, and Abyssinian breeds at a higher risk compared to other cats. No sex predisposition was found among Burmese cats. Several breeds with a lower risk of DM were identified. Conclusions and clinical importance Our results verify that the Burmese breed is at increased risk of developing DM. We also identified several previously unreported breeds with increased or decreased risk of DM.

Disposition of Extended Release Levetiracetam in Normal Healthy Dogs After Single Oral Dosing
M.J. Beasley and D.M. Boothe
Background Levetiracetam is an anticonvulsant used for control of canine epilepsy. An extended release preparation should improve dosing convenience. Objectives To determine the disposition of extended release levetiracetam in normal dogs after single dosing. Animals Pharmacokinetic study: 16 healthy, adult dogs. Methods Using a partially randomized crossover study, levetiracetam (30 mg/kg) was administered intravenously (IV) and orally (PO) as extended release preparation with or without food. Blood was collected for 24 hours (IV) or 36 hours (PO). Serum levetiracetam was quantitated by immunoassay and data were subjected to noncompartmental analysis. Results Pharmacokinetic parameters for fasted versus fed animals, respectively, were (mean ± SEM): Cmax = 26.6 ± 2.38 and 30.7 ± 2.88 µg/mL, Tmax = 204.3 ± 18.9 and 393.8 ± 36.6 minutes, t1/2 = 4.95 ± 0.55 and 4.48 ± 0.48 hours, MRT = 9.8 ± 0.72 and 10 ± 0.64 hours, MAT = 4.7 ± 0.38 and 5.6 ± 0.67 hours, and F = 1.04 ± 0.04 and 1.26 ± 0.07%. Significant differences were limited to Tmax (longer) and F (greater) in fed compared to fasted animals. Serum levetiracetam concentration remained above 5 µg/mL for approximately 20 hours in both fasted and fed animals. Conclusions and Clinical Importance Extended release levetiracetam (30 mg/kg q12h), with or without food, should maintain concentrations above the recommended minimum human therapeutic concentration.

Low-Field Magnetic Resonance Imaging and Multislice Computed Tomography for the Detection of Cervical Syringomyelia in Dogs
Background Syringomyelia (SM) is defined as the presence of fluid-containing cavities within the parenchyma of the spinal cord. Sagittal magnetic resonance (MR) images have been described as the preferred technique for visualizing SM in dogs and humans. Objective To investigate whether computed tomography (CT) can be used to diagnose SM. Animals Thirty-two client-owned dogs referred for investigation of the cervical spine on magnetic resonance imaging (MRI) and CT. Methods Two reviewers retrospectively analyzed sagittal and transverse T1-weighted spin echo (T1WSE) MR images and CT images from each dog for the presence of SM and, if SM was present, the width (mm, syrinx width [SW]) was measured. The results were analyzed statistically. Results For the presence of SM there was a moderate interobserver agreement for MR (81%, $\kappa = 0.54$) and almost perfect agreement for CT (94%, $\kappa = 0.87$). There was a moderate intramodality agreement for both observers (observer 1 81%, $\kappa = 0.59$; observer 2 81%, $\kappa = 0.57$). For measurement of SW the repeatability was the best on the midsagittal T1WSE images (95% repeatability coefficient <0.52 mm) and the reproducibility was the best on midsagittal images in both modalities (95% limits of agreement −0.55–0.45; $P = 0.002$). Conclusion and Clinical Importance Both techniques can be used to detect SM. Midsagittal MR and CT images are best used for measuring SW. Computed tomography can be used as a diagnostic tool for SM when MRI is not available, but CT cannot replace MRI as the standard screening technique for the detection of SM in Cavalier King Charles Spaniel for breeding purposes.

Quantitation of the Regional Lymph Node Metastatic Burden and Prognosis in Malignant Mammary Tumors of Dogs
M.R. de Araújo, L.C. Campos, E. Ferreira and G.D. Cassali
Background As in women, regional lymph node status impacts survival in dogs with malignant mammary tumors. However, few studies have evaluated regional lymph node metastases in dogs with malignant mammary gland tumors. Objectives To estimate overall survival based on the assessments of the lymph node status and the morphologic and morphometric features in female dogs with malignant mammary gland tumors. Materials and Methods In total, 178 lymph nodes from 97 female dogs were assessed and reviewed, and after confirmation by immunohistochemistry (IHC), 161 lymph nodes were selected for analysis of metastases. Animals were considered metastasis-free (negative lymph nodes) only after IHC analysis for cytokeratin AE1/AE3. The number of positive lymph nodes, the number of metastatic foci, the maximum diameter and the area of metastasis were analyzed, and estimates of overall survival were made. Results Dogs with metastasis had lower mean survival than those with metastasis-free regional lymph nodes, showing a direct relationship between the number of affected lymph nodes and shorter survival. However, histologic analysis of the lymph nodes identified lower survival rates in animals with macrometastases and isolated tumor cells, areas of metastasis >20.11 mm², and metastatic diameters >7.32 mm. Conclusion The identification of ≥1 lymph nodes positive for metastasis and morphometric characterization of lymphatic metastases indicate the prognostic relevance of lymph node status in dogs with mammary tumors.

Electroporation Enhances Bleomycin Efficacy in Cats with Periocular Carcinoma and Advanced Squamous Cell Carcinoma of the Head
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Background Advanced carcinoma of the head represents a substantial health problem in cats for local control and overall survival. Objectives Evaluate the capability of electrochemotherapy (ECT) to improve bleomycin efficacy in cats with periocular carcinoma and advanced carcinoma of the head. Animals Twenty-one cats with periocular carcinoma (17 squamous cell carcinoma [SCC] and 4 anaplastic carcinoma) and 26 cats with advanced SCC of the head. Methods Nonrandomized prospective controlled study. Periocular carcinoma cohorts: 12 cats were treated with bleomycin (15 mg/m² IV) coupled with ECT under anesthesia; 9 cats were treated with bleomycin alone. Advanced head SCC cohorts: 14 cats were treated with bleomycin (15 mg/m² IV) coupled with ECT administered under sedation; 12 control cats were treated with bleomycin alone. ECT treatments (2–8) were performed every other week until complete remission (CR) or tumor progression occurred. Results Toxicities were minimal and mostly treated symptomatically. Overall response rate in the ECT treated animals was 89% (21 Complete Response [CR] and 2 Partial Response [PR]) whereas controls had response rate of 33% (4 CR and 3 PR). Median time to progression in ECT group was 30.5 months, whereas in controls it was 3.9 months ($P < .0001$). Median time to progression for ECT cohorts was 24.2 months for periocular cohort and 20.6 in advanced head SCC cohort, respectively. Conclusions Electrochemotherapy is well tolerated for advanced SCC of the head in cats; its use may be considered among loco-regional strategies for cancer therapy in sensitive body regions such as periocular region.
Evaluation of Iron Deficiency Using Reticulocyte Indices in Dogs Enrolled in a Blood Donor Program
D.S. Foy, K.R. Friedrichs and J.F. Bach
Background People donating blood more than twice annually are at risk of developing iron deficiency. Little is known about the iron status of dogs enrolled in blood donor programs. Hypothesis Dogs donating blood ≥6 times annually will show evidence of iron deficiency based on their reticulocyte indices. Animals Thirteen dogs enrolled in a blood donor program donating ≥6 times over the preceding 12 months and 20 healthy non-donor control dogs. Methods Prospective observational study. Mature red blood cell (RBC) indices, reticulocyte indices, serum iron, serum ferritin, and total iron-binding capacity (TIBC) were compared between groups. Results Packed cell volume (median 47%, range 40–52%, P < .01), hematocrit (median 46.4%, range 40.3–52.5%, P < .01), and reticulocyte count (median 16,000/µL, range 9,000–38,000/µL, P < .01) were significantly lower in the blood donor dogs. No statistically significant differences were noted in the mature RBC indices between groups. Both reticulocyte mean corpuscular volume (median 88.8 fl, range 83.4–95.5 fl, P = .03) and reticulocyte hemoglobin content (median 24.6 pg, range 23.1–26.6 pg, P < .01) were significantly lower in the blood donor group. Serum iron and ferritin were similar between groups; however, TIBC was significantly higher in the control group (median 403 µg/dL, range 225–493 µg/dL, P = .02). Conclusions The findings in dogs donating ≥6 times annually suggest the presence of iron-deficient erythropoiesis in this population.

Magnetic Resonance Imaging Findings in a Dog with Sensory Neuronopathy
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Oral tylosin administration is associated with an increase of faecal enterococci and lactic acid bacteria in dogs with tylosin-responsive diarrhoea
Susanne Kilpinnen, Merja Rantala, Thomas Spillmann, Johanna Björkroth, Elias Westermarck
The term tylosin-responsive diarrhoea (TRD) is used for canine recurrent diarrhoea cases for which no underlying cause can be found after extensive diagnostic investigations, but which show a response to the antibiotic tylosin in a few days. The objective of this prospective, one-arm longitudinal trial was to assess the effects of oral tylosin administration on the faecal levels of potentially probiotic bacteria, such as Enterococcus spp. and lactic acid bacteria (LAB), in dogs with TRD. This trial included 14 client-owned suspected TRD dogs that were on tylosin treatment and had firm faeces. Treatment was then terminated and dogs were followed up for up to 2 months to determine the recurrence of diarrhoea. Once diarrhoea started, dogs received tylosin (orally, 25 mg/kg, once daily for 7 days). At the end of the treatment period, stools were firm again in 11 dogs (TRD dogs); three dogs continued having diarrhoea and were excluded from the study. Faecal samples were collected at all three time-points for culture of LAB and enterococci. In TRD dogs, the colony counts of Enterococcus spp. (P = 0.003), LAB (P = 0.037), tylosin-resistant Enterococcus spp. (P < 0.001) and LAB (P < 0.001) were significantly higher when the dogs were on tylosin treatment and had normal faecal consistency compared to when they had diarrhoea following discontinuation of tylosin. In conclusion, cessation of diarrhoea in TRD dogs with tylosin treatment could be mediated by selection of a specific lactic acid population, the Enterococcus spp., due to their potential probiotic properties.

Influence of a survivin suppressor YM155 on the chemoresistance of canine histiocytic sarcoma cells
Hirotki Yamazaki, Satoshi Takagi, Kenji Hosoya, Masahiro Okumura
Histiocytic sarcoma (HS) in dogs exhibits aggressive biological behaviors and currently few effective treatments are available. Survivin could serve as a potential therapeutic target in several cancers. Sepantronium bromide (YM155) is a potential novel survivin-targeting agent and in this study the influence of survivin expression on clinical outcomes and the effects of YM155 on biological activities in HS cells were investigated. Specimens of HS dogs (n = 30) and four canine HS cell lines were used. The correlation between survivin expression and clinical outcome in the HS dogs was retrospectively assessed using quantitative PCR. Following YM155 treatment of cell lines, apoptosis, cell viability, and drug transporter activities were evaluated using annexin V staining, methylthiazole tetrazolium assays, and Hoechst-33342 staining, respectively. Elevated survivin expression in the HS dogs corresponded with reduced disease-free intervals and survival time, and increased chemoresistance, which led to poor clinical outcomes. Furthermore, YM155 treatment suppressed cell-growth and resistance to lomustine in HS cells by inhibiting the activity of ATP-binding cassette transporters. The evidence presented here supports favorable preclinical evaluation and indicates that survivin-targeted therapies might be effective against HS dogs.
Platelet activation and platelet–leukocyte interaction in dogs naturally infected with Babesia rossi
Amelia Goddard, Andrew L. Leisewitz, Annemarie T. Kristensen, Johan P. Schoeman
Using flow cytometry, platelet–leukocyte aggregate (PLA) formation has previously been documented in dogs with a variety of systemic inflammatory disorders and immune-mediated haemolytic anaemia. Platelet activation and subsequent interaction between platelets and leukocytes are important for regulating innate immunity and systemic inflammation. The objective of this study was to investigate PLA formation in canine babesiosis and to determine whether it was associated with outcome. Blood was collected from 36 client-owned dogs diagnosed with Babesia rossi infection and 15 healthy controls using EDTA as anticoagulant. Activated platelets and PLA formation were detected by measuring surface expression of P-selectin (CD62P) on platelets, monocytes and neutrophils. Of the Babesia-infected dogs, 29 survived and seven died. The percentage of CD62P-positive monocytes was significantly higher (P = 0.036) in the Babesia-infected dogs (54%) than in healthy control dogs (35.3%). However, there were no significant differences between the Babesia-infected and control groups for CD62P-positive platelets (4.9% and 1.2%, respectively) and CD62P-positive neutrophils (28.3% and 17.9%, respectively). The percentage of CD62P-positive monocytes was significantly higher (P = 0.019) in the survivors (58.9%) than in healthy control dogs; however, there were no significant differences between the non-survivors (39.2%) and the controls or between survivors and non-survivors. There were no significant differences between groups for the percentage of CD62P-positive platelets (survivors 4.8%; non-survivors 5.3%; controls 1.2%) or CD62P-positive neutrophils (survivors 31.6%; non-survivors 5.6%; controls 17.9%). In conclusion, Babesia-infected dogs, specifically dogs that survived, had a significantly increased percentage of platelet–monocyte aggregates compared to healthy control dogs.

Detection of indoxyl sulfate levels in dogs and cats suffering from naturally occurring kidney diseases
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Indoxyl sulfate (IS), a protein-bound uraemic toxin, has been found to accumulate in the serum of people with renal diseases and is associated with free radical induction, nephrotoxicity cardiovascular toxicity, and osteoblast cytotoxicity. Although IS has been studied in humans and in experimental models, the role of IS in dogs and cats with kidney disease has not been investigated. A high performance liquid chromatography system was applied to detect plasma IS concentrations in non-azotaemic animals (63 dogs, 16 cats) and in animals with renal azotaemia (66 dogs, 69 cats). The IS levels of azotaemic animals were significantly higher (P < 0.01) than those of non-azotaemic animals (median [IQR] 20.4 (9.5) mg/L vs. 7.2 (8.8) mg/L for dogs; median [IQR] 21 (18.9) mg/L vs. 14.8 (12.3) mg/L for cats). The IS level was significantly correlated with blood urea nitrogen, serum creatinine and phosphate concentrations. Dogs with acute kidney injury had significantly higher IS levels (P < 0.01) than those with chronic kidney diseases (CKD) (median [IQR] 57.7 (40.8) mg/L vs. 17.7 (25.1) mg/L). When CKD was graded using the International Renal Interest Society (IRIS) staging system, IS levels were correlated with CKD severity in both dogs and cats. The IS concentration is directly related to loss of renal function. Further studies are necessary to determine whether measurement of IS provides any additional diagnostic or prognostic information in dogs and cats with kidney disease.

Differences between coagulation and cytokine profiles in dogs of different ages
In human medicine, age is a risk factor for thromboembolic diseases associated with hypercoagulable and antifibrinolytic states, but information in veterinary medicine is limited. This study compared the thromboelastometric (TEM) profiles of two groups of dogs of distinct ages. Ten healthy old (>10 years) Beagles and 10 healthy young (<3 years) Beagles were recruited. White blood cell counts and haematocrit were significantly lower in the old group compared to the young group, and fibrinogen, total proteins, globulins and monocyte chemoattractant protein-1 plasma concentrations were significantly higher in the old group. Comparisons of the TEM profiles indicated a hypercoagulable profile and a decrease in fibrinolytic activity in all old Beagles. The findings support the need to consider age as a possible risk factor for thrombosis in dogs.