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Contributors

Dave Collins
BVSc FANZCVS

Anna Dengate
BVSc BMedSc MANZCVSc (Small Animal Medicine)

Karina Graham
BVSc (Hons) FANZCVS (Small Animal Medicine)

Chris Greenwell
BVSc

Amy Lam
BVSc (Hons I) GradCertVetStud MANZCVS MRCVS
February 2013 Abstracts

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Xenotransfusion with canine blood in the feline species: review of the literature
Catherine Bovens and Tim Gruffydd-Jones

Xenotransfusion (the transfusion of blood from another species) of canine blood to cats has been historically performed commonly and is still performed nowadays in some countries. Considering the current lack of commercial availability of haemoglobin-based oxygen carrier solution (Oxyglobin), there may be rare occasions when treating an anaemic cat when compatible feline blood cannot be obtained, and where a transfusion with canine blood may need to be considered as a life-saving procedure. This article reviews the published evidence about feline xenotransfusion with canine blood and the results that can be expected with this procedure. Published evidence in a limited number of cases (62 cats) indicates that cats do not appear to have naturally-occurring antibodies against canine red blood cell antigens: compatibility tests prior to the first transfusion did not demonstrate any evidence of agglutination or haemolysis of canine red cells in feline serum or plasma. No severe acute adverse reactions have been reported in cats receiving a single transfusion with canine whole blood. Anaemic cats receiving canine blood are reported to improve clinically within hours. However, antibodies against canine red blood cells are produced rapidly and can be detected within 4–7 days of the transfusion, leading to the destruction of the transfused canine red cells in a delayed haemolytic reaction. The average lifespan of the transfused canine red cells is less than 4 days. Any repeated transfusion with canine blood later than 4–6 days after the first transfusion causes anaphylaxis, which is frequently fatal.

Persistent right aortic arch and associated axial skeletal malformations in cats
Giovanni Tremolada, Maria Longeri, Michele Polli, Pietro Parma, and Fabio Acocella

Persistent right aortic arch (PRAA) in cats is an uncommon vascular anomaly with clinical signs referable to oesophageal obstruction. To our knowledge no reports of axial skeletal malformations concomitant to PRAA have been reported in cats. The aim of this study is to depict a new clinical feature in cats affected by PRAA. In the study six cats with a diagnosis of vascular ring anomaly were enrolled. A complete physical examination, a neurological examination and a total body radiograph were performed on each animal. Four of the six cats showed contemporary PRAA and skeletal malformations. Additionally, for the first time, a genetic test was performed on one subject to detect DNA alterations in the homologous DiGeorge region of cat. The percentage of skeletal malformations reported in the normal population was compared with animals with PRAA and showed a higher frequency. Genetic testing failed to demonstrate a correlation between PRAA and DiGeorge genomic deletion. A review of veterinary and human diseases that presented both conditions was assessed. The few animals enrolled do not allow definitive conclusions. Further studies are required to corroborate the correlation between PRAA and axial skeletal malformations in cats.

Body size and metabolic differences in Maine Coon cats with and without hypertrophic cardiomyopathy
Lisa M Freeman, John E Rush, Kathryn M Meurs, Barret J Bulmer, and Suzanne M Cunningham

An interplay between growth, glucose regulation and hypertrophic cardiomyopathy (HCM) may exist, but has not been studied in detail. The purpose of this study was to characterize morphometric features, insulin-like growth factor-1 (IGF-1) and glucose metabolism in Maine Coon cats with HCM. Body weight, body condition score (BCS), head length and width, and abdominal circumference were measured in Maine Coon cats >2 years of age. Echocardiography and thoracic radiography (for measurement of humerus length, and fourth and twelfth vertebrae length) were also performed. Blood was collected for biochemistry profile, DNA testing, insulin and IGF-1. Sixteen of 63 cats had HCM [myosin binding protein C (MYBPC)+, n = 3 and MYBPC−, n = 13] and 47/63 were echocardiographically normal (MYBPC+, n = 17 and MYBPC−, n = 30). There were no significant differences in any measured parameter between MYBPC+ and MYBPC− cats. Cats with HCM were significantly older (P <0.001), heavier (P = 0.006), more obese (P = 0.008), and had longer humeri (P = 0.02) compared with the HCM− group. Cats with HCM also had higher serum glucose (P = 0.01), homeostasis model assessment (HOMA) and IGF-1 (P = 0.01) concentrations, were from smaller litters (P = 0.04), and were larger at 6 months (P = 0.02) and at 1 year of age (P = 0.03). Multivariate analysis revealed that age (P <0.001), BCS (P = 0.03) and HOMA (P = 0.047) remained significantly associated with HCM. These results support the hypothesis that early growth and nutrition, larger body
size and obesity may be environmental modifiers of genetic predisposition to HCM. Further studies are warranted to evaluate the effects of early nutrition on the phenotypic expression of HCM.

A retrospective study of 180 anaemic cats: features, aetiologies and survival data
Rachel M Korman, Natasha Hetzel, Toby G Knowles, Andrea M Harvey, and Séverine Tasker
The study comprised 180 anaemic cats. Descriptive and survival data were obtained. Cats were classified by aetiology of anaemia development and degenerative, anomalous, metabolic, miscellaneous, neoplastic, infectious, inflammatory, immune-mediated, toxic, traumatic or vascular disease (DAMNITV) classification and anaemia severity. Sixty-four (35.6%) cats had mild (packed cell volume (PCV)/haematocrit (HCT) 20–24.9%), 58 (32.2%) moderate (14–19.9%), 23 (12.8%) severe (11–13.9%) and 35 (19.4%) very severe (<10.9%) anaemia. By aetiology of anaemia development, bone marrow (BM) abnormalities were more common (95, 52.8%) than haemorrhage (37, 20.6%) or haemolysis (19, 10.6%). By DAMNITV classification, infectious diseases were more common (39, 21.7%) than neoplasia (36, 20%), metabolic (21, 11.7%), trauma (15, 8.3%), miscellaneous (14, 7.8%), inflammatory (11, 6.1%), immune-mediated (11, 6.1%), anomalous (8, 4.4%), toxic (2, 1.1%) or vascular disease (1, 0.6%). BM abnormalities were significantly associated with more severe anaemia ($P = 0.003$). Most cats (112, 62.2%) survived to discharge whereas 55 (30.6%) were euthanased and 13 (7.2%) died. Survival to discharge was not associated with anaemia severity but was associated significantly with aetiology of anaemia development ($P = 0.046$), as cats with haemolysis were more likely to survive to discharge than cats with BM abnormalities. Survival to discharge was also associated significantly with DAMNITV classification ($P = 0.010$), with cats with neoplasia being less likely, and cats with immune-mediated disease more likely, to survive to discharge. Cox regression analysis found that survival was not associated with anaemia severity, but was associated with DAMNITV classification ($P = 0.011$) and age ($P = 0.082$), with cats with immune-mediated disease and younger cats more likely to survive.

Ultrasound-guided dorsal approach for femoral nerve blockade in cats: an imaging study
Paulina Haro, Francisco Laredo, Francisco Gil, Eliseo Belda, Maria D Ayala, Marta Soler, and Amalia Agut
This study was conducted to describe and validate a dorsal ultrasound-guided approach to block the femoral nerve (FN) in cats by means of anatomical and computed tomography (CT) studies. The anatomical study was carried out in four fresh feline cadavers to determine the anatomic landmarks to approach this nerve. Then, an ultrasonographic study of the FN was performed in another eight cadavers using a 13 MHz linear transducer. The accuracy of the neurolocation by ultrasonography (US) was determined in four cadavers by the injection of 1 ml blue ink around the FN. The staining of the nerve was evaluated in anatomical studies. The feasibility of this technique was also evaluated by CT after injecting 1 ml of an iodinated contrast medium (150 mg/ml) around the FN in the other four cadavers. The landmarks to approach the FN were the cranial border of the iliac crest and the dorsal processes of L6 and L7. The FN was visualised as a round hypoechogenic structure surrounded by a hyperechogenic rim located within the iliopsoas muscle on transverse scans. The anatomical and CT studies confirmed the accuracy of the US location of the FN. The dorsal ultrasound-guided approach may allow feasible and accurate access to the FN in cats and it could be useful in producing successful blockade.

Urinary cytokine levels in apparently healthy cats and cats with chronic kidney disease
Lauren M Habenicht, Tracy L Webb, Laurie A Clauss, Steven W Dow, and Jessica M Quimby
Chronic kidney disease (CKD) is a common cause of illness and death in cats. The hallmark of CKD in cats is chronic tubulointerstitial nephritis, and inflammation contributes to the progression of renal fibrosis. However, at present, it is difficult to assess directly the degree of intra-renal inflammation without renal biopsy. Measurement of inflammatory cytokine levels in urine may provide a non-invasive means of assessing intra-renal inflammation. Urine cytokine levels (urine cytokine/urine creatinine ratio) were measured in 18 healthy cats and 26 cats with CKD. When urine cytokine levels in healthy and CKD cats were compared, we found significantly higher levels of IL-8 and transforming growth factor-β1 (TGF-β1) in urine of CKD cats, along with significantly lower vascular endothelial growth factor (VEGF) levels. A significant positive correlation between serum creatinine and TGF-β1 levels was found in CKD cats. Urinary cytokine measurement may, potentially, be a useful means of assessing intra-renal inflammation, fibrosis and vascular health in cats with CKD.
Regional brain perfusion in 12 cats measured with technetium-99m-ethyl cysteinate dimer pinhole single photon emission computed tomography (SPECT)
Tim Waelbers, Kathelijne Peremans, Simon Vermeire, André Dobbeleir, VO Boer, Hendrik de Leeuw, Maarten AD Vente, Koen Piron, Myriam Hesta, and Ingeborgh Polis
With the use of perfusion tracers, in vivo examination of the regional cerebral blood flow in cats can be performed with single photon emission computed tomography (SPECT). Reliable perfusion data of normal, healthy cats are necessary for future clinical studies or other research use. Therefore, this dataset of the regional perfusion pattern of the normal feline brain was created. Twelve cats were used in this study. Technetium-99m-ethyl cysteinate dimer (99mTc-ECD) was injected intravenously and the acquisition, using a triple head gamma camera equipped with three multi-pinhole collimators (pinhole SPECT), was started 40 mins after tracer administration under general anaesthesia. Nineteen regions of interest were defined using 7T magnetic resonance images of the feline brain and a topographical atlas. Regional counts were normalised to the counts of two reference regions: the total brain and the cerebellum. The highest tracer uptake was noticed in the subcortical structures, and the lowest in the frontal cortex and the cerebellum. Also left–right asymmetry in the temporal cortex and a rostrocaudal gradient of 3% were observed.

Anatomy of the temporomandibular joint in the cat: a study by microdissection, cryosection and vascular injection
Jorge Arredondo, Amalia Agut, María Jesús Rodríguez, Ricardo Sarriá, and Rafael Latorre
The minute anatomy of the temporomandibular joint (TMJ) is of great clinical relevance in cats owing to a high number of lesions involving this articulation. However, the precise anatomy is poorly documented in textbooks and scientific articles. The aim of this study was to describe, in detail, the TMJ anatomy and its relationship with other adjacent anatomical structures in the cat. Different anatomical preparations, including vascular and articular injection, microdissection, cryosection and plastination, were performed in 12 cadaveric cats. All TMJ anatomical structures were identified and described in detail. A thorough understanding of the TMJ anatomy is essential to understand the clinical signs associated with TMJ disorders, to locate lesions precisely and to accurately interpret the results in all diagnostic imaging techniques.

Evaluation of sensor sites for continuous glucose monitoring in cats with diabetes mellitus
Michaela Hafner, Thomas A Lutz, Claudia E Reusch, and Eric Zini
The continuous glucose monitoring system allows generation of detailed glucose curves via measurement of glucose concentration in interstitial fluid. The conventional site for sensor placement in diabetic cats is the subcutaneous tissue of the lateral chest wall. The aim of this study was to investigate the feasibility and accuracy of sensors placed in the lateral chest wall and in two alternative sites — the dorsal neck and lateral knee fold — of diabetic cats. Initialisation was successful in 15/20 lateral chest wall sensors, 9/10 neck sensors and 3/10 knee fold sensors. Compared with the reference portable blood glucose meter, 0.8% of measurements from lateral chest wall sensors, 0.7% from knee fold sensors and 0% from neck sensors would have resulted in erroneous treatment. This preliminary study suggests that dorsal neck placement may be superior to lateral chest wall and lateral knee fold; however, further investigation with a larger number of cases would be required to confirm this finding.

A comparison of thermographic imaging, physical examination and modified questionnaire as an instrument to assess painful conditions in cats
Mari H Vainionpää, Marja R Raekallio, Jouni JT Junnila, Anna K Hielm-Björkman, Marjatta PM Snellman, and Outi M Vainio
Pain recognition in cats is difficult and requires a multidisciplinary approach for diagnosis. A total of 103 client-owned cats were enrolled in this prospective, blinded clinical trial. Cats were invited to the clinic, or presented for annual rechecks/vaccinations, or gastrointestinal, dental or locomotor problems. The cats were of different breeds; both shorthaired and longhaired cats were included. Those cats that tolerated it were palpated and all cats were examined with the non-invasive method of thermographic imaging. Owners filled out a questionnaire about their cat’s behaviour and estimated whether the cat was in any pain. The agreement between a questionnaire and thermographic imaging or palpation was low. Also, the agreement between the owner’s estimation of pain and thermographic imaging or palpation was low. The agreement between palpation and thermographic imaging was moderate, suggesting that thermographic imaging is a potential tool in clinical practice for detecting and screening cats that are, potentially, in pain.
Clinical outcome in 19 cats with clinical and magnetic resonance imaging diagnosis of ischaemic myelopathy (2000–2011)
Anita Theobald, Holger A Volk, Ruth Dennis, Davide Berlato, and Luisa De Risio
Previous publications on ischaemic myelopathy in cats are limited to single case reports and small case series. The overall prognosis appears poor, with 42% of cats being euthanased. In this study the clinical outcome of 19 cats with a presumptive diagnosis of ischaemic myelopathy [based on clinical and magnetic resonance imaging (MRI) findings] was evaluated retrospectively. The degree of neurological dysfunction at the time of presentation was similar to previously reported cases, ranging from ambulatory paresis to plegia with intact nociception. The most common lesion localisations (based on MRI) were to the C1–C5 (30%) and C6–T2 (30%) spinal cord segments, with the T3–L3 and L4–S1 spinal cord segments accounting for 25% and 15%, respectively. Potential inciting or predisposing causes for development of spinal infarction were identified in 12 cats, including physical exertion, trauma, general anaesthesia, renal disease, hyperthyroidism, hypertension and hypertrophic cardiomyopathy. The median time to recovery of ambulation was 3.5 days (3–19 days). Four cats (21%) were euthanased within 2 months of diagnosis. The remaining 15 (79%) cats had a favourable outcome. Follow-up ranged from 6 months to 10 years and 4 months, with a median of 3 years and 1 month. Even when plegia was present at the time of presentation, all surviving cats with long-term, owner-derived follow-up were reported to return to a normal quality of life, suggesting that the long-term prognosis for recovery from presumed ischaemic myelopathy is favourable in the majority of cats.

Serum thymidine kinase activity in clinically healthy and diseased cats: a potential biomarker for lymphoma
Samantha Taylor, Steve Dodkin, Kostas Papasouliotis, Helen Evans, Peter A Graham, Zoe Belshaw, Sara Westberg, and Henrik P von Euler
The thymidine kinases are enzymes that convert deoxythymidine to deoxythymidine monophosphate and have a function in DNA synthesis. Rapidly proliferating cells will have higher levels of thymidine kinase. Serum thymidine kinase activity (sTK) is a useful tumour marker in humans and dogs, with utility as a prognostic indicator in lymphoma. In the current study serum samples were collected from 49 clinically healthy cats, 33 with lymphoma, 55 with inflammatory disease and 34 with non-haematopoietic neoplasia (NHPN). sTK was measured using a radioenzyme assay and a reference interval (1.96 × SD) was established from the clinically healthy cats (<5.5 U/l). Mean sTK activity for healthy cats was 2.2 U/l (range 0.8–8.4, ± SD 1.7). Mean sTK activity for cats with lymphoma was 17.5 U/l (range 1.0–100.0 SD ± 27.4). Mean sTK activity for cats with NHPN was 4.2 U/l (range 1.0–45.0, SD ± 8.6). Mean sTK activity for the inflammatory group was 3.4 U/l (range 1.0–19.6, SD 3.9). Cats with lymphoma had significantly higher sTK activity than healthy cats or cats with inflammatory disease (P <0.0001) and cats with NHPN (P <0.0002). sTK activity is a potentially useful biomarker for feline lymphoma and further study is required to assess its utility as a prognostic indicator.

Ultrasonographic and clinicopathological features of feline gastrointestinal eosinophilic sclerosing fibroplasia in four cats
Andrea Weissman, Dominique Penninck, Cynthia Webster, Silke Hecht, John Keating, and Linden E Craig
Four cats with feline gastrointestinal eosinophilic sclerosing fibroplasia (FGESF) are described. Clinical signs included decreased appetite, weight loss, vomiting and diarrhea. Bloodwork abnormalities included mild neutrophilia (n = 2) and hyperglobulinemia with concurrent hyperproteinemia (n = 2). Ultrasonographically, a total of five solitary masses with mural thickening and loss of layering were identified in the stomach, duodenum, jejunum and colon. In one cat a second, separate lesion was diagnosed 3 weeks following surgical resection of one mass. Histopathologically, lesions were characterized by collagen trabeculae and mixed inflammatory cell infiltrates, predominantly eosinophils. Multiple areas of necrosis were also noted, which contained bacteria in 2/4 cats. In two cats, changes consistent with FGESF were also noted in the liver. All cats had surgical resection of their lesions. Two cats are still living at time of publication (43 and 24 months post-surgery). FGESF should be considered as a differential for intestinal masses in cats.

Head trauma as a possible cause of central diabetes insipidus in a cat
Karen M Oliveira, Fabiola B Fukushima, Camila M Oliveira, Isabel R Rosado, Bruno BJ Torres, Mário Sérgio L Lavor, Carla Maria O Silva, and Eliane G Melo
A 13-month-old female domestic shorthair cat presented with a 10-month history of polyuria and polydipsia that began after having been hit by a car. Neurological examination revealed visual deficits and an absent bilateral menace response. Hematological and serum biochemical analyses were within reference values, but hyposthenuria was identified. Failure to concentrate urine during the water
deprivation test followed by an increase in urine specific gravity after administration of synthetic antidiuretic hormone (ADH) suggested a diagnosis of central diabetes insipidus. Subcutaneous or oral administration of synthetic ADH was effective in central diabetes insipidus treatment during the 19-month follow-up.

**Suspected muscarinic mushroom intoxication in a cat**
Vicente J Herreria-Bustillo, Rocio Saiz-Alvarez, and Shailen Jasani
A 3-year-old domestic shorthair cat was witnessed ingesting mushrooms and developed signs of muscarine intoxication. After stabilisation and treatment with atropine the cat recovered well and was discharged from hospital in 2 days. This report describes the features and successful management of this unusual toxicosis in cats.

**Compendium**

**Surgical Views: Thoracoscopy: Common Techniques in Small Animals**
Philipp Mayhew
Thoracoscopy is gaining popularity in small animal surgery as an alternative to thoracotomy for an increasing variety of cases. This article discusses the details of some of the most frequently performed thoracoscopic procedures in small animal practice: diagnostic biopsy of pleural, mediastinal, pericardial, and lung tissue; thoracoscopic pericardial window creation and subphrenic pericardecotomy; lung lobectomy; thoracic duct ligation; and cranial mediastinal mass resection. A companion article that presented the instrumentation, anesthesia challenges, and approaches for thoracoscopic procedures in small animals was published in the January 2013 issue.

**Tremorgenic Mycotoxicosis in Dogs**
Andrew K. Barker, Chase Stahl, Steve M. Ensley, Nick D. Jeffrey
Ingestion of tremorgenic mycotoxins formed in spoiled food can cause an acute tremor syndrome, the severity of which can range from mild to life-threatening. Swift recognition of the likely cause is required for accurate prognostication and rapid institution of appropriate therapy, which leads to complete resolution in most cases.

**New Alternatives for Minimally Invasive Management of Uroliths: Nephroliths**
Alice Defarges, Allyson C. Berent, Marilyn Dunn
Urolithiasis is a common clinical problem in small animal veterinary patients. Management of upper urinary tract calculi can be particularly challenging in small animals, as traditional surgical removal can be associated with significant morbidity. In humans, minimally invasive treatment options have replaced traditional surgical removal in many cases. This article reviews the current literature on the various types of lithotripsy and some of the newer minimally invasive options available for management of nephrolithiasis in small animal veterinary patients. A companion article in the January 2013 issue addressed management of lower urinary tract uroliths; a future article will discuss current management strategies for ureteroliths.

**The Veterinary Journal**

**Genetics of canine diabetes mellitus: Are the diabetes susceptibility genes identified in humans involved in breed susceptibility to diabetes mellitus in dogs?**
Brian Catchpole, Jamie P. Adams, Angela L. Holder, Andrea D. Short, William E.R. Ollier, Lorna J. Kennedy.
Diabetes mellitus is a common endocrinopathy in companion animals, characterised by hyperglycaemia, glycosuria and weight loss, resulting from an absolute or relative deficiency in the pancreatic hormone insulin. There are breed differences in susceptibility to diabetes mellitus in dogs, with the Samoyed breed being overrepresented, while Boxers are relatively absent in the UK population of diabetic dogs, suggesting that genetic factors play an important role in determining susceptibility to the disease. A number of genes, linked with susceptibility to diabetes mellitus in humans, are associated with an increased risk of diabetes mellitus in dogs, some of which appear to be relatively breed-specific. Diabetes mellitus in dogs has been associated with major histocompatibility complex (MHC) class II genes (dog leucocyte antigen; DLA), with similar haplotypes and genotypes being identified in the most susceptible breeds. A region containing a variable number of tandem repeats (VNTR) and several polymorphisms have been identified in the canine insulin gene, with some alleles associated with susceptibility or resistance to diabetes mellitus in a breed-specific manner.
Polymorphisms in the canine CTLA4 promoter and in other immune response genes are associated with susceptibility to diabetes mellitus in a number of pedigree breeds. Genome wide association studies are currently underway that should shed further light on the genetic factors responsible for the breed profile seen in the diabetic dog population.

**Intervertebral disc disease in dogs – Part 1: A new histological grading scheme for classification of intervertebral disc degeneration in dogs.**

Intervertebral disc (IVD) degeneration is common in dogs and can lead to serious disorders. Current treatments can relieve clinical signs of disease, but do not restore IVD function. The development of regenerative strategies for IVD dysfunction requires detailed knowledge of the pathogenesis of IVD degeneration and its underlying mechanisms. Histological examination of IVDs at different stages of degeneration might provide this knowledge, but as there is currently no histological grading scheme for canine IVD degeneration, the aim of this study, which is the first of a two-part series, was to design and validate an appropriate scheme. Three independent observers evaluated 35 IVDs at different stages of degeneration using the scheme. Glycosaminoglycan contents of the nucleus pulposus and macroscopic grading according to Thompson, which are considered ‘gold standards’ for IVD degeneration, were used to validate the scheme. Reproducibility was assessed by analysing the inter-observer reliability of all individual variables of the grading scheme, using a weighted \( \kappa \) analysis. Significant correlations were found between Thompson grading and total histological score (\( r = 0.94; P < 0.01 \)) and between glycosaminoglycan content and total histological score (\( r = -0.72; P < 0.01 \)). Most individual histological variables showed ‘moderate’ to ‘almost perfect’ inter-observer reliability. The high correlation with the gold standards in combination with the high reproducibility indicates that the proposed histological grading scheme is reliable and objective for classification of IVD degeneration in both chondrodystrophic and non-chondrodystrophic dog breeds.

**Intervertebral disc disease in dogs – Part 2: Comparison of clinical, magnetic resonance imaging, and histological findings in 74 surgically treated dogs.**
Hendrik-Jan C. Kranenburg, Guy C.M. Grinwis, Niklas Bergknut, Ninke Gahrmann, George Voorhout, Herman A.W. Hazewinkel, Björn P. Meij.

The relationship between intervertebral disc (IVD) disease and IVD degeneration remains unclear. The aim of the present study was to compare the clinical severity of IVD herniation (IVDH), determined with a neurological grading system, with findings of magnetic resonance imaging (MRI) and histology using grading systems for IVD degeneration in chondrodystrophic (CD; \( n = 37 \)) and non-chondrodystrophic (NCD; \( n = 37 \)) dogs. This study is the second part of a two-part investigation, where the first part involved the development and validation of a histological grading scheme for classification of canine IVD degeneration. IVD degeneration graded on MRI correlated significantly with IVD degeneration graded on histology, but not with pre-operative clinical signs. Hansen type 1 hernias were more common in the cervical and thoracolumbar segments and Hansen type 2 hernias were more common in the lumbar-sacral segment. Type 1 hernias occurred more often in CD dogs than in NCD dogs, and CD dogs were clinically more severely affected than NCD dogs. The grade of IVD degeneration on MRI was higher in CD dogs than in NCD dogs, but there was no difference between dogs with type 1 and type 2 hernias. No significant differences in histological grade were found between CD and NCD dogs or between type 1 and type 2 hernias. It was possible to conclude that IVD degeneration did not correlate with the neurological severity of IVDH. The extent of degeneration identified on MRI correlated with degeneration seen histologically. Although the MRI grading system reflected the severity of IVD degenerative changes as confirmed by histopathology, it appeared less useful in predicting the clinical implications.

**The bitch uterine response to semen deposition and its modification by male accessory gland secretions.**

Little is known about the response of the bitch’s reproductive tract to semen deposition. In this study, an influx of polymorphonuclear neutrophils (PMNs) into the uterus was detected after artificial insemination, but there was normal fertility. Doppler ultrasonography showed that insemination induced an increase in uterine artery blood velocity and a decrease in the resistance index of short duration, indicating vasodilation. Semen that was extended in fluid from the sperm rich fraction of the ejaculate (seminal plasma, SP), or third fraction of the ejaculate (prostatic fluid, PF), produced a similar magnitude of effect but of longer duration. It was hypothesised that vasodilation following...
insemination was largely induced by SP and PF which, together with PMN influx, was part of a normal uterine response. Physiological concentrations of PMNs in vitro reduced the ability of spermatozoa to attach to uterine epithelium, most likely as a result of spermatozoa becoming attached to PMNs. However, both SP and PF increased attachment of spermatozoa to the uterine epithelium by reducing sperm attachment to PMNs, and potentially by an additional mechanism that did not involve inhibition of sperm binding to PMNs. These are the first canine studies to document an apparent physiological response by the uterus to semen, associated with uterine artery vasodilation and PMN influx. Moreover, these investigations are the first to demonstrate that canine SF and PF are part of the mechanism for increasing uterine perfusion and that both fluids have a modulatory effect on PMN-induced inhibition of spermatozoal attachment to uterine epithelium, most likely mediated by reduced sperm attachment to PMNs.

Epithelial surface changes and spermatozoa storage in the reproductive tract of the bitch.
Spermatozoa are known to bind to the epithelial cells lining the uterine tube in various species, but information in canids is conflicting and sparse. The first aim of this study was to measure the epithelial surface outline (ESO) of different regions of the canine uterine tube in the four stages of the oestrous cycle as an indicator of a changing potential reservoir for spermatozoa. The second aim was to identify the site of sperm storage in the bitch after natural mating. Reproductive tracts were collected from bitches undergoing routine ovariohysterectomy. Histological analysis showed that, when corrected for uterine tube size, the ESO of pro-oestrus (P < 0.005) and oestrus (P < 0.05) tubes were larger than anoestrus, but not metoestrus, tubes. The second study examined reproductive tracts from 12 Beagle bitches at 6, 12, 24 and 48 h after mating. Light and electron microscopy revealed large numbers of spermatozoa in the proximal regions of the uterus and particularly the distal utero-tubal junction (UTJ), with few present in the proximal UTJ or uterine tubes. Spermatozoa were bound by their heads to microvilli on the epithelial surface of the uterine lumen and to ciliated cells in the distal UTJ. This is the first report to measure and document differences in potential epithelial attachment sites of the uterine tubes at different stages of the oestrous cycle and to provide compelling evidence that the main spermatozoal storage site in the reproductive tract of the bitch is the distal UTJ.

Use of CD10 as a marker of canine mammary myoepithelial cells.
CD10 is an important cell marker in the diagnosis of acute lymphoblastic leukaemia and of breast myoepithelial (ME) cells in humans. The objective of this study was to assess the value of CD10 as a marker of canine ME cells using immunohistochemistry on routinely processed normal, dysplastic and neoplastic mammary tissue. Five different CD10 positive cell types were identified on the basis of cell morphology, pattern of immunoreactivity, and on the co-expression of additional cell lineage-specific markers. Type 1 cells were typical fusiform cells with a ME cell phenotype (calponin- and cytokeratin [CK] 14-positive, CK8/18-negative). Type 2 cells were typical or atypical polyhedral cells with a luminal epithelial (LE) cell phenotype (calponin- and CK14-negative, CK8/18-positive). Type 3 cells had a type 1 phenotype with variable morphology, and type 4 were atypical neoplastic cells with a mixed ME/LE phenotype. Type 5 cells were typical fusiform cells with a stromal phenotype. Type 1 cells were considered normal ME cells and were found in all sample types; type 2 cells were considered normal or neoplastic LE cells and were also found in all sample types; types 3 and 4 cells were restricted to tumour samples and to malignant tumours, respectively, and type 5 cells were found in all sample types, although predominantly in neoplastic tissue. The findings indicate that the CD10 antigen is a sensitive (although not specific) marker of canine ME cells in normal, dysplastic and neoplastic mammary tissue. Differences in the distribution and staining intensity of CD10-positive cells suggest a number of potential roles for this protein in the pathogenesis of canine mammary neoplasia.

Retrospective comparison of prednisolone and ursodeoxycholic acid for the treatment of feline lymphocytic cholangitis.
A retrospective study was performed to evaluate the effect of treatment with prednisolone or ursodeoxycholic acid (UDCA) on the survival times of 26 cats with lymphocytic cholangitis, and to determine prognostic factors. Most affected cats were males (76.9%, P = 0.006) and a breed predisposition for the Norwegian Forest Cat was demonstrated (P = 0.021). Clinical signs included weight loss, icterus, anorexia, vomiting, and listlessness. Blood analyses revealed elevated hepatic
enzymes, bile acids and hypergammaglobulinaemia. Breed, sex, and therapeutic regimen were significantly associated with survival times. Prednisolone treatment resulted in a statistically longer survival time compared to UDCA.

**Kinematic analysis in healthy and hip-dysplastic German Shepherd dogs.**
This study investigated kinematic patterns in clinically normal German Shepherd dogs (GSDs) compared to those with hip dysplasia and with no clinical signs of lameness. Two groups of GSDs, including 10 clinically healthy dogs (G1) and 10 with hip dysplasia (G2), were trotted on a treadmill at a constant speed. Kinematic data were collected by a 3-camera system and analysed by a motion-analysis program. Flexion and extension joint angles and angular velocities were determined for the shoulder, elbow, carpal, hip, stifle, and tarsal joints. Within each group, the differences between the right and left limbs in all kinematic variables were not significant. Minimum angle, angular displacement and minimum angular velocity did not differ between groups. Significant differences were observed in the maximum angular velocity and maximum angle of the hip joint (dysplastic > healthy), and in the maximum angular velocity of the carpal joint (healthy > dysplastic). It was concluded that, when trotting on a treadmill, dysplastic dogs with no signs of lameness may present joint kinematic alterations in the hind as well as the forelimbs.

**Potential predictive biomarkers of obesity in Burmese cats.**
Australian Burmese cats are predisposed to diabetes mellitus and, compared to other breeds, have delayed triglyceride clearance that may result in subtle changes within cells and tissues that trigger specific alterations in gene expression within peripheral blood leucocytes (PBLs). Expression of genes involved in energy metabolism (glucose-6-phosphate dehydrogenase and malate dehydrogenase), lipogenesis (ATP citrate lyase [ACL], fatty acid synthase [FAS] and sterol regulatory binding protein-1c [SREBP-1c]), and insulin signalling (insulin receptor substrates 1 and 2, and phosphatidylinositol-3 kinase), as well as cholesterol lipoprotein subfraction profiling were carried out on PBLs from lean Burmese cats and compared with similar profiles of age and gender matched lean and obese Australian domestic shorthaired cats (DSHs) in an attempt to identify possible biomarkers for assessing obesity. For the majority of the genes examined, the lean Burmese cats demonstrated similar PBL gene expression patterns as age and gender matched obese Australian DSH cats. Lean Burmese had increased expression of ACL and FAS, but not SREBP-1c, a main upstream regulator of lipid synthesis, suggesting possible aberrations in lipogenesis. Moreover, lean Burmese displayed a 3- to 4-fold increase in the very low density cholesterol fraction percentage, which was double that for obese DSH cats, indicating an increased degree of lipid dysregulation especially in relation to triglycerides. The findings suggest that Burmese cats may have a particular propensity for dysregulation in lipid metabolism.

**The association between Chiari-like malformation, ventriculomegaly and seizures in cavalier King Charles spaniels.**
Cavalier King Charles spaniels (CKCSs) with Chiari-like malformation (CM) and associated seizures are frequently diagnosed with idiopathic epilepsy. There could be an association between ventriculomegaly (V) or caudal fossa overcrowding (CCFP) and seizures. A retrospective case-control study was performed using MRI to investigate the possible association between these morphological abnormalities and seizures. Seizure semiology and, where possible, electroencephalographic (EEG) abnormalities were documented. Eighty-five CKCS with CM were included, 27 with seizures. There was no association between V or CCFP and seizures (P = 0.10 and 0.71, respectively). Seizures were classified as having partial onset in 61% of individuals in the study population (95% CI 42.41–76.43%). Another cause of recurrent seizures in CKCS (such as familial epilepsy) is suspected, as previously reported.

**Assessment of serological tests for the diagnosis of canine visceral leishmaniasis.**
Denise Amaro da Silva, Maria de Fátima Madeira, Tuanne Rotti Abrantes, Carlos José de Lima Barbosa Filho, Fabiano Borges Figueiredo.
An immunoenzymatic assay (ELISA), an indirect immunofluorescence antibody test (IFAT) with different antigens (ELISA-Leishmania chagasi, ELISA-L. major-like, IFAT-L. chagasi and IFAT-L. major-like), and an immunochromatographic test were assessed for the diagnosis of canine visceral
leishmaniasis (CVL). Serum samples from 144 dogs from an endemic area for visceral leishmaniasis in the municipality of Rio de Janeiro were tested. The sensitivities of the serological tests were 93%, 100%, 73%, 60% and 93%, with specificities of 87%, 92%, 77%, 96% and 92% for the ELISA-L. major-like, ELISA-L. chagasi, IFAT-L. major-like, IFAT-L. chagasi and the immuno chromatographic test, respectively. ELISA-L. chagasi was the best test for the diagnosis of CVL, but the immunochromatographic test could be a useful alternative as it offers simple and rapid diagnosis without the need for a specialized laboratory.

Real-time PCR genotyping assay for canine trapped neutrophil syndrome and high frequency of the mutant allele in Border collies.
Keijiro Mizukami, Akira Yabuki, Takuji Kawamichi, Hye-Sook Chang, Mohammad M. Rahman, Mohammad M. Uddin, Moeko Kohyama, Osamu Yamato.
Trapped neutrophil syndrome is an autosomal recessive inherited neutropenia in Border collies. The causative mutation is a 4 base pair deletion in exon 19 of the canine VPS13B gene. In this study, a real-time PCR assay was developed and a genotyping survey was carried out in Border collies in Japan. The carrier frequency was 11.1%, suggesting that the mutant allele frequency is high enough to warrant measures to control and prevent the disease.

Journal of the American Veterinary Medical Association – 1st Feb

Clinical features and magnetic resonance imaging characteristics of diskospondylitis in dogs: 23 cases (1997–2010)
J Harris, A Chen, R Tucker, J Mattoon
Objective—To describe the signalment, clinical features, and most common MRI characteristics in dogs with diskospondylitis and investigate whether a correlation exists between the degree of spinal cord compression and neurologic status of the patient.
Design—Retrospective case series.
Animals—23 dogs.
Procedures—The medical records and imaging data base of the Veterinary Teaching Hospital at Washington State University were retrospectively cross-referenced for cases of diskospondylitis in dogs from 1997 through 2010. Signalment, clinical signs, MRI characteristics, and results of bacteriologic cultures of urine, blood, CSF, or intervertebral disk material were reviewed.
Results—On T2-weighted sequences, vertebral endplates were most often of mixed signal intensity, whereas the vertebral body was hypointense. The intervertebral disk space was most often hyperintense on T2-weighted and short tau inversion recovery sequences and of mixed signal intensity on T1-weighted sequences. Paravertebral soft tissue hyperintensities were noted commonly on T2-weighted and short tau inversion recovery sequences. Heterogenous contrast enhancement of endplates and intervertebral disk spaces also occurred commonly, whereas contrast enhancement of vertebral bodies and paravertebral soft tissues was uncommon. Intramedullary spinal cord intensity was noted at 10 of 27 sites on T2-weighted sequences. Static spinal cord compression occurred in 17 of 23 dogs, and a significant direct correlation was found between the percentage of spinal cord compression and the patient neurologic score.
Conclusions and Clinical Relevance—Results suggested that diskospondylitis in dogs has a characteristic MRI appearance, and in some patients, MRI may aid in the identification of severe spinal cord compression, which could warrant surgical intervention.

Use of the vertebral heart scale for differentiation of cardiac and noncardiac causes of respiratory distress in cats: 67 cases (2002–2003)
M Sleeper, R Roland, K Drobotz,
Objective—To assess the effectiveness of the vertebral heart scale (VHS) system to differentiate congestive heart failure from other causes of dyspnea in cats.
Design—Retrospective case series.
Animals—67 cats with acute respiratory distress.
Procedures—Medical records of client-owned cats evaluated on an emergency basis because of acute respiratory distress during a 1-year period were reviewed. For study inclusion, cats must have undergone evaluation with echocardiography and thoracic radiography within 12 hours after hospital admission. The VHS was calculated for each cat by 2 investigators. Signalment, physical examination, and echocardiographic findings were reviewed for each patient.
Results—There was 83% agreement overall between the 2 investigators in assessment of cardiomegaly in cats with dyspnea (κ = 0.49). The VHS cutpoints were the same for both observers in terms of
optimizing sensitivity and specificity. A VHS of ≥ 8.0 vertebrae was the best cutpoint when screening for heart disease, whereas a VHS of ≥ 9.3 vertebrae was very specific for the presence of heart disease. Measurements between 8.0 and 9.3 vertebrae suggested the cause of dyspnea was equivocal (ie, secondary to congestive heart failure or respiratory disease), in which case echocardiography would be most useful in providing additional diagnostic information.

Conclusions and Clinical Relevance—Results suggested that the VHS system may be a useful tool to help differentiate cardiac from noncardiac causes of respiratory distress in cats in an emergency situation when an echocardiogram is not available or is not plausible in an unstable patient.

Hepatic copper concentrations in Labrador Retrievers with and without chronic hepatitis: 72 cases (1980–2010)
A Johnston, S Center, S McDonough, J Wakshlag, K Warner
Objective—To evaluate differences in hepatic copper concentrations in Labrador Retrievers with and without chronic hepatitis.

Design—Retrospective case-control study.

Sample—Liver tissue specimens from 36 Labrador Retrievers with chronic hepatitis and 36 age- and sex-matched Labrador Retrievers without chronic hepatitis (control dogs).

Procedures—Liver tissue specimens were obtained during 2 study periods (1980 to 1997 and 1998 to 2010). For each tissue specimen, a histologic score was assigned independently by each of 2 interpreters, and the hepatic copper concentration was qualitatively determined via rhodanine staining and quantitatively determined via atomic absorption spectroscopy.

Results—Mean hepatic copper concentration was significantly higher in dogs with chronic hepatitis (614 μg/g of dry weight [range, 104 to 4,234 μg/g of dry weight]), compared with that in control dogs (299 μg/g of dry weight [range, 93 to 3,810 μg/g of dry weight]), and increased significantly over time. A higher proportion of liver tissue specimens collected during the 1998–2010 study period had hepatic copper concentrations > 400 μg/g of dry weight (the upper limit of the reference range), compared with the proportion of liver tissue specimens collected during the 1980–1997 study period. The qualitative copper score did not accurately predict quantitative hepatic copper concentration in 33% of study dogs.

Conclusions and Clinical Relevance—Results suggested that the increase in hepatic copper concentrations in Labrador Retrievers with and without chronic hepatitis over time may be the result of increased exposure of dogs to environmental copper, most likely via the diet.

Disseminated mycotic infection caused by Westerdykella species in a German Shepherd Dog
R Armentano, K Cooke, B Wickes
Case Description—A 5-year-old 34.3-kg (75.5-lb) neutered male German Shepherd Dog was evaluated because of chronic azotemia that was unresponsive to typical medical management.

Clinical Findings—Urinalysis revealed pyuria and fungal hyphae. Fungal culture of a urine sample grew a sterile mold that was identified as Westerdykella spp via PCR assay.

Treatment and Outcome—The dog was treated empirically with itraconazole orally and amphotericin B IV for 5 weeks. Because of progressive azotemia, treatment was modified to oral administration of posaconazole. The dog improved but then developed progressive azotemia, hyperphosphatemia, and suspected diskospondylitis. Treatment was again modified to oral administration of terbinafine on the basis of results of antifungal susceptibility testing. The dog was euthanized after 5 months of antifungal treatment because of a deteriorating clinical condition and progressive azotemia.

Clinical Relevance—Westerdykella spp are filamentous hyphal organisms from the family Sporomiaceae and had not previously been reported to cause infections in dogs. Fungal PCR assay and antifungal susceptibility testing may be useful for a patient with a suspected fungal infection that does not respond to empirical treatment or when traditional culture methods for fungal identification are unsuccessful. Westerdykella spp should be considered as a possible etiologic agent when systemic mycosis is diagnosed.

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Outcome evaluation of a thoracoscopic pericardial window procedure or subtotal pericardectomy via thoracotomy for the treatment of pericardial effusion in dogs
J Case, M Maxwell, A Aman, E Monnet
Objective—To evaluate the disease-free interval (DFI) and median survival time (MST) in dogs with idiopathic and neoplastic pericardial effusion surgically treated by a thoracoscopic pericardial window procedure or subtotal pericardectomy via thoracotomy and to compare DFI and MST in dogs with and without a mass on preoperative echocardiography that underwent either surgical technique.
Design—Retrospective cohort study.
Animals—58 dogs with pericardial effusion.
Procedures—Medical records between 1985 and 2010 were evaluated. Dogs were included in the study if they had confirmed pericardial effusion and underwent a thoracoscopic pericardial window procedure or subtotal pericardectomy via thoracotomy.
Results—Clinical signs of dogs at initial evaluation were similar, with the exception of lethargy, between dogs treated by subtotal pericardectomy via thoracotomy or the pericardial window procedure. Dogs with idiopathic pericardial effusion that underwent the thoracoscopic pericardial window procedure had significantly shorter DFI and MST than did those treated by subtotal pericardectomy via thoracotomy. For neoplastic pericardial effusion, DFI and MST were not significantly different between dogs treated with either surgical technique.
Conclusions and Clinical Relevance—Dogs with idiopathic pericardial effusion treated with a subtotal pericardectomy via thoracotomy had a significantly longer DFI and MST, compared with dogs treated by the thoracoscopic pericardial window procedure. This difference in outcome may be related to inaccuracy of the initial diagnosis or ineffectiveness of the pericardial window to palliate the signs of idiopathic pericardial effusion long term.

T Higuchi, G Burcham, M Childress, J Rohleder, P Bonney, J Ramos-Vara, D Knapp
Objective—To determine uroplakin III expression, potential etiologic factors, biological behavior, and treatment response of transitional cell carcinoma (TCC) in the abdominal wall (ABWTCC) in dogs.
Design—Retrospective case series.
Animals—24 dogs with TCC of the urinary tract that also had histopathologic confirmation of ABWTCC.
Procedures—Medical records, histologic slides, radiographs, and ultrasonographic images of dogs with ABWTCC between July 1, 1985, and December 31, 2010, were reviewed. In available tissue specimens, immunohistochemistry was used to detect uroplakin III expression in the ABWTCC and in the primary tumor.
Results—The ABWTCC lesions ranged from < 2 to > 20 cm in diameter. Uroplakin III was expressed in 19 of 20 primary tumors and 17 of 17 ABWTCCs. Transitional cell carcinoma in the abdominal wall developed significantly more often in dogs that had undergone cystotomy (18/177 [10.2%]) than in those that had not (6/367 [1.6%]). In 1 dog that had not undergone cystotomy, TCC had invaded through the urinary bladder wall and spread down the median ligament to the abdominal wall. None of 18 dogs that received anticancer drugs had remission of the ABWTCC once clinically detected; median survival time after ABWTCC detection was 57 days (range, 0 to 324 days).
Conclusions and Clinical Relevance—Results suggested that ABWTCC is uncommon, but once TCC becomes established and clinically detectable in the abdominal wall, it carries a poor prognosis. It is crucial to minimize risk of TCC seeding at surgery. Percutaneous sampling of TCC should be avoided. Uroplakin III is commonly expressed in ABWTCC.

Preoperative factors associated with postoperative hypocalcemia in dogs with primary hyperparathyroidism that underwent parathyroidectomy: 62 cases (2004–2009)
M Milovancev, C Schmiedt
Objective—To identify preoperative variables associated with postoperative hypocalcemia in dogs with primary hyperparathyroidism undergoing parathyroidectomy.
Design—Retrospective case series.
Animals—62 dogs.
Procedures—Medical records of dogs undergoing parathyroidectomy for treatment of primary hyperparathyroidism between January 2004 and January 2009 at 4 institutions were reviewed; data regarding various preoperative variables and postoperative serum total and ionized calcium concentrations were recorded. Preoperative ultrasonographic and surgical findings were compared regarding laterality (right, left, or bilateral) of parathyroid gland lesions. Data were analyzed via ANOVA, simple linear regression, and multiple linear regression to identify associations between preoperative variables and postoperative serum total and ionized calcium nadir concentrations.
Results—Preoperative variables significantly associated with low postoperative serum total calcium nadir concentrations included old age, history of weakness, lack of gastrointestinal tract signs, high serum parathyroid hormone concentration, and low serum calcium-phosphorus concentration product value. Preoperative variables significantly associated with low postoperative serum ionized calcium nadir concentrations included sexually intact status, low body weight, high serum urea nitrogen...
concentration, and lack of polyuria and polydipsia in the history. Age, body weight, serum calcium-
phosphorus concentration product, and serum concentrations of parathyroid hormone and urea nitrogen
were included in the final multiple linear regression model for prediction of postoperative serum
calcium concentrations. Ultrasoundography was performed in 58 dogs; results for 44 (75.9%) dogs agreed
with surgical findings regarding laterality of parathyroid gland lesions.
Conclusions and Clinical Relevance—Prediction of postoperative hypocalcemia in dogs in this study
with primary hyperparathyroidism that underwent parathyroidectomy was difficult and depended on
multiple (history, physical examination, and clinicopathologic) factors.

L Waddell, R Poppenga, K Drobatz
Objective—to identify dogs with anticoagulant rodenticide (AR) screens submitted, determine
whether detected concentrations of the anticoagulants correlated with severity of clinical signs for dogs
with positive results on AR screens, and identify the most common disease processes present and the
prognosis for those with negative AR screens.
Design—Retrospective case series.
Animals—123 dogs.
Procedures—History, signalment, clinical signs, physical examination findings, PCV, total solids
concentration, prothrombin time, activated partial thromboplastin time, platelet count, AR
concentrations, duration of hospitalization, blood products administered, final diagnosis, and outcome
were recorded from medical records of dogs that underwent AR toxicology screenings.
Results—75 of 123 (60.9%) dogs tested positive for AR. Dogs tested positive for brodifacoum,
diphacinone (also called diphenadione), and chlorophacinone. Dogs with positive AR screenings
weighed significantly less, received significantly more fresh frozen plasma, had significantly longer
initial prothrombin time, and were significantly more likely to survive, compared with those with
negative screens. Anticoagulant rodenticide concentrations ranged from trace amounts to 1,120 parts
per billion and were not correlated with any recorded parameter. The most common conditions
diagnosed in the 48 dogs with negative screens included neoplasia in 15 (31.3%), immune-mediated
disease in 7 (14.6%), and gastrointestinal bleeding in 5 (10.4%) dogs.
Conclusions and Clinical Relevance—AR concentrations were not correlated with severity of clinical
signs or the degree of prolongation of coagulation times in this series of patients. Patients with severe
coagulopathies but negative results of AR screening had a poor prognosis, with neoplasia as the most
common diagnosis. Anticoagulant rodenticide intoxication had the best prognosis, with a survival rate
of 98.7% in this study.

American Journal Veterinary Research

Flow cytometric detection and procoagulant activity of circulating canine platelet-derived
microparticles.
Sarah E. Helmond, James L. Catalfamo, Marjory B. Brooks.
Objective—to measure platelet membrane–derived microparticle (PMP) content and thrombin-
generating capacity of canine plasma subjected to specific processing and storage conditions.
Animals—31 clinically normal dogs (19 males and 12 females).
Procedures—Citrate-anticoagulated blood samples obtained from each dog were centrifuged at 2,500 ×
g to isolate platelet-poor plasma (PPP), then PPP was centrifuged at 21,000 × g to isolate microparticle-
free plasma (MPF) and microparticle-enriched plasma (MPEP). Whole blood and paired samples of
fresh and frozen-thawed PPP, MPF, and MPEP were dual labeled for flow cytometric detection of
membrane CD61 (constitutive platelet antigen) and annexin V (indicating phosphatidylserine
externalization). Platelets and PMPs were enumerated with fluorescent, size-calibrated beads.
Thrombin generation in fresh and frozen-thawed PPP, MPF, and MPEP was measured via kinetic
fluorometric assays configured with low tissue factor and low phospholipid concentrations.
Results—Initial centrifugation yielded PPP with < 0.5% the platelets of whole blood, with median
counts of 413 PMPs/μL for males and 711 PMPs/μL for females. Sequential centrifugation resulted in
a 10-fold concentration of PMPs in MPEP and virtually depleted PMPs from MPF. Thrombin
generation depended on PMP content, with median endogenous thrombin potential of 0, 893, and 3,650
nmol•min in MPF, PPP, and MPEP, respectively. Freeze-thaw cycling caused significant increases in
PMP counts and phosphatidylserine externalization.
Conclusions and Clinical Relevance—Canine PMPs were major determinants of thrombin-generating
capacity; preanalytic variables influenced plasma PMP content. Processing conditions described here
may provide a basis for characterization of PMPs in clinical studies of thrombosis in dogs.
Expression of matrix metalloproteinases, their inhibitors, and lysyl oxidase in myocardial samples from dogs with end-stage systemic and cardiac diseases.
Sonja Fonfara, Udo Hetzel, Simon R. Tew, Peter Cripps, Joanna Dukes-McEwan, Peter D. Clegg.

Objective—To compare the degree of mRNA expression for matrix metalloproteinases (MMPs), tissue inhibitors (TIMPs), and lysyl oxidase in myocardial samples from dogs with cardiac and systemic diseases and from healthy control dogs.

Sample—Myocardial samples from the atria, ventricles, and septum of 8 control dogs, 6 dogs with systemic diseases, 4 dogs with dilated cardiomyopathy (DCM), and 5 dogs with other cardiac diseases.

Procedures—Degrees of mRNA expression for MMP-1, -2, -3, -9, and -13; TIMP-1, -2, -3, and -4; and lysyl oxidase were measured via quantitative real-time PCR assay. Histologic examination of the hearts was performed to identify pathological changes.

Results—In myocardial samples from control dogs, only TIMP-3 and TIMP-4 mRNA expression was detected, with a significantly higher degree in male versus female dogs. In dogs with systemic and cardiac diseases, all investigated markers were expressed, with a significantly higher degree of mRNA expression than in control dogs. Furthermore, the degree of expression for MMP-2, TIMP-1, and TIMP-2 was significantly higher in dogs with DCM than in dogs with systemic diseases and cardiac diseases other than DCM. Expression was generally greater in atrial than in ventricular tissue for MMP-2, MMP-13, and lysyl oxidase in samples from dogs with atrial fibrillation.

Conclusions and Clinical Relevance—Degrees of myocardial MMP, TIMP, and lysyl oxidase mRNA expression were higher in dogs with cardiac and systemic diseases than in healthy dogs, suggesting that expression of these markers is a nonspecific consequence of end-stage diseases. Selective differences in the expression of some markers may reflect specific pathogenic mechanisms and may play a role in disease progression, morbidity and mortality rates, and treatment response.

Description of technique and lower reference limit for magnetic resonance imaging of hippocampal volumetry in dogs.

Objective—To evaluate the use of high-resolution MRI for hippocampal volumetry in dogs and to define a lower reference limit for hippocampal formation (HF) volume.

Animals—20 dogs (with no history of seizures and no underlying structural brain disease) that underwent MRI of the brain.

Procedures—The MRI protocol included a high-resolution T1-weighted 3-D ultrafast gradient-echo sequence aligned in a dorsal plane perpendicular to the long axis of the HF. Images obtained with MRI were retrospectively analyzed by 2 observers (A and B). Intraobserver and interobserver agreement were calculated with the Lin concordance correlation coefficient. Volume measurements of the HF were adjusted for intracranial volume, and a lower 95% reference limit for adjusted HF volume was calculated.

Results—There was substantial intraobserver agreement (Lin concordance correlation coefficient, 0.97 [95% confidence interval (CI), 0.94 to 0.99]) but poor interobserver agreement (Lin concordance correlation coefficient, 0.63 [95% CI, 0.37 to 0.79]). The lower 95% reference limit for adjusted HF volume was 0.56 cm³ (90% CI, 0.52 to 0.60 cm³) for the right HF and 0.55 cm³ (90% CI, 0.52 to 0.58 cm³) for the left HF.

Conclusions and Clinical Relevance—HF volumes should be adjusted for intracranial volume to account for the large variation in canine skull size. The amount of time required to perform HF volumetry and low interobserver agreement may restrict this technique to research applications, such as the investigation of epileptic patients for hippocampal sclerosis or other cognitive disorders.

Incidence of bacteremia following upper gastrointestinal endoscopy and biopsy in healthy dogs before, during, and after treatment with omeprazole.
Katherine R. Jones, Carol W. Maddox, Marcella D. Ridgway, Stuart C. Clark-Price, Olivier Dossin.

Objective—To determine the incidence of bacteremia, as detected by routine methods for bacterial culture of blood samples, following routine endoscopic biopsy of the stomach and duodenum in healthy research dogs and to determine whether treatment with omeprazole administration affected the incidence of bacteremia.

Animals—8 healthy purpose-bred research dogs.

Procedures—All dogs underwent gastroduodenoscopy with biopsy at 4 points: twice prior to treatment with omeprazole, once following 15 days of omeprazole treatment (20 mg, PO, q 12 h), and once 14 days after treatment ceased. Dogs had a mean ± SD body weight of 18.6 ± 2.0 kg. Blood samples were aseptically obtained at 3 points during each procedure (before, immediately following, and 24 hours after each procedure).
after endoscopy), and routine aerobic and anaerobic bacterial culture of blood was performed. Results—96 cultures were attempted for each culture method, yielding positive results of aerobic culture for 2 dogs at separate time points and no positive results of anaerobic culture. Conclusions and Clinical Relevance—Routine gastrointestinal endoscopy with biopsy in healthy dogs did not result in a detectable bacteremia in most dogs. Treatment with the gastric acid-suppressing medication omeprazole did not affect the incidence of bacteremia as detected via standard techniques.

Evaluation of delivery agents used for introduction of small interfering RNAs into feline corneal cells.
Objective—To evaluate agents used for delivery of small interfering RNAs (siRNAs) into feline corneal cells, toxicity of the delivery agents, and functionality of anti-feline herpesvirus 1 (FHV-1)–specific siRNA combinations.
Sample—Feline primary corneal cells and 19 six-month-old colony-bred cats.
Procedures—siRNA delivery into corneal cells via various delivery agents was evaluated via flow cytometric detection of labeled siRNAs. Cellular toxicity was evaluated with a proliferation assay. Functionality was tested via quantitative reverse transcriptase PCR assay, plaque assay, and flow cytometry. In vivo safety was evaluated with an ocular scoring method following topical application of delivery agents containing siRNAs into eyes. Corneal biopsy specimens were used to assess safety and uptake of siRNAs into corneal cells.
Results—Use of 3 delivery agents resulted in > 95% transfection of primary corneal cells. Use of a peptide for ocular delivery yielded approximately 82% transfection of cells in vitro. In cultured corneal cells, use of the siRNA combinations resulted in approximately 76% to 89% reduction in FHV-1–specific mRNA, 63% to 67% reduction of FHV-1–specific proteins in treated cells, and 97% to 98% reduction in FHV-1 replication. The agents were nonirritating in eyes, caused no substantial clinical ocular signs, and were nontoxic. Histologically, corneal epithelium and stroma were normal in treated cats. However, none of the agents were effective in delivering siRNAs into the corneal cells in vivo.
Conclusions and Clinical Relevance—The tested anti–FHV-1–specific siRNAs could potentially be used as a treatment for FHV-1 if a successful means of in vivo delivery can be achieved.

Evaluation of vincristine-associated myelosuppression in Border Collies.
Denise L. Lind, Janean L. Fidel, John M. Gay, Katrina L. Mealey.
Objective—To determine whether Border Collies (ATP binding cassette subfamily B1 gene [ABCB1] wildtype) were more likely than other breeds to develop vincristine-associated myelosuppression (VAM) and, if so, whether this was caused by a mutation in ABCB1 distinct from ABCB1-1Δ.
Animals—Phase 1 comprised 36 dogs with the ABCB1 wildtype, including 26 dogs with lymphoma (5 Border Collies and 21 dogs representing 13 other breeds) treated with vincristine in a previous study; phase 2 comprised 10 additional Border Collies, including 3 that developed VAM and 7 with an unknown phenotype.
Procedures—For phase 1, the prevalence of VAM in ABCB1-wildtype Border Collies was compared with that for ABCB1-wildtype dogs of other breeds with data from a previous study. For phase 2, additional Border Collies were included. Hematologic adverse reactions were graded with Veterinary Co-operative Oncology Group criteria. Genomic DNA was used to amplify and sequence all 27 exons of the canine ABCB1. Sequences from affected dogs were compared with those of unaffected dogs and dogs of unknown phenotype.
Results—3 of 5 Border Collies with the ABCB1 wildtype developed VAM; this was significantly higher than the proportion of other dogs that developed VAM (0/21). A causative mutation for VAM in Border Collies was not identified, although 8 single nucleotide polymorphisms in ABCB1 were detected.
Conclusions and Clinical Relevance—Breed-associated sensitivity to vincristine unrelated to ABCB1 was detected in Border Collies. Veterinarians should be aware of this breed predisposition to VAM. Causes for this apparent breed-associated sensitivity should be explored.

Effects of oral administration of anti-inflammatory medications on inhibition of paracentesis-induced blood-aqueous barrier breakdown in clinically normal cats.
Amy J. Rankin, Lionel Sebbag, Nora M. Bello, William R. Crumley, Rachel A. Allbaugh.
Objective—To assess inhibitory effects of orally administered anti-inflammatory medications on paracentesis-induced intraocular inflammation in clinically normal cats.
Animals—30 clinically normal domestic shorthair cats.
Procedures—Cats were randomly assigned to a control group and 4 treatment groups. Cats in the treatment groups received an anti-inflammatory medication orally once daily at 7 AM (acetylsalicylic acid [40.5 mg/cat], meloxicam [0.1 mg/kg], prednisone [5 mg/cat], or prednisolone [5 mg/cat]) for 5 days beginning 2 days before paracentesis-induced breakdown of the blood-aqueous barrier (BAB) and continuing until 2 days after paracentesis. Paracentesis of the anterior chamber was performed in 1 randomly selected eye of each cat. Fluorophotometry was performed in both eyes of each cat immediately before (time 0) and 6, 24, and 48 hours after paracentesis.

Results—At 24 and 48 hours after paracentesis, fluorescein concentration in the eye subjected to paracentesis in the cats receiving prednisolone was decreased, compared with that in the control cats. At 48 hours, a decrease in the fluorescein concentration was also apparent in the eye subjected to paracentesis in the cats receiving meloxicam, compared with that in the control cats. There was no evidence of treatment effects for acetylsalicylic acid or prednisone. There was no evidence of treatment effects in eyes not subjected to paracentesis.

Conclusions and Clinical Relevance—Orally administered prednisolone and meloxicam significantly decreased intraocular inflammation in clinically normal cats with paracentesis-induced BAB breakdown. Oral administration of prednisolone or meloxicam may be an effective treatment for cats with uveitis.

Effects of a topically applied 2% delta-9-tetrahydrocannabinol ophthalmic solution on intraocular pressure and aqueous humor flow rate in clinically normal dogs.

Kristin M. Fischer, Daniel A. Ward, Diane V. H. Hendrix.

Objective—To determine the effects of topically applied 2% delta-9-tetrahydrocannabinol (THC) ophthalmic solution on aqueous humor flow rate (AHFR) and intraocular pressure (IOP) in clinically normal dogs.

Animals—21 clinically normal dogs. Procedures—A randomized longitudinal crossover design was used. Following acquisition of baseline IOP (morning and evening) and AHFR (afternoon only) data, dogs were randomly assigned to 2 treatment groups and received 1 drop of either 2% THC solution or a control treatment (olive oil vehicle) to 1 randomly selected eye every 12 hours for 9 doses. The IOPs and AHFRs were reassessed after the final treatment. Following a washout period of ≥ 7 days, dogs were administered the alternate treatment in the same eye, and measurements were repeated.

Results—Mean ± SD IOPs in the morning were 15.86 ± 2.48 mm Hg at baseline, 12.54 ± 3.18 mm Hg after THC treatment, and 13.88 ± 3.28 mm Hg after control treatment. Mean ± SD IOPs in the evening were 13.69 ± 3.36 mm Hg at baseline, 11.69 ± 3.94 mm Hg after THC treatment, and 12.13 ± 2.99 mm Hg after control treatment. Mean IOPs were significantly decreased from baseline after administration of THC solution but not the control treatment. Changes in IOP varied substantially among individual dogs. Mean ± SD AHFRs were not significantly different from baseline for either treatment.

Conclusions and Clinical Relevance—Topical application of 2% THC ophthalmic solution resulted in moderate reduction of mean IOP in clinically normal dogs. Further research is needed to determine efficacy in dogs with glaucoma.

Effects of topical ocular administration of high doses of human recombinant interferon alpha-2b and feline recombinant interferon omega on naturally occurring viral keratoconjunctivitis in cats.

Jessica M. Slack, Jean Stiles, Christian M. Leutenegger, George E. Moore, Roman M. Pogranichniy.

Objective—To determine whether 14-day topical ocular administration of high doses of feline recombinant interferon omega (FelFN) or human recombinant interferon alpha-2b (HulFN) solution improves clinical disease and decreases virus shedding in cats with naturally acquired viral keratoconjunctivitis.

Animals—36 cats with upper respiratory tract disease and ocular involvement.

Procedures—Cats received 1 drop of FelFN solution (1 × 10⁶ U/mL), HulFN solution (1 × 10⁶ U/mL), or saline (0.9% NaCl) solution (12 cats/group) in each eye twice daily for 14 days (beginning day 1). Oropharyngeal and conjunctival swab samples were collected from each cat before (day 0) and on day 14 of treatment for virus isolation (VI) and real-time quantitative PCR (RT-qPCR) testing to detect feline herpesvirus-1 and feline calicivirus. Subjective clinical scores were recorded on days 0, 3, 7, 10, and 14.

Results—The number of cats for which feline herpesvirus-1 was detected via VI or RT-qPCR assay was generally (albeit not always significantly) lower on day 14, compared with day 0 findings; however, findings on days 0 or 14 did not differ among groups. The number of cats for which feline calicivirus was detected via VI or RT-qPCR assay did not differ significantly between days 0 and 14 for any group. Clinical scores significantly decreased over the 14-day period but did not differ among
Pharmacokinetics of N-acetylcysteine after oral and intravenous administration to healthy cats.
Objective—To describe the pharmacokinetics of N-acetylcysteine (NAC) in healthy cats after oral and IV administration.
Animals—6 healthy cats.
Procedures—In a crossover study, cats received NAC (100 mg/kg) via IV and oral routes of administration; there was a 4-week washout period between treatments. Plasma samples were obtained at 0, 5, 15, 30, and 45 minutes and 1, 2, 4, 8, 12, 24, 36, and 48 hours after administration, and NAC concentrations were quantified by use of a validated high-performance liquid chromatography–mass spectrometry protocol. Data were analyzed via compartmental and noncompartmental pharmacokinetic analysis.
Results—Pharmacokinetics for both routes of administration were best described by a 2-compartment model. Mean ± SD elimination half-life was 0.78 ± 0.16 hours and 1.34 ± 0.24 hours for the IV and oral routes of administration, respectively. Mean bioavailability of NAC after oral administration was 19.3 ± 4.4%.
Conclusions and Clinical Relevance—The pharmacokinetics of NAC for this small population of healthy cats differed from values reported for humans. Assuming there would be similar pharmacokinetics in diseased cats, dose extrapolations from human medicine may result in underdosing of NAC in cats with acute disease. Despite the low bioavailability, plasma concentrations of NAC after oral administration at 100 mg/kg may be effective in the treatment of chronic diseases.

Evaluation of mass spectrometry of urinary proteins and peptides as biomarkers for cats at risk of developing azotemia.
Objective—To evaluate proteomic delineation of feline urine by mass spectrometry as a method for identifying biomarkers in cats at risk of developing azotemia.
Samples—Urine samples from geriatric cats (> 9 years old) with chronic kidney disease and nonazotemic cats that either remained nonazotemic (n = 10) or developed azotemia (10) within 1 year.
Procedures—Optimization studies with pooled urine were performed to facilitate the use of surface enhanced laser desorption-ionization time-of-flight mass spectrometry (SELDI-TOF-MS) for analysis of the urinary proteome of cats. Urine samples from nonazotemic cats at entry to the study were analyzed via SELDI-TOF-MS with weak cation exchange and strong anion exchange arrays. Spectral data were compared to identify biomarkers for development of azotemia.
Results—Low protein concentration in feline urine precluded direct application to array surfaces, and a buffer exchange and concentration step was required prior to SELDI-TOF-MS analysis. Three preparation conditions by use of weak cation and strong anion exchange arrays were selected on the basis of optimization studies for detection of biomarkers. Eight potential biomarkers with an m/z of 2,822, 9,886, 10,033, 10,151, 10,234, 11,653, 4,421, and 9,505 were delineated. Conclusions and Clinical Relevance—SELDI-TOF-MS can be used to detect urinary low-molecular weight peptides and proteins that may represent biomarkers for early detection of renal damage. Further study is required to purify and identify potential biomarkers before their use in a clinical setting.

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C. Robat, J. Burton, D. Thamm and D. Vail.
Objectives - To determine whether doxorubicin–piroxicam combination is safe and has activity against transitional cell carcinoma in dogs.
Methods - Data was collected retrospectively from 34 dogs from two institutions over a 6-year period. Signalment, clinical presentation, treatment specifics, adverse events, response, progression-free survival and overall survival time were evaluated.
Results- Dogs received doxorubicin every 3 weeks and daily piroxicam; 17 dogs (50%) had surgery. Clinical presentations were those typically reported for transitional cell carcinoma. Mean number of
doses administered was 3·5. Of the 23 dogs with measurable disease, 14 (60·5%) had stable disease, 7 (30·5%) had progressive disease and 2 (9%) a partial response. Adverse events were generally manageable, and gastrointestinal in origin; one dog died of treatment-related complications. Overall median progression-free survival and overall survival were 103 and 168 days, respectively. Cytoreductive surgery did not result in prolongation of progression-free survival, but significantly prolonged overall survival. All dogs but one died as a result of disease progression. Clinical Significance - Doxorubicin–piroxicam combination therapy is well-tolerated in dogs with transitional cell carcinoma although progression-free survival, overall survival and biological response rates appear modest. Combination with surgery appears to offer a survival advantage; however, this may reflect tumour location and volume. Prospective studies are necessary to compare activity of combination doxorubicin–piroxicam to currently applied therapies.

Objectives - To evaluate the efficacy of hypofractionated radiotherapy for canine nasal tumours, including the improvement in clinical signs, rate of complications and assessment of prognostic factors.
Methods - Medical records of 38 dogs with malignant nasal tumours were reviewed, and those treated with a weekly schedule of hypofractionated radiotherapy were included in the study. Acute and late side effects were defined as complications noted either within 1 month or after 6 months of irradiation, respectively. Progression-free interval and overall survival were calculated using the Kaplan–Meier method. Log-rank test and Cox proportional hazard model were also performed.
Results - Clinical signs improved in 30 of 36 dogs. Acute complications were seen in 28 of 36 dogs and were considered manageable. Late complications were observed in 17 of 30 dogs that survived 6 months or longer, but severe side effects were not observed. The median progression-free interval and overall survival was 245 days (95% CI: 127–512 days) and 512 days (95% CI: 203–820 days), respectively. Age, breed and presence of dyspnoea were negatively correlated with overall survival. Clinical Significance - These results suggest that hypofractionated radiotherapy could be a viable option for the treatment of nasal tumours in dogs that are not candidates for conventional multifractionated radiotherapy.

Quality of canine spermatozoa retrieved by percutaneous epididymal sperm aspiration.
Objectives - To investigate the feasibility of percutaneous epididymal sperm aspiration in dogs and whether it might provide a population of epididymal spermatozoa similar to the population that can be obtained by processing isolated epididymis caudae.
Methods - Concentration and total sperm number, motility, morphology and acrosomal integrity of spermatozoa retrieved by percutaneous epididymal sperm aspiration, in vitro aspiration and mincing of the cauda of the epididymis were compared.
Results - Percutaneous epididymal sperm aspiration is a feasible procedure to retrieve a population of spermatozoa in dogs. Quality is similar to that of spermatozoa collected in vitro, although a wide variation amongst animals was observed.
Clinical Significance - In case of ejaculation failure due to pathological conditions in dogs, the collection of spermatozoa from the cauda of the epididymis could be an option for providing gametes for assisted reproductive technologies. Percutaneous epididymal sperm aspiration can be used in dogs with compromised reproductive performance, in which orchectomy cannot be performed for medical or owner reasons. Further studies aimed to investigate whether the percutaneous epididymal sperm aspiration technique might be feasible for repeated semen collection and to accurately evaluate side effects are required.

Curettage and diathermy: a treatment for feline nasal planum actinic dysplasia and superficial squamous cell carcinoma.
Objective - To evaluate curettage and diathermy as a treatment for actinic dysplasia and superficial squamous cell carcinoma of the feline nasal planum.
Methods - Thirty-four cats clinically assessed to have actinic dysplasia and superficial squamous cell carcinoma involving less than 50% of the nasal planum were treated with a three-cycle curettage and diathermy procedure. Degree of dysplasia, response to treatment, adverse effects, owner perceptions, time to recurrence and proportion disease free at 1 year were evaluated.
Results - Lesions ranged from actinic keratoses to invasive squamous cell carcinoma. A complete response to treatment was obtained in all cats. The median follow-up time was 18 · 2 (IQR:
Two cats had a clinical recurrence of lesions at 161 and 192 days after treatment. The probability of remaining disease free after 12 months was 0.94 (95% CI: 0.85–1.0). Median time to recurrence was not reached. The procedure was well tolerated with a good cosmetic outcome and no significant post-operative complications.

**Clinical Significance** - This study suggests that curettage and diathermy is an effective treatment for feline actinic dysplasia and for superficial squamous cell carcinoma involving less than 50% of the nasal planum. Curettage and diathermy is an easily mastered technique, requiring minimal equipment.

**Intracranial migration of *Eucoleus (Capillaria) boehmi* in a dog.**


A 4-year-old, spayed-female great Dane was referred for surgical treatment of a suspected meningioma, diagnosed on magnetic resonance imaging 10 days prior to presentation. The suspected meningioma was removed via image-guided stereotactic craniotomy. Histopathological diagnosis was severe, locally extensive, chronic meningoencephalitis with an intraleisional nematode egg. The egg was morphologically consistent with *Eucoleus boehmi*, and aberrant migration into the cranial cavity was the presumed cause of this lesion. Three faecal samples were collected and revealed 4+ *E. boehmi* eggs. Treatment involved 110 mg/kg fenbendazole (Panacur, Intervet) orally twice daily for 14 days.

Nematodes including *E. boehmi* are a previously un-recognised source of intracranial disease in dogs, and should be considered as a differential for mass-like lesions visualised by magnetic resonance imaging.

**Long-term outcome in dogs undergoing mitral valve repair with suture annuloplasty and chordae tendinae replacement.**

T. Mizuno, T. Mizukoshi and M. Uechi.

Mitral valve repair under cardiopulmonary bypass was performed in three dogs with clinical signs associated with mitral regurgitation that were not controlled by medication. Mitral valve repair comprised circumferential annuloplasty and chordal replacement with expanded polytetrafluoroethylene. One dog died 2 years after surgery because of severe mitral regurgitation resulting from partial circumferential suture detachment. The others survived for over 5 years, but mild mitral valve stenosis persisted in one. The replaced chordae did not rupture in any dog. Mitral valve repair appears to be an effective treatment for mitral regurgitation in dogs. Chordal replacement with expanded polytetrafluoroethylene is a feasible technique, demonstrating long-term durability in dogs. However, mitral annuloplasty techniques need improvement.

**Basal cell carcinoma in a dog with chronic solar dermatitis.**


A seven-year-old, entire male, American Staffordshire bull terrier was diagnosed with chronic solar dermatitis and basal cell carcinoma, based on physical examination, cutaneous cytology and histopathology. Immunohistochemistry revealed that the tumour cells did not express p53. To the authors’ knowledge this is the first reported case of canine basal cell carcinoma developing as a complication of chronic solar dermatitis.

**Descriptive epidemiology of upper respiratory disease and associated risk factors in cats in an animal shelter in coastal western Canada**

N Gourkow, J H. Lawson, S C. Hamon, C J.C. Phillips

**Animal control measures and their relationship to the reported incidence of dog bites in urban Canadian municipalities**

N M. Clarke, D Fraser

**Carpal intra-articular blastomycosis in a Labrador retriever**

K S. Woods, M Barry, D Richardson

**Subclinical cecal impaction in a dog**

S Westgarth, A Singh, A R. Vince
Renal adenoma in a 5-year-old Labrador retriever: Big is not always bad
K Lillakas

Free proximal cortical ulnar autograft for the treatment of distal radial osteosarcoma in a dog
E Gasch, P Rivier, J Bardet

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