Canine Cardiac Troponin I Significantly Complements Established Prognostic Composite Score In Dogs With Systemic Inflammation.

Langhorn, Rebecca; Oyama, M.; King, L.; Machen, M.; Trafny, D.; Thawley, V.; Willesen, Jakob; Tarnow, Inge; Kjelgaard-Hansen, Mads

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### ORAL PRESENTATIONS – Thursday, May 31

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### BREAK

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<td>Sara Johns</td>
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<td>C-10</td>
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<td>C-11</td>
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<td>Keith Blass</td>
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**Also see Cardiology abstracts C-13 – C-26 (Thursday, May 31, 2:15 pm – 6:15 pm)**

Boldface type indicates ACVIM Resident Research Award eligibility.
SMALL ANIMAL - ENDOCRINOLOGY

9:00 am  EN-1  Tim Williams  RESTORATION OF EUTHYROIDISM IN MEDICALLY TREATED HYPERTHYROID CATS WITH IATROGENIC HYPOTHYROIDISM (IH) IMPROVES RENAL FUNCTION

9:15 am  EN-2  Mark Peterson  THYROID SCINTIGRAPHY FINDINGS IN 917 CATS WITH HYPERTHYROIDISM

9:30 am  EN-3  Bethany Sabatino  AMINO ACID, IODINE, SELENIUM, AND COAT COLOR STATUS AMONG HYPERTHYROID, SIAMESE, AND AGE-MATCHED CONTROL CATS

9:45 am  EN-4  Aline Vieira  EFFECT OF THE STAGE OF CHRONIC KIDNEY DISEASE ON SERUM TOTAL THYROXINE IN CATS

BREAK

10:30 am  EN-5  Eric Walsh  ASPART INSULIN CONSTANT RATE INFUSION FOR TREATMENT OF DOGS WITH DIABETIC KETOACIDOSIS

10:45 am  EN-6  Mia Reeve-Johnson  DETERMINATION OF REFERENCE VALUES FOR CASUAL BLOOD GLUCOSE CONCENTRATION IN CLINICALLY-HEALTHY, AGED CATS MEASURED WITH A PORTABLE GLUCOSE METER FROM AN EAR OR PAW SAMPLE

11:00 am  EN-7  Erin Mooney  EARLY-ONSET HYPOADRENOCORTICISM IN A KINDRED OF POMERANIANS

11:15 am  EN-8  Rebecca Haviland  CLINICAL FEATURES OF HYPOADRENOCORTICISM IN SOFT-COATED WHEATEN TERRIERS: 72 CASES (1979–2011)

11:30 am  EN-9  Emily Skovira  THE EFFECT OF SURGERY ON THE PITUITARY-ADRENAL AXIS IN DOGS

11:45 am  EN-10  Pascale Smets  LONG-TERM FOLLOW-UP OF RENAL FUNCTION IN DOGS WITH ACTH-DEPENDENT HYPERADRENOCORTICISM (ESVE Award Winner)

12:00 pm  EN-11  Jessica Timian  EVALUATION OF A LONG-ACTING SOMATOSTATIN RECEPTOR LIGAND FOR THE TREATMENT OF FELINE ACROMEGALY

12:15 pm  EN-12  Linda Martin  BASAL ALDOSTERONE CONCENTRATIONS AND RESPONSE TO ACTH STIMULATION IN HEALTHY AND CRITICALLY ILL DOGS

SMALL ANIMAL – NEPHROLOGY / UROLOGY

9:00 am  NU-1  Meryl Littman  PROTEIN-LOSING NEPHROPATHY ASSOCIATED WITH MUTATIONS IN NPHS1 (NEPHRIN) AND KIRREL2 (NEPH3/FILTRIN) IN SOFTCOATED WHEATEN TERRIERS

9:15 am  NU-2  Cara Horowitz  PRE-OPERATIVE PREDICTORS OF OUTCOME FOR CATS WITH SUCCESSFUL MANAGEMENT OF URETERAL OBSTRUCTIONS VIA URETERAL STENTING OR A SUBCUTANEOUS URETERAL BYPASS DEVICE

9:30 am  NU-3  Sarah Stewart  EVALUATION OF WHITE COAT HYPERTENSION IN DOGS AND CATS USING THE petMAP OSCILLOMETRIC BLOOD PRESSURE MONITOR

9:45 am  NU-4  Danielle Weinstein  THE EFFECT OF BODY POSITION ON INDIRECT SYSTOLIC BLOOD PRESSURE MEASUREMENT IN DOGS

BREAK

10:30 am  NU-5  Rebecca Geddes  FEEDING A RENAL DIET IS ASSOCIATED WITH A REDUCTION IN PLASMA FIBROBLAST GROWTH FACTOR 23 (FGF-23) IN CATS WITH STABLE CHRONIC KIDNEY DISEASE (CKD)

10:45 am  NU-6  Adam Eatroff  ACUTE KIDNEY INJURY IN DOGS HOSPITALIZED IN THE INTENSIVE CARE UNIT: A PROSPECTIVE STUDY (INTERIM ANALYSIS)

11:00 am  NU-7  Thierry Francey  LONG-TERM RENAL OUTCOME OF DOGS WITH ACUTE KIDNEY INJURY
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**SMALL ANIMAL – INFECTION DISEASE**

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<td>Megan Downey</td>
<td>CYTAUXZOOON FELIS CYTOCHROME B GENOTYPE IS ASSOCIATED WITH SURVIVAL IN DOMESTIC CATS WITH CYTAUXZOONOSIS</td>
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<td>Leah Cohn</td>
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<td>Audra Fenimore</td>
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<td>Matthew Krecic</td>
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<td>Linda Kidd</td>
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**Also see Infectious Disease abstracts ID-13 – ID-17 (Thursday, May 31, 2:45 pm – 4:00 pm)**

**EQUINE**

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<td>Colin Schwarzwald</td>
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9:15 am  E-2  Mark Bowen  VALIDATION OF A POINT OF CARE ULTRASOUND DEVICE FOR THE ASSESSMENT OF CARDIAC DISEASE IN THE HORSE

9:30 am  E-3  Erin McConachie  DOPPLER AND VOLUMETRIC ECHOCARDIOGRAPHIC METHODS FOR CARDIAC OUTPUT MEASUREMENT IN STANDING ADULT HORSES

9:45 am  E-4  Stacy Tinkler  EFFECTS OF PRE-RACE FUROSEMIDE ADMINISTRATION ON PLASMA ELECTROLYTE CONCENTRATIONS AND ACID-BASE BALANCE IN STANDARDBREDS UNDERGOING A SIMULATED RACE PROTOCOL

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10:30 am  E-5  Stacey Sullivan  ASSOCIATION BETWEEN EXERCISE-INDUCED PULMONARY HAEMORRHAGE AND DURATION OF RACING CAREER IN THOROUGHBRED RACE HORSES

10:45 am  E-6  Maty Looijen  HYPERBARIC OXYGEN THERAPY DOES NOT ALTER mRNA INFLAMMATORY GENES EXPRESSION IN HEALTHY HORSES

11:00 am  E-7  Krista Estell  TEMPORAL VIRAL LOAD IN SEVEN HORSES WITH NATURALLY OCCURRING EQUINE HERPESVIRUS-1 MYELOENCEPHALOPATHY

11:15 am  E-8  Nicola Pusterla  INVESTIGATION OF THE ROLE OF MULES DURING AN OUTBREAK OF EQUINE HERPESVIRUS-1 MYELOENCEPHALOPATHY IN CALIFORNIA

11:30 am  E-9  Nathan Slovis  EQUINE SALMONELLOSIS. THE USE OF AN ENHANCED RAPID TEST SYSTEM (Reveal® 2.0 Salmonella Test System) FOR EARLY DETECTION OF SALMONELLA IN FECES AND ENVIRONMENTAL SAMPLES

11:45 am  E-10  Gillian Perkins  ANTIMICROBIAL SUSCEPTIBILITY OF SALMONELLA ISOLATES OBTAINED FROM HORSES IN THE NORTHEASTERN UNITED STATES

12:00 pm  E-11  Florence Polle  ROLE OF INTRAOCULAR BACTERIAL INFECTIONS IN HORSES WITH RECURRENT UVEITIS IN LOUISIANA

12:15 pm  E-12  Raffaella Teixeira  GENETIC DETERMINANTS OF MELANOMA SUSCEPTIBILITY IN GRAY HORSES

SMALL ANIMAL – CARDIOLOGY**

2:15 pm  C-13  Manuela Perego  ANALYSIS OF ATRIAL REPOLARIZATION WAVE (Ta) IN DOGS WITH THIRD-DEGREE ATRIOVENTRICULAR BLOCK

2:30 pm  C-14  Jorge Vila  STRUCTURAL AND MOLECULAR PATHOLOGY OF THE ATRIUM IN BOXER ARRHYTHMOGENIC CARDIOMYOPATHY

2:45 pm  C-15  Jordan Vitt  INCIDENCE OF HEART DISEASE IN CATS WITH ELECTROCARDIOGRAPHIC EVIDENCE OF LEFTWARD MEAN ELECTRICAL AXIS SHIFT

3:00 pm  C-16  Jennifer Mulz  NT-PROBNP AS A SCREENING TOOL TO DETECT CLINICALLY SIGNIFICANT HEART DISEASE IN ASYMPTOMATIC CATS WITH HEART MURMURS AND/OR GALLOP RHYTHMS

3:15 pm  C-17  Bethany Smouther  HEART RATE AND ARRHYTHMIA FREQUENCY OF NORMAL CATS COMPARED TO CATS WITH HYPERTROPHIC CARDIOMYOPATHY

3:30 pm  C-18  Bethany Smouther  EFFECT OF ATENOLOL ON HEART RATE, ARRHYTHMIAS, BLOOD PRESSURE, AND DYNAMIC LEFT VENTRICULAR OUTFLOW TRACT OBSTRUCTION IN CATS WITH ASYMPTOMATIC HYPERTROPHIC CARDIOMYOPATHY

3:45 pm  C-19  Andrea Lantis  THE EFFECT OF ENALAPRIL ON FUROSEMIDE-ACTIVATED RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM (RAAS) IN NORMAL DOGS
4:30 pm C-20 Marisa Ames THE EFFECT OF HIGH DOSE PIMOBENDAN ON THE FUROSEMIDE-INDUCED RENIN-ANGIOTENSIN-ALDOSTERONE-SYSTEM (RAAS)

4:45 pm C-21 Mari Waterman DURATION OF BETA-BLOCKADE ASSOCIATED WITH REPEATED ONCE-DAILY ADMINISTRATION OF ATENOLOL IN HEALTHY DOGS.

5:00 pm C-22 Dennis Trafny EFFECT OF KETANSERIN, A SEROTONIN 2A-RECEPTOR ANTAGONIST, ON ECHOCARDIOGRAPHIC INDICES OF MITRAL REGURGITATION IN DOGS WITH DEGENERATIVE MITRAL VALVE DISEASE

5:15 pm C-23 Sonja Fonfara MYOCARDIAL ICAM1 mRNA IS INCREASED IN CANINE DILATED CARDIOMYOPATHY

5:30 pm C-24 Melanie Hezzell ASSOCIATIONS BETWEEN N-TERMINAL PROCOLLAGEN TYPE III (PIIINP), FIBROSIS AND ECHOCARDIOGRAPHIC INDICES IN DOGS WITH MITRAL VALVE DISEASE

5:45 pm C-25 Kristen Parker NOT ALL ARTERIES ARE CREATED EQUAL: COMPARISON OF PRESSURES WITHIN THE AORTIC ROOT AND THE DORSAL PEDAL ARTERY IN CATS

6:00 pm C-26 Brandon Pogue RETROGRADE CORONARY VENOUS STEM CELL DELIVERY: A PILOT STUDY EVALUATING SAFETY AND FEASIBILITY

**Also see Cardiology abstracts C-1 – C-12 (Thursday, May 31, 9:00 am – 12:30 pm)**

SMALL ANIMAL - HEMATOLOGY

2:15 pm HM-1 Anna Dengate THE OVERALL HAEMOSTASIS POTENTIAL: A NOVEL, COST EFFECTIVE, GLOBAL COAGULATION ASSAY FOR USE IN CANINE PLASMA

2:30 pm HM-2 Reinhard Mischke MEASUREMENT OF THROMBIN GENERATION IN DOGS WITH DIFFERENT DISEASES

2:45 pm HM-3 Bérénice Conversy IN VITRO EVALUATION OF THE EFFECT OF RIVAROXABAN ON COAGULATION PARAMETERS IN HEALTHY DOGS

3:00 pm HM-4 Fiona Park ASSESSMENT OF HYPERCOAGULABILITY IN CANINE PITUITARY-DEPENDENT HYPERADRENOCORTICISM

3:15 pm HM-5 Anna Dengate DELAYED FIBRINOLYSIS IN DOGS WITH NATURALLY OCCURRING PITUITARY DEPENDANT HYPERADRENOCORTICISM

3:30 pm HM-6 Craig Ruaux SYRINGE AND AGGREGATE FILTER ADMINISTRATION DOES NOT AFFECT SURVIVAL OF TRANSFUSED AUTOLOGOUS FELINE RED BLOOD CELLS

3:45 pm HM-7 Jessica Schavone LEUKOREDUCTION OF FELINE WHOLE BLOOD USING A NEONATAL LEUKOCYTE REDUCTION FILTER: A PILOT EVALUATION

SMALL ANIMAL - HEMATOLOGY

4:30 pm HM-8 Alex Lynch UTILITY OF SERIAL ANTI-XA MONITORING IN DOGS RECEIVING DALTEPARIN

4:45 pm HM-9 Reinhard Mischke PLATELET FUNCTION IN DOGS WITH INFLAMMATORY DISEASES

5:00 pm HM-10 Alice Defarges 15-GAUGE CORE BONE MARROW BIOPSY IN SMALL DOGS AND CATS WITH HEMATOLOGIC DISORDERS – 16 CASES

5:15 pm HM-11 Stephanie Smith SERUM BIOMARKERS INDICATE HEMOLYSIS AND AN INFLAMMATORY RESPONSE TO TRANSFUSION OF AUTOLOGOUS STORED ERYTHROCYTE CONCENTRATES

5:30 pm HM-12 Sean Majoy ASSESSMENT OF PLATELET ACTIVATION IN DOGS ADMITTED TO THE INTENSIVE CARE UNIT (ICU) BY USE OF FLOW CYTOMETRY AND THROMBOELASTOGRAPHY
5:45 pm  HM-13 Melissa Bucknoff  EVALUATION OF THROMBOELASTOGRAPHY TO PREDICT CLINICAL BLEEDING IN THROMBOCYTOPENIC DOGS AFTER TOTAL BODY IRRADIATION AND HEMATOPOIETIC CELL TRANSPLANTATION

6:00 pm  HM-14 Andrea Zoia  IMMUNE-MEDIATED HEMOLYTIC ANEMIA IN CATS WITH PANCREATITIS

SMALL ANIMAL – NEUROLOGY / PHARMACOLOGY

2:15 pm  N-1 Christopher Levine  CEREBELLAR ABIOTROPHY IN FOUR RELATED POMERANIANS

2:30 pm  N-2 Unity Jeffery  DOES CEREBROSPINAL FLUID CYTOMETRY PREDICT CENTRAL NERVOUS SYSTEM HISTOLOGY?

2:45 pm  N-3 Katherine Crook  THE PHARMACOKINETICS OF CYTARABINE IN DOGS WHEN ADMINISTERED VIA SUBCUTANEOUS AND CONTINUOUS INTRAVENOUS INFUSION ROUTES

3:00 pm  N-4 Intan Shafie  CEREBROSPINAL FLUID CLUSTERIN IS A POTENTIAL BIOMARKER OF CANINE NEURODEGENERATIVE DISORDERS

3:15 pm  N-5 Daniel Sanchez-Masian  L-2-HYDROXYGLUTARIC ACIDURIA IN YORKSHIRE TERRIER DOGS: CHARACTERIZATION OF THE MOLECULAR DEFECT

3:30 pm  N-6 Kendra Mikoloski  DIAGNOSTIC VALUE AND DISCRIMINATORY ABILITY OF PROTON MAGNETIC RESONANCE SPECTROSCOPY FOR INTRACRANIAL NEOPLASIA IN DOGS

3:45 pm  N-7 Cona Anwer  MAGNETIC RESONANCE IMAGING FEATURES OF INTRACRANIAL GRANULAR CELL TUMORS IN SEVEN DOGS

BREAK

4:30 pm  N-8 Devon Hague  SIGNALMENT, CLINICAL FINDINGS, MAGNETIC RESONANCE IMAGING FEATURES AND SURGICAL OUTCOMES WITH HISTOPATHOLOGICALLY CONFIRMED EPIDURAL AND SUBDURAL SPINAL CORD HEMATOMA IN DOGS

4:45 pm  N-9 Jessica Barker  MRI ASSESSMENT OF DOGS WITH DESCENDING TRANSTENTORIAL AND / OR FORAMEN MAGNUM BRAIN HERNIATIONS

5:00 pm  N-10 Kari Foss  KINEWATOMIC GAIT ANALYSIS USING 3-D MOTION MOTION CAPTURE IN DOBERMAN PINCERS WITH AND WITHOUT CERVICAL SPONDYLOMYELOPATHY

5:15 pm  N-11 Thomas Flegel  THE VACUUM PHENOMENON IN INTERVERTEBRAL DISC DISEASE OF DOGS BASED ON COMPUTED TOMOGRAPHY IMAGES

5:30 pm  N-12 E Beltran  MUTATION ASSOCIATED WITH NEONATAL CEREBELLAR CORTICAL DEGENERATION IN BEAGLE DOGS IDENTIFIED BY GENOME-WIDE MRNA SEQUENCING

5:45 pm  N-13 Starr Cameron  SURGICAL REMOVAL OF FELINE INTRACRANIAL MENINGIOMAS: CLINICAL FEATURES AND OUTCOME IN 121 CASES (1994-2011)

6:00 pm  P-1 Michaela Beasley  THE PHARMACOKINETICS OF SINGLE DOSE EXTENDED RELEASE KEPPRA® WITH AND WITHOUT FOOD IN HEALTHY ADULT DOGS

SMALL ANIMAL – RESPIRATORY / OTHER

2:15 pm  R-1 Katharine Woods  COMPARISON OF BRONCHOALVEOLAR LAVAGE ASPIRATION TECHNIQUES IN HEALTHY DOGS: MANUAL ASPIRATION VIA POLYETHYLENE TUBING AND SUCTION PUMP ASPIRATION

2:30 pm  R-2 Richard Stone  ENVIRONMENTAL AIR QUALITY, METEOROLOGICAL FACTORS, AND FELINE RESPIRATORY DISEASE

2:45 pm  R-3 Erinne Branter  TRACHEAL MALFORMATIONS IN YORKSHIRE TERRIERS
3:00 pm  R-4  Chee-hoon Chang  ORAL GLUCOCORTICOIDS MAY DIMINISH EFFICACY OF ALLERGEN-SPECIFIC IMMUNOTHERAPY IN EXPERIMENTAL FELINE ASTHMA

3:15 pm  R-5  Chee-hoon Chang  FELINE T REGULATORY CELLS IN BRONCHOALVEOLAR LAVAGE FLUID AND WHOLE BLOOD IN HEALTHY AND EXPERIMENTALLY ASTHMATIC CATS

3:30 pm  R-6  A. Ray Dillon  LUNG PATHOLOGY ASSOCIATED WITH TOXOCARA CATI INFECTION IN CATS IS INDEPENDENT OF DEVELOPMENT OF ADULT INTESTINAL PARASITES

3:45 pm  R-7  Laura Nafe  CERVICAL LUNG LOBE HERNIATION IN DOGS WITH COUGH AS IDENTIFIED BY FLUOROSCOPY

BREAK

4:30 pm  R-8  Yukihito Shiroshita  ASSESSMENT OF ARTERIALIZATION OF PERIPHERAL VENOUS BLOOD IN WELL-PERFUSED DOGS

4:45 pm  OT-1  Withdrawn

5:00 pm  OT-2  Alexandra Floras  HOSPITAL VERSUS COMMUNITY ACQUIRED INTRA-ABDOMINAL INFECTION OF GASTROINTESTINAL ORIGIN IN DOGS

5:15 pm  OT-3  Medora Pashmakova  MULTI-CENTER EVALUATION OF THE ADMINISTRATION OF CROTALID ANTIVENOM IN CATS

5:30 pm  OT-4  Stacy Burdick  ENDOSCOPIC-GUIDED LASER ABLATION OF VESTIBULOVAGINAL DEFECTS IN 36 DOGS

5:45 pm  OT-5  Joshua Rowe  18FLT-PET/CT FOR NON-INVASIVE FUNCTIONAL IMAGING OF CANINE BONE MARROW

6:00 pm  OT-6  Kara Osterbur  LIPOPOLYSACCHARIDE, TUMOR NECROSIS FACTOR, AND INTERLEUKIN-1β INDUCE NT-PRO C-TYPE NATRIURETIC PEPTIDE SECRETION FROM CANINE VASCULAR ENDOTHELIAL CELLS

SMALL ANIMAL - GASTROENTEROLOGY**

2:15 pm  GI-1  Melissa Markel  CHARACTERIZATION OF FECAL DYSBIOSIS IN DOGS WITH CHRONIC ENTEROPATHIES AND ACUTE HEMORRHAGIC DIARRHEA

2:30 pm  GI-2  Maria Volkmann  FINAL DIAGNOSES IN 136 DOGS WITH CHRONIC DIARRHEA

2:45 pm  GI-3  Niels Grützner  SERUM HOMOCYSTEINE CONCENTRATIONS IN CHINESE SHAR PEIS AND DOGS OF SIX OTHER BREEDS WITH COBALAMIN DEFICIENCY

3:00 pm  GI-4  Caroline Mansfield  CONFOCAL ENDOMICROSCOPY ENABLES IN VIVO IDENTIFICATION OF GASTRIC HELICOBACTER-LIKE ORGANISMS IN DOGS

3:15 pm  GI-5  Romy Heilmann  FECAL S100A12 CONCENTRATIONS ARE INCREASED IN DOGS WITH INFLAMMATORY BOWEL DISEASE

3:30 pm  GI-6  Katie Stroda  HISTOPATHOLOGICAL, CLINICAL, ENDOSCOPIC, AND ULTRASOUND FEATURES OF DOGS WITH CHRONIC ENTEROPATHIES AND SMALL INTESTINAL CRYPT LESIONS

3:45 pm  GI-7  Itamar Aroch  SERUM PEPsiNOGEN A AS A PROGNOSTIC MARKER IN CANINE GASTRIC DILATATION AND VOLVULUS
4:45 pm GI-8 Caroline Goutal  
**COMPARISON OF QUALITY AND DIAGNOSTIC ADEQUACY OF CANINE DUODENAL MUCOSAL BIOPSY SPECIMENS OBTAINED WITH DIFFERENT ENDOSCOPIC FORCEPS IN 17 DOGS**

5:00 pm GI-9 Cris Otoni  
**SEROLOGIC AND FECAL MARKERS IN PREDICTION OF ACUTE DISEASE COURSE IN CANINE CHRONIC ENTEROPATHIES**

5:15 pm GI-10 Alexandra Galler  
**FLOW CYTOMETRICAL ANALYSIS OF PERIPHERAL BLOOD MONONUCLEAR CELLS IN DOGS WITH INFLAMMATORY BOWEL DISEASE**

5:30 pm GI-11 Shingo Maeda  
**DECREASED IMMUNOGLOBULIN A LEVELS IN FECES, DUODENUM, AND PERIPHERAL BLOODLYMPHOCYTES OF DOGS WITH INFLAMMATORY BOWEL DISEASE**

5:45 pm GI-12 Panagiotis Xenoulis  
**FELINE EXOCRINE PANCREATIC INSUFFICIENCY: 150 CASES**

6:00 pm GI-13 Katie Tolbert  
**EXOGENOUS SIALIC ACID AND CYSTEINE PROTEASE INHIBITION BLOCK ADHERENCE OF TRITRICHOMONAS FOETUS TO THE INTESTINAL EPITHELIUM**

**Also see Gastroenterology abstracts GI-14 – GI-16 (Friday, June 1, 9:15 am – 10:00 am).**

**SMALL ANIMAL – IMMUNOLOGY / INFECTIOUS DISEASE** / **ONCOLOGY**

2:15 pm IM-1 Andrea Wang  

2:30 pm IM-2 Laura Nafe  
**EX VIVO IMMUNOSUPPRESSION OF CANINE T LYMPHOCYTE-SPECIFIC PROLIFERATION USING DEXAMETHASONE, CYCLOSPORINE, AND THE ACTIVE METABOLITES OF AZATHIOPRINE AND LEFLUNOMIDE IN A FLOW CYTOMETRIC ASSAY**

2:45 pm ID-13 Nahvid Etedali  
**NT-pCNP AS A DIAGNOSTIC BIOMARKER FOR SEPSIS IN DOGS PRESENTING FOR EMERGENCY CARE**

3:00 pm ID-14 Monika Burns  
**SERIAL NT-pCNP in HOSPITALIZED DOGS WITH SEPSIS**

3:15 pm ID-15 Amy Davenport  
**PHYLOGENETIC DIVERSITY OF BACTERIA ISOLATED FROM SICK DOGS USING THE BAPGM ENRICHMENT CULTURE PLATFORM**

3:30 pm ID-16 Kimberly Yore  
**PREVALENCE OF BARTONELLA SPP. AND HEMOPLASMAS IN THE BLOOD OF DOGS AND THEIR FLEAS IN FLORIDA**

3:45 pm ID-17 Lindsay Tangeman  
**CLINICOPATHOLOGIC FEATURES AND ATYPICAL PRESENTATIONS OF NATURALLY OCCURRING CANINE LEPTOSPIROSIS: 51 CASES (2000-2010)**

**Also see Infectious Disease abstracts ID-1 – ID-12 (Thursday, May 31, 9:00 am – 12:30 pm)**

**BREAK**

4:30 pm O-1 Esther Chon  
**CHARACTERIZATION OF BETA-CATENIN EXPRESSION IN CANINE ORAL MELANOMA (VCS AWARD WINNER)**

4:45 pm O-2 Lindsay Thalheim  
**AGREEMENT BETWEEN FLOW CYTOMETRY, PCR FOR ANTIGEN RECEPTOR REARRANGEMENT, AND IMMUNOHISTOCHEMISTRY IN CANINE LYMPHOMA (VCS AWARD WINNER)**

5:00 pm O-3 Deborah Knapp  
**FIROCOXIB HAS ANTITUMOR ACTIVITY AS A SINGLE AGENT AND ENHANCES THE ACTIVITY OF CISPLATIN IN DOGS WITH TRANSITIONAL CELL CARCINOMA OF THE URINARY BLADDER**

5:15 pm O-4 Mitchell Kaye  
**PHASE II CLINICAL TRIAL OF VINOELBINE AND PIROXICAM FOR DOGS WITH TRANSITIONAL CELL CARCINOMA OF THE URINARY BLADDER**
5:30 pm O-5 Krysta Deitz  
**COMPUTED TOMOGRAPHIC APPEARANCE OF CANINE THYROID TUMORS**

5:45 pm O-6 Cecilia Robat  
**MULTI-INSTITUTION RETROSPECTIVE STUDY OF 85 CASES OF CANINE THYMOMA (1999-2010)**

6:00 pm O-7 Krysta Deitz  
**EVALUATION OF SECRETED FRIZZLED-RELATED PROTEIN 2 EXPRESSION IN CANINE THYROID TUMORS USING RT-PCR AND IMMUNOHISTOCHEMISTRY**

**EQUINE**

2:15 pm E-13 Victoria Scott  
**EFFECT OF BODY POSITION ON ABDOMINAL PRESSURES IN ADULT HORSES**

2:30 pm E-14 Harold Schott II  
**VOLUME OF DISTENDED SMALL INTESTINE AND IONIC COMPOSITION OF GASTRIC REFUX AND SMALL INTESTINAL FLUID IN HORSES**

2:45 pm E-15 Jocelyn Habershon-Butcher  
**PREVALENCE AND RISK FACTORS FOR ULCERATION OF THE GASTRIC GLANDULAR MUCOSA IN THOROUGHBRED RACEHORSES IN TRAINING IN THE UK AND AUSTRALIA**

3:00 pm E-16 James Belknap  
**REGULATION OF HYPOXIA INDUCTIBLE FACTOR-1A AND RELATED GENES IN THE EQUINE KERATINOCYTE AND DIGITAL LAMINAE IN EXPERIMENTAL MODELS OF EQUINE LAMINITIS**

3:15 pm E-17 Teresa Burns  
**LAMINAR INFLAMMATORY EVENTS IN LEAN AND OBESE PONIES SUBJECTED TO HIGH CARBOHYDRATE FEEDING: IMPLICATIONS FOR PASTURE-ASSOCIATED LAMINITIS**

3:30 pm E-18 Heidi Banse  
**ABSENCE OF OXIDATIVE STRESS IN THE SKELETAL MUSCLE OF OBESE HORSES**

3:45 pm E-19 Kate McGovern  
**THE EFFECTS OF EXPERIMENTALLY INDUCED HYPERGLYCEMIA AND ENDOTOXEMIA ON COAGULATION PARAMETERS IN HEALTHY ADULT HORSES**

**BREAK**

4:30 pm E-20 Jennifer Mahon  
**EVALUATION OF HYPERCOAGULABILITY IN GERIATRIC HORSES WITH/WITHOUT PITUITARY PARS INTERMEDIA DYSFUNCTION**

4:45 pm E-21 Katarzyna Dembek  
**RENN-ANGIOTENSIN-ALDOSTERONE SYSTEM (RAAS) RESPONSE AND ACTH/ALDOSTERONE RATIO IN SEPTIC NEWBORN FOALS**

5:00 pm E-22 Martin Furr  
**EFFECTS OF BLOOD CONTAMINATION ON PARAMETERS OF CEREBROSPINAL FLUID ANALYSIS**

5:15 pm E-23 Alexandra Draper  
**THE EPIDEMIOLOGY OF SHIVERS IN HORSES**

5:30 pm E-24 Nora Nogradi  
**PROGNOSTIC FACTORS ASSOCIATED WITH SHORT-TERM AND LONG-TERM OUTCOME IN HORSES WITH CHRONIC RENAL FAILURE**

5:45 pm E-25 Noah Cohen  
**IN VIVO ADMINISTRATION OF CPG ENHANCES FOAL NEUTROPHIL FUNCTION**

6:00 pm E-26 Alexandra Burton  
**EFFECT OF AGE ON THE PHARMACOKINETICS OF A SINGLE DAILY DOSE OF GENTAMICIN SULPHATE IN FOALS**

**FOOD ANIMAL**

2:15 pm FA-1 Christopher Luby  
**SKILLS REQUIRED OF ENTRY LEVEL VETERINARIANS: A SURVEY OF DAIRY PRACTITIONERS**

2:30 pm FA-2 Scott Weese  
**METAGENOMIC EVALUATION OF THE INTESTINAL MICROBIOME IN VEAL CALVES AND THE INFLUENCE OF ORAL TETRACYCLINE**

2:45 pm FA-3 Scott Weese  
**A PROSPECTIVE CONTROLLED STUDY ON PREVALENCE OF CLOSTRIDIUM DIFFICILE IN VEAL CALVES RECEIVING AND NOT RECEIVING ORAL OXYTETRACYCLINE**
3:00 pm FA-4 Angelika Schoster INCREASED STRONG ION GAP IN DAIRY CALVES WITH DIARRHEA IS LIKELY DUE TO D-LACTATE

3:15 pm FA-5 Gillian Perkins ANTIMICROBIAL RESISTANCE TRENDS AMONG SALMONELLA ISOLATES OBTAINED FROM DAIRY CATTLE IN THE NORTHEASTERN USA, 2004-2010

3:30 pm FA-6 Gretchen Grissett EVALUATION OF ORALLY SUPPLEMENTED D, L-METHIONINE AS A URINE ACIDIFIER FOR SMALL RUMINANTS

3:45 pm FA-7 Philippa Sprake THE EFFECT OF AMMONIUM CHLORIDE TREATMENT AS A LONG TERM PREVENTATIVE APPROACH FOR UROLITHIASIS IN GOATS AND A COMPARISON OF CONTINUOUS AND PULSE DOsing REGIMES

BREAK

4:30 pm FA-8 Sébastien Buczinski ECHOCARDIOGRAPHIC MEASUREMENT OF VALVULAR THICKNESS IN HEALTHY COWS, COWS WITH BACTERIAL ENDOCARDITIS AND COWS WITH CARDIORESPIRATORY DISEASES

4:45 pm FA-9 Withdrawn

5:00 pm FA-10 Meera Heller UTERINE NEOPLASIA IN SMALL RUMINANTS: RETROSPECTIVE STUDY (1991-2011)


5:30 pm FA-12 Toby Pinn COMPARISON OF THREE IMMUNOGLOBULIN G (IgG) ASSAYS FOR DIAGNOSIS OF FAILURE OF PASSIVE TRANSFER IN NEONATAL ALPACAS

5:45 pm FA-13 Amanda Kreuder BIOAVAILABILITY AND PHARMACOKINETICS OF ORAL MELOXICAM IN LLAMAS

6:00 pm FA-14 Kristen Thane FLORFENICOL PHARMACOKINETICS IN HEALTHY ADULT ALPACAS, EVALUATING TWO COMMERCIALLY AVAILABLE DRUG FORMULATIONS

ORAL PRESENTATIONS – FRIDAY, JUNE 1

SMALL ANIMAL – NUTRITION / METABOLISM

8:00 am NM-1 Ebenezer Satyaraj NUTRITIONAL IMMUNOMODULATION: BOVINE COLOSTRUM FOR IMMUNE & GUT HEALTH IN DOGS

8:15 am NM-2 Alexander German EFFECTS OF WEIGHT LOSS IN OBESE DOGS ON A RANGE OF RENAL BIOMARKERS

8:30 am NM-3 Hannelore Van de Velde mRNA EXPRESSION RESPONSE OF ADIPOKINES TO FELINE OBESITY DEPENDS ON ADIPOSE TISSUE LOCATION

8:45 am NM-4 Isabelle Jeissette COMPARISON OF TWO WEIGHT LOSS DIETS IN OVERWEIGHT CATS

9:00 am NM-5 Angela Witzel (Lusby) COMPARISION OF HIGH FIBER AND LOW CARBOHYDRATE DIETS ON OWNER-PERCEIVED SATIETY OF CATS DURING WEIGHT LOSS

9:15 am NM-6 Samuel Serisier SEASON AND MONTH EFFECTS ON FOOD INTAKE IN ADULT COLONY CATS

9:30 am NM-7 Raphael Goudezie INFLUENCE OF DIFFERENT SOURCES OF CORN STARCH ON STOOLS CHARACTERISTICS IN DOGS DIFFERING IN BODY SIZE

9:45 am NM-8 Samuel Serisier A 8.5-YEAR LONGITUDINAL STUDY TO IDENTIFY RISK FACTORS OF OBESITY IN COLONY CATS
**SMALL ANIMAL – HEPATOLOGY / GASTROENTEROLOGY**

8:00 am  HP-1 Clémence Peyron  LIVER HISTOLOGICAL LESIONS IN 43 SCOTTISH TERRIERS (ST) WITH HYPERACTIVITY OF ALKALINE PHOSPHATASES (AP)


8:30 am  HP-3 Sharon Center  LONG-TERM SURVIVAL OF DOGS (n= 597) WITH CONGENITAL OR ACQUIRED PORTOSYSTEMIC SHUNTING: 1980-2010

8:45 am  HP-4 Manabu Sakai  SERUM BRANCHED-CHAIN AMINO ACID/TYROSINE RATIO (BTR) IN DOGS WITH LIVER DISEASES

9:00 am  HP-5 Yumi Sakamoto  PLASMA AND HEPATIC ENDOTHELIN-1 IN DOGS WITH CHRONIC LIVER DISEASES

9:15 am  GI-14 Belgin Dogan  COMPARISON OF *E. COLI* ASSOCIATED WITH GRANULOMATOUS COLITIS OF BOXER DOGS AND *E. COLI* FROM HEALTHY CONROLS

9:30 am  GI-15 Alison Manchester  GRANULOMATOUS COLITIS IN FRENCH BULLDOGS IS ASSOCIATED WITH INVASIVE *E. COLI* AND CLINICAL RESPONSE TO FLUOROQUINOLONE ANTIBIOTICS

9:45 am  GI-16 Sabrina Hoehne  FELINE ALIMENTARY LYMPHOMA IS ASSOCIATED WITH CHANGES IN THE SPATIAL DISTRIBUTION OF MUCOSAL BACTERIA

**Also see Gastroenterology abstracts GI-1 – GI-13 (Thursday, May 31, 2:15 pm – 6:15 pm).**

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**POSTER PRESENTATIONS**

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Friday, June 1, 7:00 am – 7:00 pm  
Saturday, June 2, 7:00 am – 2:30 pm

Attended by Authors Eligible for ACVIM Resident Research Awards:  
Thursday, May 31, 9:50 am – 10:30 am  
Friday, June 1, 9:50 am – 10:30 am

Attended by all Authors – Wine & Cheese Reception:  
Friday, June 1, 6:00 pm – 7:30 pm

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C-35 Joanelle Hernandez-Lopez  RADIOGRAPHIC VERTEBRAL HEART SIZE AND LEFT ATRIAL BISECTING LINE: INTEROBSERVER VARIABILITY AND COMPARISON TO ECHOCARDIOGRAPHIC LEFT ATRIAL SIZE IN DOGS WITH DEGENERATIVE MITRAL VALVE DISEASE
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C-38 Antonio Camacho  DOXORUBICIN-INDUCED DILATED CARDIOMYOPATHY IN A RABBIT MODEL: AN UPDATE
C-39 Maria Helena Larsson  ASSESSMENT OF SERUM ADIPONECTIN AND ITS CORRELATION WITH OBESITY AND MITRAL VALVE ENDOCARDIOSIS IN DOGS
C-40 Antonio Camacho  ARTERIAL BLOOD PRESSURE ASSESSMENT IN NORMAL AND OVERWEIGHT DOGS BY THREE DIFFERENT METHODS
C-41 Denise Schwartz  PLASMA LEVELS OF NT-PRO BNP AND VENTRICULAR DIASTOLIC FUNCTION ASSESSED BY PULSED TISSUE DOPPLER ECHOCARDIOGRAPHY IN OBSESE DOGS
C-42 Hung-Yin Chen  EFFECT OF BODYWEIGHT ON ASSESSMENT OF LEFT VENTRICULAR FUNCTIONS USING TWO-DIMENSIONAL SPECKLE-TRACKING ECHOCARDIOGRAPHY
C-43 Denise Schwartz  ECHOCARDIOGRAPHIC FINDINGS IN OBSESE DOGS
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C-45 Denise Schwartz  TRANSVENOUS PERMANENT PACEMAKER THERAPY IN DOGS: BRAZILIAN EXPERIENCE
C-46 Paula Itikawa  ECHOCARDIOGRAPHIC EVALUATION OF LEFT ATRIAL SIZE IN MAINE COON CATS, FROM APICAL FOUR CHAMBER VIEW
C-47 Gretchen Singletary  SURVIVAL OF CATS WITH ISOLATED DISCRETE UPPER SEPTAL THICKENING (DUST) VS. CATS WITH AND WITHOUT CARDIOMYOPATHY
C-48 Maggie Machen  EFFECT OF ATENOLOL THERAPY ON ECHOCARDIOGRAPHIC PARAMETERS IN CATS WITH HYPERTROPHIC OBSTRUCTIVE CARDIOMYOPATHY
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C-53 Mark Oyama  SURVEY OF SIX POTENTIAL CARDIAC BIOMARKERS IN DOGS WITH HEART DISEASE: CHROMOGGRANIN-A, ENDOGLIN, GALECTIN-3, NT-PROBNP, ST2, and OSTEOPONTIN
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HM-17 Haruhiko Maruyama  EVALUATION OF A HUMAN ELISA KIT FOR THE MEASUREMENT OF PLASMA ADAMTS13 ACTIVITY IN DOGS

SMALL ANIMAL – INFECTIOUS DISEASE

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ID-19 Megan Downey  MITOCHONDRIAL GENOME SEQUENCES RESULT IN IMPROVED UNDERSTANDING OF THE PHYLOGENETIC RELATIONSHIPS OF PIROPLASMS THAT INFECT COMPANION ANIMALS

ID-20 Sukullaya Assanasakorn  PREVALENCE OF BARTONELLA SPP. ASSOCIATED CANINE INFECTIOUS ENDOCARDITIS IN BANGKOK, THAILAND

ID-21 Rosalind Carslake  PREVALENCE OF SELECTED INFECTIOUS DISEASES IN SAMOAN DOGS

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SMALL ANIMAL - CARDIOLOGY

ABSTRACT C-1
PROGNOSTIC VALUE OF 24-HOUR AMBULATORY ECG (HOLTER) MONITORING IN BOXER DOGS, PF Mötskula1, C Linney2, DJ Connolly2, YM Chang2, C Pace3, J Dukes McEwan1, V Luis Fuentes1. 1The Royal Veterinary College, London, UK, 2School of Veterinary Sciences, University of Liverpool, Neston, UK

Arrhythmogenic right ventricular cardiomyopathy (ARVC) in Boxers is characterized by fatty hypertrophy of the right ventricular myocardium, often leading to ventricular ectopia, syncope and sudden cardiac death. Antemortem diagnosis depends on identification of arrhythmias on ambulatory ECG (Holter) monitoring. The prognostic value of Holter monitoring in Boxer dogs has not been clearly defined.

We aimed to identify factors associated with cardiac death. The medical records, initial Holter recordings and echocardiography results were reviewed for all boxer dogs seen at 2 centres between 2004-2011. Exclusion criteria were congenital heart disease, and a Holter recording <1hr. Owners/veterinarians of included dogs were contacted for survival data.

Outcome data was available for 108 dogs, with 63 deaths (41 cardiac). At presentation, 83 dogs had a history of syncope, 11 had congestive heart failure (CHF) and 24 had no clinical signs. Log rank analysis showed reduced cardiac survival with presence of CHF, ventricular bigeminy/trimeminy, ventricular couplets/triplets, ventricular tachycardia (VT), and male sex, but not with a history of syncope. Univariable Cox proportional hazards analysis of Holter variables showed that mean heart rate, presence of polymorphic ventricular premature complexes (VPCs), VT, couplets or triplets, bigeminy/trimeminy, or number of VPCs/hour were positively associated with cardiac death. In a forwards stepwise multivariable model, presence of polymorphic VPCs (p=0.001, hazard ratio (HR) 3.2 [95% confidence interval (CI) 1.7-6.3]), presence of VT (p=0.013, HR 2.2 [95%CI 1.2-4.1]) and presence of SVT (p=0.007, HR 2.5 [95%CI 1.3-4.9]) independently predicted outcome.

Holter monitoring in Boxer dogs with suspected ARVC provides valuable prognostic information.

ABSTRACT C-2
COMPARISON OF TRANSTHRORACIC TWO-DIMENSIONAL ECHOCARDIOGRAPHY, THREE-DIMENSIONAL ECHOCARDIOGRAPHY, TRANSESOPHAGEAL ECHOCARDIOGRAPHY, COMPUTED TOMOGRAPHY ANGIOPHARY, AND GATED MAGNETIC RESONANCE IMAGING IN NORMAL CANINE HEARTS, RC Fries1, SG Gordon1, MW Miller1, AB Saunders1, CD Harri1, MBogess1, M Lennox2, TW Fossum1. 1Texas A&M University College of Veterinary Medicine, College Station, TX, 2The Texas A&M Institute for Veterinary Medicine, College Station, TX, 3The Texas A&M Institute for Preclinical Studies, College Station, TX

The purpose of this study was to determine the accuracy of two-dimensional echocardiography (2DE), three-dimensional echocardiography (3DE), transesophageal echocardiography (TEE), and computed tomography angiography (CTA) in comparison to gated cardiac magnetic resonance imaging (cMRI). Echocardiography was performed using the GE Vivid E9 with appropriate 2DE, 3DE, and adult TEE probes. CTA and cMRI images were acquired utilizing a 128-slice positron emission tomography (PET)/CT scanner and a prospective ECG-gated, 3 Tesla MRI respectively. CTA and cMRI image analysis was performed off-line using a Siemens LEONARDO 3D workstation and applicable software. Six, adult, female mixed breed dogs (18-25 kg) were anesthetized and underwent transthoracic 2DE, 3DE, and TEE (all by a single observer) CTA, and cMRI. Left ventricular internal dimension, area, and volume (in systole and diastole), stroke volume (cardiac output), and ejection fraction were assessed. Left atrial dimension, area, and volume were also evaluated.

The mean and standard deviation of the difference between cMRI and each measurement modality for the left ventricle, in diastole and systole, and left atrial volumes were estimated via maximum likelihood, with robust standard errors. For left ventricular end-diastolic volume the right parasternal four chamber view performed with 2DE (4Ch-2D) had the smallest standard deviation, wind, TEE and CTA had means closest to zero. For end-systolic volume the apical four chamber view performed with 3DE had the smallest standard deviation, while the mean of 4Ch-2D was closest to zero. Left atrial volume assessment with 3DE appears mildly superior to 2DE.

ABSTRACT C-3
USE OF COMPUTED TOMOGRAPHY IN THE ASSESSMENT OF DOGS WITH PERICARDIAL EFFUSION, B Bottorff, S Stieger-Vanegas, D Sisson. Oregon State University College of Veterinary Medicine, Corvallis, OR

The goal of this study was to prospectively evaluate the clinical utility of contrast-enhanced computed tomography (CT) in dogs with pericardial effusion (PE).

Eleven dogs with PE were evaluated via thoracic radiography, transthoracic echocardiography (TTE), and contrast-enhanced thoracic and abdominal CT. Two dogs had small volume PE and 9 had moderate to large volume PE with echocardiographic evidence of cardiac tamponade. TTE was performed in 9/11 dogs prior to pericardiocentesis (PCC), whereas CT was performed after PCC in 10/11 dogs. A right atrial mass was identified in 5/11 dogs via TTE and a heart base mass was identified in 1/11 dogs. One dog was diagnosed with PE due to right heart failure via TTE. Mesothelioma was later diagnosed in this dog via stereo lymph node cytology. CT detected findings consistent with TTE in all dogs with right atrial (5/5) and heart base masses (1/1). Localized pericardial hemorrhage and soft tissue changes at the site of PCC suggested a mass lesion by CT in 3/11 dogs. In all dogs mild to moderate sternal lymphadenopathy was noted using CT, which was not noted on radiographs. CT identified hepatic and splenic lesions in 5/11 and 6/11 dogs, respectively. Pulmonary metastasis was identified in 1/11 dogs via thoracic radiography and in 2/11 dogs via CT. Cardiac masses were confirmed by histopathology in 3/6 dogs.

In this population of dogs, CT and TTE had similar sensitivity for the detection of cardiac masses in dogs with PE. The value of CT resided primarily in the detection of pulmonary metastasis and extra-cardiac lesions in the liver and spleen. Pericardiocentesis performed prior to CT evaluation may confound the interpretation of CT in dogs with PE.

ABSTRACT C-4
DIRECT ARTERIAL BLOOD PRESSURE MEASUREMENT USING A CAROTID CATHETER IN COMPARISON TO OSCILLOMETRIC AND DOPPLER METHOD. K Parker, A Carr, T Duke-Novakovski. Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, SK

Blood pressure measurement is an important parameter when assessing hemodynamic status in animals. Cats have always been considered especially difficult to measure indirectly. This study was carried out in anesthetized cats to evaluate two newer oscillometric devices. (High Definition Oscillometry, Memodiagnostic S+B medvet, Babenhausen Germany; PC-VetGuard+, DVM Solutions, San Antonio, TX), as well as ultrasonic Doppler (Parks Medical).

A total of six cats ranging from 2 to 13 years were included in this study. The anesthetized cats had the carotid artery isolated surgically and then a direct tip blood pressure transducer inserted (Millar 3.5 Fr), then advanced approximately to the level of the aortic root. Blood pressure data were recorded continuously (Powerlab 26T, Model ML856, LabChart 7.2 software AD Instruments). The catheter was calibrated using a mercury sphygmomanometer prior to placement. The position of the cuffs of the sphygmomanometers were rotated between forelimbs and tail to measure blood pressure, whereas the forelimb alone was used for Doppler measurements. Blood pressure was adjusted using various isoflurane concentrations, colloids and dobutamine to
achieve hypo- (<80 mmHg), normo- (80-110 mmHg) and hypertension (>110 mmHg). Bias (indirect method minus direct) and precision (SD of the differences) were calculated.

265 paired samples from the HDO and Aortic root were analyzed. Results for normotension using the HDO wereBias (-1.1) SD 5.0 mmHg for mean arterial pressure (MAP), Systolic Arterial Pressure (SAP) 3.7 (SD 10.7), and diastolic (-5.8) (SD 6.7).

In hypotension (99 data pairs) bias for Mean was (-6.5) (SD 9.9), SAP 17.3 (SD 15.7) and diastolic (-9.93) (SD 14.5). In hypertension HDO underestimated SAP with a bias of (-15.0) (SD 12.8), MAP (-9.6) (SD 15.90, and diastolic (-20.9) (SD 14.3).

The VG (236 data pairs) was slightly less accurate in hypo-, normo-, and hypertensive states. In hypotension bias in MAP was 0.0 (SD 12.8 mmHg), systolic (-1.1) (SD 13.4), and diastolic (-12.3) (SD 13.4). In normotension the SAP bias was (-9.3) (SD 10.3), MAP (-12.6) (SD 7.1), and diastolic (-12.3) (SD 13.4). In hypertension the SAP bias was (-23.9) (SD 16.0), MAP (-19.3) (SD 11.3), and diastolic (-20.8) (SD 13.7).

Paired samples used the Doppler Technique, when used to assess SAP.

ABSTRACT C-5
CAN STRAIN RATE IMAGING DIFFERENTIATE PHYSIOLOGIC FROM PATHOLOGIC HYPERTROPHY IN THE DOG? SM Johns, OL Nelson. Washington State University College of Veterinary Medicine, Pullman WA

The appearance of hypertrophy of the athlete’s heart can be similar to hypertrophy due to heart disease or systemic hypertension. Pathologic cardiac hypertrophy can lead to decreased cardiac function and increased risk of potentially life-threatening arrhythmias. However, athletic hypertrophy is a benign process of measuring blood pressure in all pressure ranges, losing some accuracy as the patient approaches hypertension. Doppler, when used for a measurement of MAP, is accurate but less so when used to assess SAP.

ABSTRACT C-6
OPTIMIZATION OF IMPLANTABLE CARDIOVERTER DEFIBRILLATOR (ICD) DEFIBRILLATION THRESHOLDS IN DOGS. C Saelinger, J Vila, P Queiroz-Williams, R Pariaut. Dept. of Veterinary Clinical Sciences, Louisiana State University, Baton Rouge, LA

In dogs, treatment of malignant ventricular arrhythmias is centered on the administration of antiarrhythmics. Despite a reduction of clinical signs, the risk for sudden death is not decreased. In human patients, utilization of implantable cardioverter defibrillators (ICDs) in conjunction with antiarrhythmics is standard of care to reduce clinical signs and sudden death from ventricular arrhythmias. As ICDs become more available for implantation in dogs, optimization of the device programming and programming while considering the unique canine anatomy and physiology is crucial.

The objectives of this study were to: 1) implant ICDs in healthy canines in an anatomical location that allows successful, low energy defibrillation (at least 10 J safety margin) and 2) identify the shock configuration that achieves the lowest defibrillation thresholds (DFTs), i.e. the lowest energy that terminates ventricular fibrillation (VF). We hypothesized that a fixed pulse duration shock configuration, as determined by a surrogate of the cardiac tissue time constant, results in a lower DFT compared to a fixed tilt shock configuration.

Ten healthy mongrels (24.6 kg ± 3.86 kg) were included in this study. Under fluoroscopic guidance, a 65-cm, 2-coiled endocardial lead was placed into the right ventricular apex through the left jugular vein. The proximal portion of the lead was tunneled subcutaneously under the left shoulder and secured into the generator in a subcutaneous pocket between the 4th and 6th left intercostal spaces, above the left ventricle. Capture testing was performed. VF was induced via the shock-on-T method and the upper limit of vulnerability theory was used to reduce the number of VF inductions needed to determine the DFT. DFT testing was performed with both fixed pulse and fixed tilt shock configurations in random order. Plasma Troponin I (TnI) levels were measured before induction of VF and after the first and second DFT protocols. Paired t-test was used to analyze DFT results and repeated measures ANOVA was used for TnI levels. All values are shown as mean ± SD. P ≤ 0.05 was considered statistically significant.

One subject died during the induction of anesthesia. Nine remaining dogs underwent successful ICD implantation and DFT testing. Overall mean DFT was 9.19 ± 3.88 J. DFTs for fixed pulse (9.06 ± 4.195 J) and fixed tilt (9.31 ± 3.783 J) shock configurations were not significantly different. There was a significant difference in the TnI levels between baseline (0.034 ± 0.028 ng/mL) and following determination of the first (0.124 ± 0.055 ng/mL, P ≤ 0.05) and second (0.217 ± 0.104 ng/mL, P ≤ 0.0001) DFT values.

Important results of this study are: 1) the proposed ICD placement consistently resulted in a very low and more than adequate (more than 20 J below maximum energy of the device) DFT in normal canines, 2) there was no difference between the fixed pulse and fixed tilt shock configurations, and 3) the increase in TnI was not considered to be clinically significant.

ABSTRACT C-7
ATRIAL FIBRILLATION IS A NEGATIVE PROGNOSTIC INDICATOR IN LARGE BREED DOGS WITH MYXOMATOUS MITRAL VALVE DEGENERATION AND CONGESTIVE HEART FAILURE. SW Jung, LG Griffiths, MD Kittleson, WR Pritchard. Veterinary Medical Teaching Hospital, University of California-Davis, Davis, CA

The outcome of congestive heart failure (CHF) due to myocardial dysfunction (MMVD) or atrial fibrillation (AF) has been well documented. MMVD also occurs in large breed dogs (> 15 kg) but the disease characteristics in this cohort are poorly documented and are somewhat different from small breed dogs. For example, large breed dogs with MMVD usually have overt evidence of myocardial dysfunction when CHF develops and appear to develop atrial fibrillation (AF) more frequently than small dogs. The aim of the present study was to evaluate the prevalence and prognostic significance of AF in large breed dogs with MMVD and CHF.

Medical records between January 2005 and December 2010 were reviewed retrospectively and 63 large breed dogs with MMVD and
CHF that reached the primary endpoint (cardiac-related death) were identified. CHF was defined as pulmonary edema, ascites or both due to severe cardiac disease. The onset of CHF was defined as the time when diuretic drug administration was initiated. The median age and body weight were 11 years of age (range: 6-15 years) and 24 kg (range: 16-64 kg), respectively. The median ratio of left atrial diameter to aortic root diameter on 2D short-axis view was 2.5 (range: 1.7-3.7). The median shortening fraction was 36% (range: 22-55%). The median survival time of all dogs from the identification of CHF by the referring veterinarian to cardiac death was 172 days (range: 9-879 days). Thirty three dogs (52%) had sustained atrial fibrillation. Their median heart rate before and after pharmacological rate control was 220 beats/min (range: 160-270 beats/min) and 177 beats/min (range: 84-240 beats/min), respectively. Kaplan-Meier statistics revealed that dogs in atrial fibrillation had a significantly shorter median survival time (142 days; range: 9-478 days) compared with dogs in sinus rhythm (234 days; range: 13-879 days) (P = 0.006).

We conclude that the prevalence of AF in large breed dogs in CHF due to MMVD is high and that AF adversely impacts survival time. A prospective clinical trial was warranted to confirm or refute the findings from this study.

**ABSTRACT C-9**

**UTILIZATION OF TRANSESOPHAGEAL ATRIAL PACING TO OBTAIN SINUS NODE RECOVERY TIME IN DOGS.**

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Sick sinus syndrome (SSS) is classified into two etiologic categories: extrinsic and intrinsic. Extrinsic SSS, a vagally influenced bradycardia must be differentiated from intrinsic SSS, true sinoatrial node dysfunction. The atropine response test (ART) has been utilized to rule out extrinsic causes of SSS; however, there are variable responses with intrinsic SSS to the ART. Thus sinus node recovery time (SNRT) via intracardiac electrophysiology studies is often utilized as a more reliable method to measure sinus node function in humans. Similar methodology is particularly limited in veterinary medicine due to the invasive nature of this test and the extremely limited availability of expensive electrophysiological equipment to veterinary cardiologists. Thus diagnosis of dogs with intrinsic SSS has been restricted in veterinary medicine to ART. Transesophageal atrial pacing (TEAP) is an easily obtainable and cost-effective means to temporarilly pace the atrium in dogs. We sought to compare SNRT results obtained by using TEAP to those obtained by standard intracardiac atrial pacing (ICAP).

Seven juvenile beagle dogs underwent general anesthesia followed by oral placement of a multipolar electrophysiology catheter into the esophagus to the level of the carina. Jugular venous access was obtained via modified Seldinger technique utilizing a 6 Fr introducer system following which a steerable multipolar electrode was fluoroscopically guided to the level of the right atrium. The SNRT was obtained following atrial pacing for 30 seconds at 500ms, 400 ms, 300 ms, and 200ms cycle lengths respectively with each technique. Dogs were randomly selected to receive TEAP or ICAP first. Corrected sinus node recovery times (cSNRT) were also calculated.

Three male and four female dogs (10.9 ± 1.26 kgs) were evaluated in this study. No statistical differences were noted in mean SNRT and cSNRT values respectively with either technique (See table 1). Data is demonstrated as the mean ± standard deviation in milliseconds where applicable.

We conclude that TEAP pacing demonstrates similar SNRT times compared to those utilizing standard intracardiac technique normal dogs. As such TEAP may be used when standard studies are not available. Further assessment utilizing dogs with sinus node disease need to be validated.

**ABSTRACT C-10**

LONG-TERM EVALUATION OF CARDIAC SIZE AND FUNCTION IN 71 DOGS FOLLOWING PATENT DUCTUS ARTERIOSUS CLOSURE.**

AB Sanders, SG Gordon, CD Harri, RC Fries, JA Carbon, RL Winter, MW Miller, The Michael E. DeBakey Institute, College of Veterinary Medicine and Biomedical Sciences, Texas A&M University, College Station, TX

Herein we report cardiac size and function at baseline (B) and >12 months follow-up (F) in a cohort of dogs with PDA. Between July 1996-November 2009, 523 dogs presented to TAMU for PDA. Baseline data including signalment, history, physical examination, diagnostic imaging, type of closure were obtained from medical records. Follow-up was available on 71 dogs.

All had characteristic murmurs of PDA; 55 were female. The most common breed was Chihuahua (10). PDA closure methods included ligation (28), coil (20), Amplatzer® canine duct occluder (18), Amplatz® vascular plug (3). Concurrent congenital heart disease was identified in 7. Chronic valvular disease was present in 1 (B) and 16 (F). Residual ductal flow was documented within 24-hours in 9 and in 4 at F. Median time from closure to F was 48.9 months (range, 13.0-125.3). Results are reported as mean±SD (range) at B and F. Age (months) was 16±21.2 (2.2-97.9) and 69±29.9 (21.3-151.9). Weight (kg) was 8±7.9 (0.3-37.2) and 13±10.6 (1.3-36.5). Vertebral heart size was 11.7±1.1 (9.2-14.1) and 10.5±0.6 (9.0-12.6). LVIDdN was 2.1±0.5 (1.3-4.28) and 1.54±0.25 (1.10-2.20). LVIDsN was 1.37±0.41 (0.60-2.60) and 1.03±0.26 (0.50-2.90). FS% was 36±8.2 (13.0-54.0) and 29.7±10.3 (9.0-56.0). LA:AO ratio was 1.43±0.88 (0.64-2.02) and 1.21±0.15 (0.87-1.50). P-value was <0.0001 for all variables compared. VHS was > 10.5 in 56/66 (B) and 18/70 (F). The
number of dogs >95% CI for LVIDdN and LVIDsN was 53/66 (B), 36/66 (B) and 6/70 (F), 11/70 (F) respectively suggesting normal range of cardiac size ranging from 69.4 to 88.7% at long-term follow-up based on these values.

**ABSTRACT C-11**

**CANINE CARDIAC TROPONIN I SIGNIFICANTLY COMPLEMENTS ESTABLISHED PROGNOSTIC COMPOSITE SCORE IN DOGS WITH SYSTEMIC INFLAMMATION.**

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Composite scoring models based on clinical and paraclinical observations are used in intensive care units (ICUs) for stratification of disease severity and early assessment of prognosis for survival. Main components of these models are markers of organ dysfunction. However, the significance of myocardial injury was not included when the models, e.g. the Acute Patient Physiologic and Laboratory Evaluation (APPLE) score in dogs, were developed. In non-cardiac critical diseases, myocardial injury as detected by cardiac troponin I (cTnI) has been linked to high ICU mortality in several human studies. The purpose of this study was to examine the prognostic value of cTnI in critically ill dogs with systemic inflammation as an addition to the APPLE scoring system.

Dogs admitted to the ICU (University of Pennsylvania) were prospectively included over a 3 month period. Echocardiography was performed on all dogs, and dogs with evidence of primary structural cardiac disease were excluded. Systemic inflammation at ICU admission was defined as a serum concentration of C-reactive protein (CRP) > 35 mg/L within the first 24 hours in a dog with clinical evidence of inflammation. Samples for cTnI analysis were obtained at ICU admission and for CRP analysis at admission and 12-24 hours later. The APPLE score was calculated for each dog within the first 24 hours of ICU admission. Outcome (death versus survival) was determined 28 days after admission. Areas under receiver operator characteristic curves (AUC-ROC) were used to evaluate the performance of cTnI and the APPLE score as prognostic markers of outcome. cTnI concentrations were logarithmically transformed to optimize distribution for multiple logistic regression analysis (MLR), and MLR was performed to evaluate whether cTnI made a significant contribution to the APPLE score (Likelihood ratio test). Level of significance was set at P < 0.05.

Forty-two dogs were included, with a mortality rate of 26.2% (n = 11). cTnI concentrations were (median [range]) 0.416 [0.004-1415] ng/mL. 88.1% (n = 37), including all non-survivors, had cTnI concentrations above reference limit (0.07 ng/mL). AUC-ROC [95% CI] for cTnI and the APPLE score as predictors of outcome were 0.801 [0.649-0.907] and 0.776 [0.621-0.889], respectively, thus both were individually significant prognosticators. Graphing the cTnI concentration against the APPLE score suggested that cTnI complemented the APPLE score in providing additional prognostic specificity, improving the positive predictive value of cTnI in critically ill dogs with systemic inflammation as an addition to the APPLE scoring system.

Data on atrial repolarization in dogs are scarce since the QRS complex deflections usually obscure T α wave. Electrocardiographic features of T α wave can be better analyzed in patients with third degree atrioventricular (AV) block since, in this condition, the presence of AV dissociation makes the T α wave and the QRS complex uncoupled. Atrial repolarization wave varies according to the autonomic status and the presence of atrial injuries. The aim of the study was to describe the electrocardiographic characteristics of T α wave in dogs with third degree AV block, normal atrial cycle length and normal cardiac chamber size. Clinical records of 52 dogs with third degree AV block were retrospectively analyzed. Ten dogs were excluded because of the presence of ventricularbigeminy and 6 dogs for the presence of atrial arrhythmias. The sample group included 21 males and 15 females with a mean age of 110.9 (confidence interval 95% (CI 95%) 99.5-122.4) months and mean weight of 29.0 kg (CI 95% 23.5-34.4). Standard 12-lead electrocardiograms were acquired with a digital system for a subsequent off-line processing. Each parameter was evaluated by a single operator with three repeated measurements. Normality was assessed by Shapiro-Wilk test, correlation was calculated by Pearson, Spearman and Kendall tests, on variable that showed a Pearson correlation a linear regression was performed. A multivariate analysis was conducted by generalized linear model. Repeatability was tested by intra-class coefficient of correlation using Shruft-Fleiss reliability test. T α wave was detectable in 80.6 % of the cases in inferior leads (II, III and aVF), in 22.2 % in lead I, in 44.4% in lead aVL, in 75 % in lead aVR and in 67.6 % in precordial leads. T α wave showed a negative polarity in lead I, II, III and aVF. Positive polarity in lead aVL and aVR with a mean electrical axis in the frontal plane of -114.3° (CI 95% -121.6 - -107.0). In all precordial leads T α wave showed a negative polarity. The mean duration and the mean amplitude of the T α wave in lead II were, respectively, 140.2 msec (CI 95% 127.5-152.9) and 0.35 (CI 95% -0.1 - 0.08) with a T α/P duration ratio of 2.3 and a T α/P amplitude ratio of -0.35. A linear correlation between T α wave duration and T α/P interval duration was found. Multivariate analysis showed significant correlations between T α wave amplitude and examined lead, T α wave duration and weight, P-T α interval duration and atrial rate, T α wave amplitude and duration with weight and T α wave duration and P-T α interval duration with weight. T α wave measurements were repeatable (T α voltage K 0.759; T α duration K 0.942). In agreement with previous studies, we found opposite polarity of the P and the T α waves regardless of which lead was analyzed, and a positive correlation between atrial...
rate and P-Ta interval duration. In contrast with previous veterinary studies, we found no correlation between P wave and Ta wave duration. This study provides a full description of electrocardiographic features of the atrial repolarization phase in dogs with third degree AV block with possible extension of the results to the normal population. Further studies are needed to analyze the atrial repolarization phase in relation to the atrial arrhythmogenic propensity, as does QT interval analysis in the case of ventricular arrhythmias.

ABSTRACT C-14
STRUCTURAL AND MOLECULAR PATHOLOGY OF THE ATRIUM IN BOXER ARRHYTHMOGENIC CARDIOMYOPATHY. J Vila, EM Oxford, C Saelinger, NS Moise, PR Fox, R Pariani.1, 2Dept. of Veterinary Clinical Sciences, Louisiana State University, Baton Rouge, LA. 1College of Veterinary Medicine, Cornell University, Department of Clinical Sciences, Ithaca, NY. 2The Animal Medical Center, 510 E 62nd St, New York, NY.

Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC) is an inherited myocardial disease characterized by fatty or fibro-fatty infiltration of the myocardium. While the specific mechanism is still unknown, ARVC is recognized as a disease affecting the cardiac intercalated disc and more specifically the desmosomal proteins that compose it. ARVC is classically associated with ventricular arrhythmias as it primarily affects the ventricular myocardium, although atrial arrhythmias and atrial histopathological changes characteristic of ARVC have occasionally been reported in both Boxers and humans. However, the extent of atrial involvement in ARVC has not been investigated.

The objective of the study was to apply histopathology, immunohistochemical detection, immunolocalization and transmission electron microscopy (TEM) techniques to better characterize the distribution of desmosomal and gap junction proteins at the intercalated disc level in the atria of Boxers with ARVC. We hypothesized that histological changes consistent with ARVC and alterations of the proteins of the intercalated disc are present in the atria of Boxer dogs with ARVC and may represent the anatomic substrate for atrial arrhythmias.

The hearts from 14 healthy mongrel dogs and 14 Boxer dogs with confirmed ARVC were studied. Right and left atrial sections from 10 Boxers were examined by immunofluorescent microscopy. Frozen tissue samples from 8 Boxers were used for Western blot (WB) analysis. The intercalated disc proteins investigated were Connexin 43 (Cx43), Connexin 45, Connexin 40, Plakoglobin, Plakophilin 2, Desmoplakin, and Cadherin. Electron microscopy was performed on the right and left atrial sections of 2 Boxers and 2 controls. Western blot band relative density was calculated for all the proteins tested using the NIH software ImageJ. Student-t test was used to analyze the WB results. P<0.05 was considered statistically significant.

Western blots indicated a significant decrease of Cx43 in the right atrium of ARVC affected Boxers (relative density Cx43/Actin 0.68 +/- 0.23 SD) compared to controls (relative density Cx43/Actin 1.115 +/- 0.3 SD). There was no difference between controls and Boxers for the other proteins investigated. Immunofluorescence analysis showed that the concentration of Cx43 was decreased in the left and right atrium of ARVC affected Boxers compared to controls. However, the intensity of the Cx43 appeared to be the same in the two groups. TEM showed disruption of the intercalated disc in Boxers.

Our data suggests that the atrial myocardium is also affected during ARVC. The decrease in Connexin 43 in conjunction with the fatty or fibro-fatty infiltration of the myocardium could represent the substrate for the atrial arrhythmias that can be seen with ARVC.

ABSTRACT C-15

Detection of feline heart disease is difficult as physical examination, radiographic, and electrocardiographic findings can be relatively non-specific. Previously, leftward mean electrical axis shift (LAS) has been proposed as a risk factor for feline heart disease. We sought to determine if presence of LAS was predictive for echocardiographic heart disease in a retrospectively identified population of cats referred to a teaching hospital for cardiac evaluation.

The mean electrical axis (MEA) was calculated for 153 cats. Cats were classified as normal (N), or equivocal (E), or having isolated dynamic right ventricular outflow tract obstruction (DRVOTO), or heart disease (HD) based on echocardiography.

The results were as follows: LAS (+10° to -89°) n=28 (N, 2; HD, 18; DRVOTO, 1; E, 7); 64% LAS had HD. N MEA (0°-160°) n=102 (N, 21; HD, 54; DRVOTO, 7; E, 20); 53% N MEA had HD. Right MEA (161° to -91°) n=18 (N, 2; HD, 13; DRVOTO, 0; E, 3). Indeterminate MEA (-90°) n=18 (N, 0; HD, 5; DRVOTO, 0; E/R, 0). Chi-square analysis revealed that the proportion of HD vs. N in cats with N MEA vs. LAS was not statistically different (P=0.14). No significant difference was found regardless of whether E were analyzed as N or HD.

In a referral population of cats, the presence of LAS was not predictive of HD on echo compared to cats with a normal MEA, indicating that LAS was not a risk factor for presence of HD in the population. Further studies are needed to identify other parameters.

ABSTRACT C-16
NT-PROBNP AS A SCREENING TOOL TO DETECT CLINICALLY SIGNIFICANT HEART DISEASE IN ASYMPTOMATIC CATS WITH HEART MURMURS AND/OR GALLOP RHYTHMS. JM Mulz, DP Schroepe. Oradell Animal Hospital, Paramus, NJ.

The purpose of this study was to determine whether NT-proBNP could be used as a screening tool to detect clinically significant disease in patients with an indication of underlying cardiac disease based on physical exam abnormalities. Clinically significant disease was defined as structural cardiac disease severe enough to warrant follow-up within four months or recommend medications.

A total of 86 cats were enrolled in the study. The cats either presented for a routine wellness examination to the Oradell Animal Hospital, or were examined at a local animal shelter. Each cat identified had an auscultable murmur or gallop rhythm detected by a general practitioner and was otherwise asymptomatic. A complete blood count, serum chemistry, T4 level, NT-proBNP level and Doppler blood pressure were performed. Of the 86 cats, 9 cats were excluded based on bloodwork or blood pressure abnormalities and six cats were lost to follow-up, leaving a total of 71 cats in the study population. The 71 cats had echocardiograms performed by a single, experienced investigator (DPS) who performed echocardiograms for several studies concurrently, blinding the investigator as to whether or not the cat had a murmur. Cats were classified as normal (17) or having equivocal (13), mild (24), moderate (12) or severe disease (5) based on the echocardiographic findings. Due to the low numbers of cats with moderate and severe disease, these groups were combined, as all cats in these groups were considered to have clinically significant disease.

When compared to the echocardiographic results, NT-proBNP reliably differentiated mild disease from normal (p=0.0315) and equivocal disease (p=0.0410), as well as differentiating moderate and severe disease from normal (p=0.0071), equivocal (p=0.0073) and mild disease (p=0.0157). NT-proBNP did not differentiate between normal and equivocal disease (p=0.682). This study suggests that NT-proBNP may be a reliable screening tool to detect clinically significant disease in asymptomatic cats with auscultatory abnormalities.

ABSTRACT C-17
HEART RATE AND ARRHYTHMIA FREQUENCY OF NORMAL CATS COMPARED TO CATS WITH HYPERTROPHIC CARDIOMYOPATHY. BS Smouther, L Lehmkuhl, D Adin, T Nguyenha. Med Vet Medical and Cancer Centers for Pets, Worthington, OH.

Hypertrophic cardiomyopathy (HCM) often has a long asymptomatic period, but can result in congestive heart failure,
ABSTRACT C-18
EFFECT OF ATENOLOL ON HEART RATE, ARRHYTHMIA, BLOOD PRESSURE, AND DYNAMIC LEFT VENTRICULAR OUTFLOW TRACT OBSTRUCTION IN CATS WITH ASYMPTOMATIC HYPERTROPHIC CARDIOMYPATHY, B Smouther1, D Adin1, I Lehmkuhl1, T Nguyenba1, K Meurs2, B Maran3. 1MedVet Medical and Cancer Centers for Pets, Worthington, OH, 2North Carolina State University College of Veterinary Medicine, Raleigh, NC, 3Washington State University College of Veterinary Medicine, Pullman, WA

Atenolol is commonly prescribed to asymptomatic cats with hypertrophic cardiomyopathy (HCM) for theoretical benefits including heart rate (HR) reduction, increased ventricular filling time, decreased myocardial oxygen demand, arrhythmia reduction, and dynamic left ventricular outflow tract (LVOT) obstruction reduction. The purpose of this study was to describe the HR, murmur grade, arrhythmias, blood pressure (BP), and LVOT velocity in cats with HCM pre (PRE) and post (POST) atenolol administration.

Seventeen cats with HCM were prospectively evaluated by auscultation (AUSC), echocardiogram, BP, 2-minute electrocardiogram (EKG) to predict average heart rate (24AVE) and arrhythmia frequency at home assessed by 24 hour Holter monitor.

Seventeen cats with HCM and 15 normal cats were prospectively evaluated by AUSC, echocardiogram, blood pressure, ECG, and 24-hour Holter monitor.

All (17/17) HCM cats had ventricular arrhythmias (geometric mean, 124 complexes) with 82% (14/17) exhibiting complex arrhythmias (couplets, triplets, or ventricular tachycardia). Most (14/15) normal cats had ventricular arrhythmias (geometric mean, 4 complexes), but only 20% (3/15) exhibited complex complexity. HCM cats had significantly more total ventricular complexes (TOT), ventricular premature complexes (VPCs), and accelerated idioventricular rhythm than normal cats (p < 0.0001, p<0.0001, and p = 0.01, respectively). Eighty eight percent (15/17) of HCM cats had supraventricular arrhythmias (geometric mean, 9 complexes) with 23% (4/17) exhibiting complexity. Sixty percent (9/15) of normal cats had supraventricular arrhythmias (geometric mean 1 beat) with 13% (2/15) exhibiting complexity. HCM cats had significantly higher supraventricular complex and ventricular complex (p = 0.0148). Additionally, 100% of HCM cats (17/17) had arrhythmias on Holter monitor, while only 18% (3/17) had arrhythmias on ECG. All normal cats (15/15) also had arrhythmias on Holter monitor, and none had arrhythmias on ECG.

There was no difference in heart rate between HCM cats and normal cats regardless of modality used (AUSC p = 0.8, ECG p = 0.3, Holter 10% p = 0.99, Ave p = 0.97, 90% p = 0.2. When comparing 24AVE and ECG, bias was 30 bpm with limits of agreement of + 11 - 49 bpm. When comparing 24AVE to AUSC, bias was 21bpm with limits of agreement + 35 - 44 bpm. HCM cats have more frequent and complex ventricular and supraventricular arrhythmias than normal cats. Agreement between 24 hr Holter and in-clinic AUSC or ECG for HR assessment and arrhythmia detection was poor. Long term studies are needed to determine if this increased arrhythmia frequency and severity is related to sudden cardiac death or survival.

ABSTRACT C-19
THE EFFECT OF ENALAPRIL ON FUROSEMIDE-ACTIVATED RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM (RAAS) IN NORMAL DOGS. AC Lantis1, CE Atkins2, M Ames3. 1Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, VA, 2North Carolina State University College of Veterinary Medicine, Raleigh NC

The purpose of this study was to evaluate the ability of the ACE-inhibitor, enalapril, to suppress circulating RAAS activation in normal dogs treated with furosemide. We hypothesized that enalapril would suppress plasma ACE activity and furosemide-induced RAAS activation, as evaluated by urinary aldosterone:creatinine ratio.

Sixteen healthy hound dogs were used. Group 1 (control) received furosemide (2 mg/kg PO, BID) for 7 days. Group 2 received furosemide (2 mg/kg PO, BID) and enalapril (0.5 mg/kg every 12 hours) for 7 days. To measure the response of the RAAS to the medications, plasma ACE activity and urinary aldosterone:creatinine ratio (ACr) were obtained on days 1, 2, 4, and 7.

Urinary aldosterone secretion, as indicated by the A:Cr, increased nearly 3-fold by furosemide monotherapy. This was maintained for the 7 days of the study. The addition of enalapril to group 2 dogs successfully suppressed plasma ACE activity but did not significantly reduce urinary aldosterone excretion.

We have shown that, while enalapril successfully blunted ACE activity, it did not reduce urinary aldosterone excretion. The absence of circulating RAAS suppression accompanied by ACE activity inhibition defines aldosterone breakthrough. Studies in clinical patients are warranted to determine if and when aldosterone breakthrough occurs in dogs receiving ACE-I for cardiac disease, glomerular disease, or hypertension.

ABSTRACT C-20
THE EFFECT OF HIGH DOSE PIMOBENDAN ON THE FUROSEMIDE-INDUCED RENIN-ANGIOTENSIN-ALDOSTERONE-SYSTEM (RAAS). MK Ames1, CE Atkins2, AC Lantis2. 1College of Veterinary Medicine, North Carolina State University, Raleigh, NC, 2Veterinary Emergency and Referral Group, Brooklyn, NY

Pimobendan confers positive inotropic and vasodilatory effects, the latter known to activate the RAAS, which is harmful in heart failure. Evaluation of 115 dogs (from 4/2007-8/2011)
receiving pimobendan > TID for refractory heart failure revealed
30.5% to be receiving >1.2mg/kg/day (mean 2.20mg/kg/day; range 1.22-3.90mg/kg/day; recommended dosage 0.5-6.0mg/kg/ day), indicating the potential negative clinical impact of a stimu-
ant RAAS effect of ‘high-dose’ pimobendan.

The purpose of this study was to determine if high-dose pi-
mobendan (0.6mg/kg PO q12h) potentiates furosemide-induced RAAS activation. We hypothesized, based on a previous study, that high-dose pimobendan, when used concurrently with moderate-dose furosemide, would activate the RAAS more than furose-
mine alone at the same dose.

Twelve healthy dogs, randomized into groups of six, received furosemide (2mg/kg PO q12h) for 10 days (Group 1) or furose-
mine (2mg/kg PO q12h) and pimobendan (0.6mg/kg PO q12h) for 10 days (Group 2). Heart rate, body weight, blood pressure, and urine aldosterone:creatinine (UAC, a measure of circulating RAAS activation) were measured on days -2, -1, 1, 5 and 10. Serum chemistry and CBC were measured on days -2, 5 and 10.

Although there was a statistically significant rise in UAC in Group 2 over the study period (p = 0.0015), the increase differed significantly only on day 1 (p = 0.044). ‘High-dose’ pimobendan, therefore, neither suppresses nor potentiates, to a clinically-signif-
cant degree, furosemide-induced RAAS in healthy dogs.

ABSTRACT C-21
DURATION OF BETA-BLOCKADE ASSOCIATED WITH REPEATED ONCE-DAILY ADMINISTRATION OF ATENO-
LOL IN HEALTHY DOGS. MI Waterman, JA Abbott, AC Lantis, JR Wilcke. Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, VA

Atenolol is a β-adrenergic receptor antagonist used in the management of cardiovascular disease. In dogs, doses intervals of 12 and 24 hours are used but the duration of β-blockade associ-
ated with oral administration of atenolol is unknown.

To test the hypothesis that repeated, once-daily oral admin-
istration of atenolol attenuates the heart rate response to isoprote-
enol for 24 hours, we performed a double-blind, randomized, placebo-controlled crossover experiment. Twenty healthy dogs were randomly assigned to receive either placebo (P) and then atenolol (A) [1 mg/kg PO QD] or, vice versa. Treatment periods were 5-7 days; time between periods was 7 days. Heart rates (bpm) at rest (HRr) and during constant rate (0.2 µg/kg/min) infusion of isoproterenol (HRi) were electro-
diographically obtained 0, 0.25, 3, 6, 12, 18, and 24 hours after final administration of drug or placebo. Repeated measures ANOVA was used to evaluate the effects of treatment (Tr), time after drug or placebo administration (t), interaction of treatment and time (Tr×t) as well as period and sequence on HR, and HR×t. Sequence or period effects were not detected. There was a signifi-
cant effect of Tr (p <0.0001) and Tr×t (p <0.0001) on HR. Ateno-
lol significantly attenuated HR for 24 hours but did so maximally at t=3 (least squares means ± SE, A: 146±5, P: 208±5); the effect at t= 24 was small (A: 193±5, P: 206±5). Atenolol had a small but sig-
nificant effect (p <0.0001) on HRr. These data may be relevant to the use of oral atenolol in canine cardiovascular disease.

ABSTRACT C-22
EFFECT OF KETANSERIN, A SEROTONIN 2A-RECEPTOR ANTAGONIST, ON ECHOCARDIOGRAPHIC INDICES OF MITRAL REGURGITATION IN DOGS WITH DEGENERATIVE MITRAL VALVE DISEASE. DJ Trafy1, GE Singletary1, RJ Levy2, MA Oyama3. University of Pennsylvania, Philadelphia, PA. 4Children’s Hospital of Philadelphia, Philadelphia, PA

Canine mitral valve interstitial cells can be activated by seroto-
nin. A role of serotonin in degenerative mitral valve disease (DMVD) is suggested by various transcriptional, molecular, and biochemical studies in dogs. We sought to determine the effects of ketanserin, an oral serotonin 2A-receptor blocker on echocar-
diographic severity of mitral regurgitation in dogs with DMVD. Twenty-seven dogs with ISACHC class I or II DMVD were enrolled. Eight dogs completed a phase I open-label 6-month tol-
erability and dose-escalation study, followed by recruitment of dogs into a phase II randomized, placebo-controlled, double-
blinded, 12-month trial. The primary endpoint of the randomized trial was mitral regurgitant fraction (RF) as measured by Dopper echocardiography. Secondary endpoints included 2D-echo mitral valve length, thickness, area, and width, and color Doppler jet vena contractura. Results of phase I indicated that ketanserin up to doses of 1.0 mg/kg BID were tolerated. Nineteen dogs completed Phase II. Over a median study duration of 392 days (range, 357-
419 days), RF increased relative to baseline by 50.8% and 13.8% in dogs receiving 1.0mg/kg BID ketanserin and placebo respec-
tively, and this difference was not statistically significant (P = 0.21). There were no significant differences in any secondary endpoint between groups. Chronic oral ketanserin administration did not alter the slow diastolic and systolic mitral regurgitation jet flow severity in dogs with DMVD. Further studies are needed to deter-
mine the importance of the serotonin pathway in the pathophysiology of canine DMVD.

ABSTRACT C-23
MYOCARDIAL ICAM1 mRNA IS INCREASED IN CANINE DILATED CARDIOMYOPATHY. S Fonfara1, MA Oyama3, P Cripps1,3, SR Tew1, PD Clegg1. 1Department of Musculoskeletal Biology and School of Veterinary Sciences, University of Liverpool, Neston, UK, 2Department of Clinical Studies, University of Pennsylvania, Philadelphia, PA USA, 3Department of Epidemiology & Population Health, University of Liverpool, Neston, UK.

The role of intramyocardial inflammation in canine dilated cardiomyopathy (DCM) is unknown. Presence of endothelial intercellular adhesion molecule-1 (ICAM1) expression sug-
gests myocardial inflammation, pro-inflammatory cytokines, and leukocyte infiltration. Previously, no association between ICAM1 and canine degenerative valvular disease was detected but the potential role of ICAM1 in DCM is unknown.

ICAM1-gene expression in myocardial samples (right and left atrium and ventricle) of eight healthy dogs, four DCM dogs, and five dogs with other cardiac diseases was investigated by quanti-
tative RT-PCR. The association between ICAM1 with myocar-
dial cytokine expression (IL1, IL2, IL4, IL6, IL8, IL10, TNFα, IFNγ) was determined.

There was no difference in ICAM1 mRNA between cardiac regions (p = 0.08). However, a significantly higher ICAM1 mRNA expression was present in dogs with DCM in comparison to control dogs and dogs with other cardiac diseases (p = 0.004). Dogs with cardiac diseases and with and without congestive heart failure (CHF) showed no significant difference (p = 0.16), suggest-
ing an increase of ICAM1 mRNA in DCM but not necessarily other cardiac diseases causing CHF.

A positive correlation of ICAM1 with pro-inflammatory IL1, IL6, TNFα and anti-inflammatory IL10 was present (p <0.001). The cytokines were also elevated in dogs with DCM in compar-
sion to dogs with cardiac diseases other than DCM (p <0.01). These results suggest that activation of the inflammatory system and increased ICAM1 expression might be associated with canine DCM.

ABSTRACT C-24
ASSOCIATIONS BETWEEN N-TERMINAL PROCOLLAGEN TYPE III (PINP), FIBROSIS AND ECHOCARDIO-
GRAPHIC INDICES IN DOGS WITH MITRAL VALVE DISEASE. MJ Hezzell1, T Falk2, LH Olsen1, A Boswood1, J Elliott1. 1The Royal Veterinary College, London, UK, 2University of Copenhagen, Denmark.

PINP is a serum biomarker of collagen biosynthesis and is described as a marker of myocardial fibrosis in human patients.
We hypothesised that PHIPN concentrations would increase with increasing myocardial fibrosis in dogs with MMVD.

Myocardial tissue samples were collected post mortem from the following sites: upper and lower cranial and caudal papillary muscles, middle and lower left ventricular wall, left ventricular septum and the right ventricular wall. Between four and eight tissue sections from each myocardial site were examined by a pathologist masked to the dog’s clinical history. Myocardial fibrosis was scored as follows: 0, none; 1, mild interstitial; 2, moderate interstitial; 3, small to moderate areas of confluent fibrosis; 4, large areas of confluent fibrosis. The average fibrosis score for all sites in the heart (up to 72 sections) was designated the global fibrosis score (GFS). The average fibrosis score for all papillary muscle sites (up to 36 sections) was designated the papillary fibrosis score (PFS). Serum PHIPN concentrations (µg/ml) were measured using a validated commercially-available radioimmunoassay. Echocardiographic measurements and serum PHIPN are reported for the last examination prior to death or euthanasia in all cases. Non-normally distributed variables were logarithmically transformed. Correlations were assessed using Pearson’s correlation coefficient. Univariate linear regression analyses were used separately to evaluate associations between GFS and PFS, respectively, and the following characteristics: PHIPN, PIIINP, left atrial to aortic root ratio (LA/Ao), left ventricular end diastolic diameter to left ventricular free wall thickness in diastole ratio (LVEDD/LVFWd) and left ventricular end diastolic diameter normalised for body weight (LVEDDDN). Variables significant at the 20% level were entered into multivariable linear regression analyses with GFS and PFS as the dependent variable in turn.

Twenty-two dogs with MMVD were studied. In the univariate analysis (dependent variable; GFS), PHIPN (P = 0.074) and LVEDDDN (P = 0.180) were associated with GFS. In the final multivariable model, LVEDDNN (P = 0.044, B = 1.264) and PIIINP (P = 0.020, B = 0.061) were independently positively associated with GFS (R² = 0.318). In the univariate analysis (dependent variable; PFS), PIIINP (P = 0.092), Log (LA/Ao) (P = 0.076), LVEDDDN (P = 0.097) and LVEDD/LVFW ratio (P = 0.175) were associated with PFS. In the final multivariable model, LVEDDDN (P = 0.019, B = 0.265) and PHIPN (P = 0.018, B = 0.068) were independently positively associated with PFS (R² = 0.289).

In conclusion, both LVEDDDN and serum PHIPN increase with increasing fibrosis score. The relationship between extracellular matrix turnover, fibrosis and left ventricular remodelling appears to be complex in dogs with MMVD.

**ABSTRACT C-25**

**NOT ALL ARTERIES ARE CREATED EQUAL: COMPARISON OF PRESSURES WITHIN THE AORTIC ROOT AND THE DORSAL PEDAL ARTERY IN CATS, K Parker, A Carr, T Duke-Novakovski. Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, SK.**

Blood pressure measurement is important when assessing hemodynamic stability in cats. Any accessible artery, including the dorsal pedal (DP), has been considered an appropriate artery for direct measurement of systemic blood pressure.

To examine measurement of blood pressure within the dorsal pedal artery compared to within the aortic root.

Five anesthetized cats had a 24 gauge catheter with an external pressure transducer (AD Instruments) placed in DP. A transducer tip catheter (3.5 Fr. Millar) was then placed in the carotid artery and advanced to approximately six intercostal spaces, between the level of the aortic root. These were used for continuous blood pressure monitoring. Data were recorded using Powerlab (Powerlab 26T, Model ML856) LabChart 7.2 software (AD Instruments). Topical prilocaine and lidocaine cream was applied prior to surgical cut down to the DP artery to minimize vascular spasm. The DP and aortic root catheters were calibrated using a mercury sphygmomanometer prior to placement. Systolic blood pressure was adjusted using various isoflurane concentrations, colloids and dobutamine to achieve hypo- (<80 mmHg), normo- (81-110 mmHg) and hypertensive (>110 mmHg). Bias (DP minus Aortic Root), precision (SD of the differences) and limits of agreement (bias ± 2SD) were calculated.

551 matched pairs of data were compared to the aortic root in hypotensive, normotensive, and hypertensive states for Systolic, Diastolic and Mean value and lower accurate with a bias of -22.2 mmHg for hypotensive systolic (SD 16.6, Correlation Coefficient (CC) 0.74), (-22.9) hypotensive diastolic (SD 12.7, CC 0.73), (-22.2) hypertensive mean (SD 13.4, CC 0.75), (-30.4) normotensive diastolic (SD 12.8, CC 0.49), (-28.4) normotensive mean (SD 12.8, CC 0.58), (-39.8) hypertensive systolic (SD 14.1, CC 0.78), (-29.13) hypertensive diastolic (SD 16.3, CC 0.66), and (-31.6) hypertensive mean (SD 16.7, CC 0.66).

Using the dorsal pedal artery with a 24 GA catheter and external pressure transducer is not an accurate method to measure systemic arterial blood pressure in cats.

**ABSTRACT C-26**

**RETROGRADE CORONARY VENOUS STEM CELL DELIVERY: A PILOT STUDY EVALUATING SAFETY AND FEASIBILITY, B Pogue, AH Estrada, HW Maishenbacher III, A Shih, TJ Conlon.**

In human medicine, cellular transplantation of allogeneic adult stem cells into failing heart muscle has been employed via numerous delivery methods with success, causing reported improvements in heart function and survival for patients with ischemic heart disease. The purpose of this study was to develop a method of stem cell delivery for Doberman Pinschers with Dilated Cardiomyopathy (DCM) in order to determine the (acute) safety and feasibility of delivery of a large number of cells to a large portion of the left ventricular myocardium. Retrograde coronary venous delivery of adipose-derived mesenchymal stem cells transduced with tyrosine mutant Adeno-associated virus 2 (tmAAV2) to express stromal derived factor-1 (SDF-1) was performed in fifteen Dobermans with DCM (12 pre-CHF and 3 with stabilized CHF).

A balloon wedge pressure catheter was placed within the coronary sinus from the right jugular vein under general anesthesia. With the balloon tip inflated, saline was injected retrograde to coronary venous flow at a pressure of 300 mmHg in order to disrupt the vascular endothelium. Cellular implantation (10 million cells within 20mL of saline) was performed in a similar fashion and the balloon remained inflated for 10 minutes to retain cells within the coronary venous system. Anesthesia time ranged from 33 to 95 minutes (median 45 minutes), and actual procedural time ranged from 30 to 82 minutes (median 35 minutes). Fourteen dogs were discharged 24 hours following the procedure without complications. One dog developed worsening ventricular arrhythmias and suffered cardiac arrest. 7/15 dogs did not return for follow-up eventually succumbed to either sudden death or congestive heart failure (1 at 24 hours as mentioned above, 2 at 8 months, and 1 at 11 months). Antibody titers against tm-AAV2 were measured in 3/15 dogs at baseline and at 1 month and found to be negative at both time points. Echocardiograms were performed at baseline and 24 hours (15/15), at 1 month (8/15), 3 months (5/15), 6 months (5/15), and 12 months (1/15) following cellular implantation. Measurements of ejection fraction (EF), fractional shortening (FS), end diastolic and systolic volumes indexes (EDVI, ESVI) were compared to baseline. Statistical comparisons were made using a repeated measures ANOVA. Differences between the means were considered significant at P > 0.05. At 1 month, EDVI was decreased compared to baseline (105.97 mL/m² vs 111.59 mL/m², P = 0.017) and FS was improved compared to baseline (18.67% vs 17.14%, P = 0.05). At 3 months, ESVI was increased compared to baseline (79.60 mL/m² vs 73.76 mL/m², P = 0.035). At 6 months, both ESVI and EDVI had increased significantly (131.2 mL/m² and 90.02 mL/m², respectively, P < 0.0001 for both).

In summary, retrograde venous delivery of tm-AAV2-SDF1 adipose-derived mesenchymal stem cells appears safe but long term functional effects and changes in expected outcomes for affected dogs were not observed in the few Dobermans in which long term follow up was available.
ABSTRACT C-27
THE NATURAL ANTIOXIDANTS POMEGRANATE EXTRACT AND SOY ISOFAVONES FAVOURABLY MODULATE CANINE ENDOTHELIAL CELL FUNCTION. SM Berger1, F. Waldenberger1, A. Ginouves-Guerdoux3, D. McGahie3, H. Gatto1. 1Dept. Internal Medicine III, Clin. Div. of Endocrinology & Metabolism, Vienna, Austria, 2Heart Center Hietzing, Vienna, Austria, 3Laboratoire VIRBAC, Carros Cedex, France.

Cardiovascular disease, preceded by valvular and vascular endothelial dysfunction, is a prominent cause of death in dogs. Endothelial dysfunction is characterized by impairment of crucial cell functions, e.g. accelerated apoptosis and increased proliferation of endothelial cells. This study aimed to identify and characterize vasoprotective agents which may be able to prevent or ameliorate the sequelae of endothelial dysfunction and subsequent cardiovascular disease in dogs.

Due to the lack of canine-specific data from in vitro models, we established such a model on the basis of canine macrovascular (aortic) endothelial cells (CnAoECs), and showed it to be well suited to test both vasoprotective and detrimental agents. As test substances, the natural antioxidants Pomegranate Extract, Soy Isoflavones, Taurine and L-Carnitine were studied in the respective model in comparison to Glutathione (GSH), N-Acetylcystein (NAC), free fatty acids and Pioglitazone (PIO), which were previously shown to modulate human endothelial cell apoptosis and proliferation in vitro, mimicking the in vivo situation in humans. CnAoECs were cultured on fibronectin coated cell culture dishes in a serum free DMEM supplemented with 5% CO2, and were used in passages 5-7.

After replating, cells were labeled with 3-thymidine, exposed to the above mentioned test or control agents for 48 h, and apoptosis and proliferation were measured according to standardized protocols.

Pomegranate Extract and Soy Isoflavones, even at the concentration of 50 µg/ml, markedly reduced proliferation of CnAoECs by 90% and 25%, respectively. This effect was dose-dependent. Exposure of CnAoECs to 250 µg/ml of these two substances led to an impressive inhibition of the cells’ proliferation to 3.75% and 15.5% of control (set to 100%), whereas PIO and GSH reduced proliferation to only 62.25% and 54.75% of control, respectively.

Pomegranate Extract significantly reduced apoptosis at all concentrations tested. Once again this was in a dose dependent fashion, showing the most striking effect at 250 µg/ml with a reduction of 73% compared to control cells, whereas the anti-apoptotic effect of Soy Isoflavones was observed only for the highest concentration tested (250 µg/ml).

In the course of the present study we established a canine endothelial cell in vitro model, very well suited to the standardized testing of potential vasoprotective agents. Our data clearly demonstrate that Pomegranate Extract and Soy Isoflavones drastically reduce proliferation and apoptosis of canine aortic endothelial cells, which is consistent with a vasoprotective activity for these natural antioxidants. A combination of these substances in association with cardio protective agents acting on other aspects of the cardiac disease process, could be an interesting potential dietary strategy to reduce the progression of canine cardiovascular diseases.

ABSTRACT C-28
POMEGRANATE EXTRACT COMBINED WITH OTHER NATURAL ANTIOXIDANTS PROTECTS CANINE ENDOTHELIAL CELLS FROM DEATH INDUCED BY OXIDATIVE STRESS. C. Ripoll1, A. Coussaert1, FR Waldenberger2, A Ginouves-Guerdoux3, D. McGahie3, H. Gatto1. 1Naturalpatha SAS, Loos, France, 2Heart Center Hietzing, Vienna, Austria, 3Laboratoire VIRBAC, Carros Cedex, France.

Oxidative stress induces damage to canine and human cardiovascular cell types, and is implicated in the initiation and progression of cardiac diseases. Alterations in antioxidant reactivity in dogs’ blood can be related to the severity of cardiac insufficiency. Decreased cardiac efficiency contributes to further increased oxygen demand and increased free radical production. The resulting oxidative damage to the endothelium also reduces nitric oxide availability, limiting the ability of the vascular wall to relax and placing further strain on the failing heart. Several natural antioxidant substances have been shown to be beneficial in humans. However their benefit in canine cardiovascular cells has never been addressed.

In order to evaluate this point, we initially developed a canine aortic endothelial cell (CnAoEC)-based model of oxidative stress-induced cytotoxicity. We first validated the use of the MTT assay to assess cell viability after a cytotoxic challenge. We then established that a 24 hour oxidative challenge with 2mM H2O2 resulted in a reproducible and consistent decrease of cell viability.

In the second part of the study, we used this model to assess the ability of 4 natural substances (Pomegranate Extract, Soy Isoflavones, Taurine and L-Carnitine), alone and in combination, to protect the CnAoECs from oxidative stress. They were also assessed, at 1, 50 and 250µg/ml, for their antioxidant properties using two common acellular in vitro free radical scavenging assays.

In both the free radical scavenging assays, Soy Isoflavones and, in particular, Pomegranate Extract, alone or in combination with the other substances, proved to be potent antioxidants. Indeed, 50 µg/ml of Pomegranate Extract was sufficient to quench over 97% of the radicals. Soy Isoflavones quenched 83% and 92% of the radicals at 50 and 250µg/ml respectively. Taurine and L-Carnitine provided only low quenching. However they did not interfere with the action of the Pomegranate Extract and Soy Isoflavones in the mix.

In the CnAoEC assay, Pomegranate Extract showed a strong protective effect and increased the CnAoEC viability by 35% and 82% at 50 and 250µg/ml respectively. In this assay the other substances were not efficient at protecting the cells from such a potent oxidative challenge on their own. However they did not interfere with the beneficial effects of the Pomegranate Extract and may even have had a positive impact on the cells when used in combination (cell viability increased by 41% with the mix at 50µg/ml, which contains only 12.5µg/ml of Pomegranate Extract).

This study has shown that potent natural antioxidant substances such as Pomegranate Extract are able to protect CnAoECs from significant oxidative challenge, representing a potentially beneficial dietary strategy to maintain endothelial cell health during initiation and progression of canine cardiovascular diseases.

ABSTRACT C-29
CHANGES OF SERUM CARDIAC TROPONIN I CONCENTRATION IN 13 DOGS WITH INTRACRANIAL DISORDERS. J Kim, R Song, D Lee, H Lee, J Park, C Park. College of Veterinary Medicine, Chonbuk National University, Jeonju, Jeonbuk, Korea.

Cardiac troponin I (cTnl) that is found within myofibers and is leaked from damaged myocardial cell is a sensitive and specific biomarker for myocardial injury in humans and animals. The protein structure of cTnl is highly conserved between species. cTnl has greater sensitivity and specificity for myocardial damage than other test including CK-MB, cardiac troponin C and T.

Seizures can result in myocardial damage through elevated catecholamines causing increased heart rate, blood pressure, contractility, and myocardial oxygen demand. Serum cTnl concentration was measured by electrochemiluminescence immunoassay (ECLIA) in 13 dogs with seizure caused by intracranial lesions including granulomatous meningoencephalitis (GME), necrotizing meningoencephalitis (NME), glioma, idiopathic epilepsy, arachnoid cysts and head trauma. The serum cTnl concentration was significantly increased in 6 of 13 dogs (reference range 0 to 0.026).

Measuring cTnl concentrations in dogs with seizure caused by intracranial disorders may help to identify myocardial damage and possibly lead to earlier therapeutic interventions.
ABSTRACT C-30
C-REACTIVE PROTEIN IS ELEVATED IN DOGS IN SEVERE HEART FAILURE. A Domanjko Petricic, T Lukman, B Verk, A Nemee Svet. Clinic for Surgery and Small Animal Medicine, University of Ljubljana, Slovenia.

C-reactive protein (CRP) is an acute phase protein and an early marker of inflammation. Recent studies in human medicine provide evidence that inflammation plays a role in the pathogenesis of cardiovascular disease. To our knowledge, studies that investigate CRP concentration in heart failure in dogs have not been reported. The authors aimed to investigate whether CRP is elevated in patients with various cardiovascular diseases and heart failure. In addition we were interested whether there is an association between ISACHC class and CRP concentration.

Thirty-nine client-owned cardiac patients (31 males and 8 females; 0.8 - 16 years old) and 12 healthy controls (2 males and 10 females; 1 - 10 years old) were included in the study. The dogs were judged to be healthy based upon normal history, clinical examination, and results of hematological and biochemical analysis. Various congenital and acquired cardiovascular diseases were confirmed on the basis of history, clinical examination, thoracic radiographs, electrocardiogram and echocardiography and classified into International Small Animal Cardiac Health Council classes (ISACHC). Patients with other diseases were excluded from the study. Serum CRP concentration was determined with LifeAssays® Canine CRP Test Kit, which is a two-site heterogeneous immunoassay. Independent T-test was used to compare serum CRP levels between controls and individual class of heart disease. One-Way ANOVA was used to test for statistically significant differences in CRP concentration between ISACHC groups. Pearson’s correlation coefficient test was used to correlate ISACHC class with CRP concentration, white blood cell count (WBC) and neutrophil cell count (NEUTH). A value of P < 0.05 was considered statistically significant. Results of statistical analysis demonstrated significantly higher CRP concentration in ISACHC III group (range: 10 - 62 mg/L) versus controls (range: 10 - 13 mg/L), while no significant differences were found between controls and ISACHC I and II. Serum CRP was significantly higher in ISACHC II (range: 10 - 37 mg/L) and III versus ISACHC I (<10 mg/L) and significantly higher in ISACHC III comparing to ISACHC II. Significant positive correlations were found between ISACHC class and CRP (r = 0.330; P = 0.040), WBC (r = 0.459; P = 0.000) and NEUTH (r = 0.464; P = 0.000), as well as between CRP and WBC (r = 0.690; P = 0.000) and between CRP and NEUTH (r = 0.634; P = 0.000).

In conclusion, CRP concentration is elevated in heart failure patients and increases with severity of heart failure. The results of this present study warrant further studies on CRP as a biomarker of effectiveness of cardiac therapy.

ABSTRACT C-31
ASSESSMENT OF HYPERTROPHIC CARDIOMYOPATHY IN SMALL BREED DOGS AFFECTED WITH HYPERADRENOCORTICISM USING 2D SPECKLE-TRACKING ECHOCARDIOGRAPHY. HY Chen, HP Huang. Institute of Veterinary Clinical Science, School of Veterinary Medicine, National Taiwan University, Taipei, Taiwan.

The aim of the study was to assess left ventricular systolic and diastolic function using 2D speckle-tracking echocardiography (2D-STE) in small breed dogs affected with hypertrophic cardiomyopathy (HCM) in pituitary- and adrenal-dependent hyperadrenocorticism (PDH and ADH, respectively) and age-matched control dogs. Diagnosis of HCM was based upon findings of conventional echocardiography. Diagnosis of hyperadrenocorticism (HAC) was based on affirmative results from adrenocorticotropic hormone stimulation tests and ultrasonographic adrenal morphology. In 2D-STE, peak systolic and diastolic relative/longitudinal tissue velocity, circumferential/longitudinal strain rate and peak systolic circumferential/longitudinal strain of 6 segments, and septal and lateral corners of mitral annulus were assessed from right parasternal short-axis/left apical views.

In conventional echocardiography, 7 dogs with PDH (prevalence: 7/13, 54%), 8 dogs with ADH (8/12, 67%) and 11 non-HAC dogs (11/53, 21%) were diagnosed as HCM (P = 0.002). In these dogs, either the systolic (fractional shortening, ejection fraction) or diastolic parameters (E/A ratio, isovolumetric relaxation time) was not different among dogs with PDH, ADH and non-HAC dogs. In 2D-STE analysis, 23 of 98 (23%) 2D-STE variables were significantly different among 3 groups. The dogs with ADH exhibited significantly decreased longitudinal peak systolic and early diastolic strain rates (P = 0.046 and P = 0.002, respectively), and longitudinal peak systolic strain (P = 0.038) compared to PDH and non-HAC dogs.

HAC was prevalent in HAC comparing to age-matched non-HAC small breed dogs. In dogs with HCM, 2D-STE revealed significant decreases in both diastolic and systolic functions those were not detected using conventional echocardiography in ADH comparing to PDH-affecting and non-HAC dogs.

ABSTRACT C-32
ECHOCARDIOGRAPHIC EVALUATION OF LEFT ATRIAL SIZE IN HEALTH COCKER SPANIEL DOGS AND WITH DILATED CARDIOMYOPATHY. GT Goldfeder, PH Itikawa, GG Pereira, JR Castro, VM Oliveira. MHMA Larsson School of Veterinary Medicine and Animal Sciences, University of Sao Paulo, SP, Brazil.

Left atrial (LA) size is considered an important prognostic factor in many cardiomyopathies. In humans, it is known that LA remodeling can occur in different planes, according to the cause. The aim of this study was to evaluate left atrial size, by measuring the apical-basilar (Abd), medio-lateral (MLd) and cranio-caudal (Cc) axis.

Eleven healthy adult Cocker Spaniel dogs (control) and nine adult Cocker Spaniel dogs with dilated cardiomyopathy (DC) were included. Control animals were screened by physical examination, thoracic radiography, echocardiography, systolic blood pressure measurement, echocardiography and laboratory tests (CBC, biochemical blood urea and creatinine). Abd and MLd measurements were done from apical 4 chamber view (Ap4cv) of the heart, in end-systole. Abd was obtained by drawing a line from the mitral apposition point of mitral leaflets to middle point of LA roof. MLd measurement was performed drawing a perpendicular line to the Abd. Cc measurements were done anterior-posterior diameter from the paraesternal long-axis view. Data were tested for normality and expressed as mean and standard deviation. Comparisons among the methods were performed by One-way Analysis of Variance. LA measurements in Abd were 2.63±0.21 cm to control and 4.3±0.83 cm to DC; in MLd were 2.31±0.18 cm to control and 3.57±0.65 cm to DC; in Cc were 2.44±0.21 cm to control and 3.59±0.42 cm to DC. LA diameters were significantly different among methods. Posterior similar studies involving dogs with different heart disease are recommended.

ABSTRACT C-33
TIME-DOMAIN HEART RATE VARIABILITY IN HEALTHY DOGS. E Zacché, FN Gava, EMG Ortiz, FA Rosa, R Camacho, FM Marinho, R Navarrete, AA Camacho. São Paulo State University – UNESP, Jaboticabal, São Paulo, Brazil.

Heart rate variability (HRV) is one of the most valuable non-invasive marker of autonomic nervous system and is a prominent method to assess its modulation of cardiovascular system. It is well known that, besides different diseases, several physiologic conditions can affect HRV in human beings but it still being studied in canine patients. Thus, the aim of the present work was to evaluate the influence of different characteristics in HRV in healthy dogs.

Twenty client-owned healthy dogs of different breeds were enrolled in the study. Heart rate variability, determined from 24-hour Holter recordings in home environment, was assessed by SDNN, SDANN, SDNN-index, rMSSD and pNN50. Dogs were grouped on the basis of different criteria such as gender (male, n = 8 and female, n = 12), age (<3 years-old, n = 7 and >3 years-old, n = 13), cranial conformation (brachycephalic, n = 5 and
non-brachycephalic, n=15) and body weight (<15 Kg, n=11 and > 15 Kg, n=9). Data was submitted to a normality test and then analysis between groups was performed by using unpaired Student’s t-test.

There was no significant difference (p > 0.05) between groups when SDNN, SDANN, SDNNIDX and rMSSD were evaluated on the basis of any of the tested criteria. The general mean (± standard deviation) of such parameters were 328 ± 65 ms, 164 ± 35 ms, 77.4% and 130 ± 44 ms, respectively. However, pNN50 was significantly higher (p < 0.02) in patients with body weight ≤ 15 Kg (71.93 ± 8.22 %) compared with patients with body weight 15 Kg (62.66 ± 9.13 %).

Indexes based on the comparison between adjacent cycles (rMSSD and pNN50) reflect, predominantly, vagal tonus. Thus, pNN50 seems to be caused by increased activity of sympathetic nervous system of healthy dogs is not influenced by age, gender or cranial conformation but is body weight dependent. For this reason, the establishment of normal range values should be based especially on that last criteria.

**ABSTRACT C-34**

**HEART RATE VARIABILITY IN BOXER DOGS WITH ARRHYTHMogenic RIGHT VENTRICULAR CARDIOMYOPATHY.** PPC Chamas, VMC Oliveira, FL Yamaki, MHMA Larsson, School of Veterinary Medicine and Animal Science - University of São Paulo, SP, Brazil.

Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a familial disease that affects mainly Boxer dogs, characterized by frequent ventricular arrhythmias that lead to sudden death. In human patients, studies suggest important role of sympathetic overstimulation in the genesis of these ventricular arrhythmias through observation of diminished heart rate variability (HRV) indices.

Seventy-three Boxer dogs were screened and classified, according to results of ambulatory electrocardiography and echocardiography, into four groups: CB - control Boxers (n = 28, less than 50 VPC/24 hours), SB - suspected Boxers (n = 8, 50 to 300 VPC/24 hours), ARVCB - affected Boxers without systolic dysfunction (n = 19, more than 300 VPC/24 hours) and SDB - affected Boxers with systolic dysfunction (n = 18). Five time domain HRV indices were analyzed: SDNN, SDANN, SDNNi, rMSSD and pNN50. Statistical analyses comprised ANOVA test, Pearson correlation and Cox proportional hazards regression.

Compared to CB group, there was no decrease in HRV indices on SB or ARVCB groups, and no correlation was found between HRV indices and number or degree of ventricular arrhythmias, suggesting that ventricular arrhythmias in Boxer ARVC do not seem to be caused by increased activity of sympathetic nervous system, as observed in human patients. Otherwise, SDB group had impairment of these indices, justified by sympathetic stimulation that occurs in congestive heart failure (CHF) associated with systolic dysfunction. No relation was found between HRV indices and cardiac related death (sudden death or death due to CHF) of dogs with ARVC, demonstrating that such indices are poor prognostic indicators for this disease.

**ABSTRACT C-35**


Radiographic assessment of left heart enlargement is an important diagnostic component of canine degenerative mitral valve disease (DMVD). Previously, investigators have proposed the radiographic left atrial bisecting line (L-LABL) as a more specific measure of left atrial enlargement than ventricular heart size (VHS).

Radiographs from 23 dogs diagnosed with DMVD from 2009-2011 were examined by three investigators and VHS and LABL (defined as the line from the 90 degree intersection of the short and long axis VHS measurements to the dorsal border of the left atrium) were measured in vertebral bodies. Interobserver variability (coefficient of variation, CV) and correlation to echocardio- graphic LA:Ao were calculated.

CV of right and left lateral LABL (R-LABL, 15.3%±3.3%; L-LABL, 25.1%±23.1%) were significantly (P < 0.0001) greater than CV of VHS (R-VHS, 6.1%±4.4%; L-VHS, 4.2%±3.8%). Linear regression revealed moderate correlation between R-VHS (r² = 0.406; P = 0.006) or L-VHS (r² = 0.551; P = 0.004) and LA: Ao. Significant correlation of between R-LABL (r² = 0.265, P = 0.034) or L-LABL (r² = 0.208; P = 0.12) and LA: Ao. Median R-or-L-LABL was not significantly (P > 0.05) greater in dogs with CHF (n = 12) vs. without CHF (n = 11). Difficulty of the LABL measurement was graded as easy, moderate, or hard in 54%, 28%, and 18% of measurements, respectively.

Assessment of left atrial size using LABL is challenging due to high interobserver variability and weak correlation with echocardiographic LA:Ao, which is likely due to difficulty in ascertaining the dorsal radiographic border of the left atrium in dogs with more advanced disease. Future studies evaluating modifications of the LABL technique should be performed.

**ABSTRACT C-36**

**LEFT ATRIAL FUNCTION ANALYSIS BY LEFT ATRIAL TRACKING METHOD IN CANINE CHRONIC MITRAL VALVULAR HEART DISEASE.** K Nakamura, T Otsuji, M Yamasaki, H Ohta, M Takiguchi. Department of Veterinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Sapporo, Hokkaido, Japan.

Left atrial tracking method is a novel echocardiographic modality for evaluation of left atrial function. The purpose of this study was to assess the value of this method for the evaluation of canine chronic mitral valvular heart disease.

Firstly, the repeatability of variables of left atrial tracking method was investigated with 6 normal beagles. The within-day and between-day coefficients of variation of %LASpass (conduit function index), %LASact (booster pump function index), %LAStotal (reservoir function index) were all clinically acceptable (< 20%).

Secondly, 36 clinical dogs with chronic mitral valvular heart disease (15 dogs in ACVIM stage B1, 9 dogs in stage B2, 6 dogs in stage C, 6 dogs in stage D) were enrolled. Receiver operating characteristic curve analysis revealed that LA:Ao, E, %LASact were highly useful (area under the curve > 0.9) and E/A, E'/A', %LAStotal were moderately useful (area under the curve > 0.7) to distinguish asymptomatic dogs (stage B1 and B2) from symptomatic dogs (stage C and D). On the other hand, only %LASact was highly useful (area under the curve > 0.9) and E, E', A, %LASpass, %LAStotal were moderately useful (area under the curve > 0.7) to distinguish mild symptomatic dogs (stage C) from severe symptomatic dogs (stage D). LA:Ao had no value to distinguish mild from severe symptomatic dogs.

In conclusion, these results indicate that left atrial tracking method has adequately high repeatability for routine clinical usage in dogs. Moreover, this method is more valuable than conventional echocardiographic method in assessing the severity of canine chronic mitral valvular heart disease.

**ABSTRACT C-37**

**EARLY DETECTION OF LEFT VENTRICULAR DYSFUNCTION IN DOGS WITH DOXORUBICIN-INDUCED CARDIOMYOPATHY BY 2D SPECKLE TRACKING ECHOCARDIOGRAPHY.** K Sugimoto, H Takano, H Sunahara, T Aoki, G Sugahara, Y Uno, Y Fuji. Azabu University, School of Veterinary Medicine, Kanagawa, Japan.

Doxorubicin (DOX) is one of the most frequently used drugs for chemotherapy in dogs, and well known to have cardiac toxicity. Two-Dimensional Speckle Tracking Echocardiography (STE) is a relatively novel method to assess regional myocardial function and has been reported to be useful to detect early myocardial dysfunction in doxorubicin-induced cardiomyopathy of human and rats. The purpose of the study is to evaluate the usefulness of STE to detect early left ventricular (LV) myocardial dysfunction due to DOX in dogs by comparing the changes of STE parameters with histopathological findings of corresponding regions in LV.
DOX (30 mg/m², 3 weeks apart, 4 times, total 120 mg/m²) and saline were administered to five (DOX group) and four clinically healthy beagles (placebo group), respectively. Conventional echocardiographic and STE parameters were measured and compared.

Radial strain at the apical level and radial strain rate in early diastole at chordae tendineae level decreased significantly in the DOX group, suggesting a significant change in conventional paramet ers. Three of 4 dogs in the DOX group appeared to have decreased STE parameters corresponding to severity of histopathological lesions. Histopathological lesions among segments were almost homogeneous in LV, but, changes of segmental STE parameters did not always agree with the histological score. Because of complex arrays of myocardial fiber in some LV regions, STE parameters may not accurately detect localized myocardial lesions in some areas.

**ABSTRACT C-38**

**DOXORUBICIN-INDUCED DILATED CARDIOMYOPATHY IN A RABBIT MODEL: AN UPDATE.** FN Gava, E Zacchê, EMG Ortiz, T Champion, MB Bandarra, JC Barbosa, RO Vasconcelos AA Camacho. São Paulo State University – UNESP, Jaboticabal, São Paulo, Brazil.

Dilated cardiomyopathy (DCM) is characterized by chamber dilatation, important systolic dysfunction and poor prognosis. Thus, studies with experimental models of DCM are always important. The purpose of this study was to investigate the onset of systolic dysfunction using echocardiography in rabbits receiving different doses of doxorubicin (DOX) and to characterize by histological analysis and scanning electron microscopy from three different areas of myocardium.

Thirty male New Zealand White rabbits were randomized in three experimental groups with 10 rabbits each, named: G1: control group, receiving NaCl 0.9 %, G2: receiving DOX 1 mg/kg twice a week and G3: receiving DOX 2 mg/kg once a week, for 6 weeks. Echocardiographic evaluations were performed in awaken animals, before DOX administration (T0) and every fifteen days (T15, T30, T45 and T60). The statistical analysis was performed by analysis of variance followed by Tukey’s test.

Vacuolisation, intracytoplasmatic granulation, necrosis and extensive interstitial fibrosis characterized DCM through histology and electron microscopy in left ventricle (LV), interventricular septum (IVS) and right ventricle (RV). The results showed a high mortality rate (70%) for G3 and only 30% for G2. There were significant reductions (p<0.05) in fractional shortening for G2 and G3 at T45 (G1 = 38.57 ± 2.22%, G2 = 20.71 ± 4.02%, G3 = 22.66 ± 3.78%) and T60 (G1 = 37.35 ± 4.83%, G2 = 22.66 ± 3.40%, G3 = 22.33 ± 4.04%). This was also detected for the ejection fraction at T45 (G1 = 73.28 ± 3.03%, G2 = 45.78 ± 7.44%, G3 = 49.33 ± 6.80%) and T60 (G1 = 71.00 ± 5.83%, G2 = 49.50 ± 6.25%, G3 = 48.33 ± 6.65%).

Echocardiograph was important to indicate the start of systolic dysfunction whereas the histology and electron microscopy featured the main lesions of doxorubicin-induced DCM. The administration of 1 mg/kg twice a week for only 6 weeks is sufficient to induce DCM in rabbits.

**ABSTRACT C-39**

**ASSESSMENT OF SERUM ADIPONECTIN AND ITS CORRELATION WITH OBESITY AND MITRAL VALVE ENDOCARDIOSIS IN DOGS.** MHMA Larsson1, FLAM achaô1, DS Schwartz2, G Goldfelder3, MM Jerico.1 School of Veterinary Medicine and Animal Science – University of São Paulo, São Paulo, SP, Brazil. 2School of Veterinary Medicine - University Anhembí Morumbi, São Paulo, SP, Brazil.

Adipose tissue is known as a site for energy storage and synthesis of hormones. Among them, adiponectin, a protein expressed exclusively in adipocytes, is responsible for the correlation between obesity and the atherosclerosis associated with insulin resistance. Its circulating levels are inversely proportional to body fat increase. Studies have suggested that adiponectin has its effects as an anti-atherogenic and anti-inflammatory molecule. However, human studies have shown that circulating adiponectin values should be interpreted with caution, because high levels of adiponectin have been associated with increased mortality rate in patients with coronary artery disease and heart failure. This study evaluated the serum concentration of adiponectin in dogs, divided into three groups: control (n=8), with chronic mitral valve disease-dvcm (n=11) and obese patients with chronic mitral valve insufficiency concomitantly (n=9). Blood samples were processed by means of laboratory techniques of radioimmunoassay (RIA) and ELISA, verifying the correlation between serum adiponectin levels among the groups. The group of dogs with chronic mitral valve disease was classified according to the ACVIM Consensus Statements of 2009. The results showed no statistical significance (Mann-Whitney test) among the groups, probably due to the small sample (RIE: control/dvcm and obese (p=0.283); control/dvcm and obese (p=0.147)), however, we observed a tendency for decrease in mean and median adiponectin values in dogs with dvcm and obese group compared to the control group, confirming the paradox between adiponectin circulating levels in obesity and heart failure.

**ABSTRACT C-40**

**ARTERIAL BLOOD PRESSURE ASSESSMENT IN NORMAL AND OVERWEIGHT DOGS BY THREE DIFFERENT METHODS.** BC Rodrigues, FN Gava, E Zacchê, EMG Ortiz, RDM Junior, T Champion, AA Camacho, São Paulo State University – UNESP, Jaboticabal, São Paulo, Brazil.

The measurement of arterial blood pressure (ABP) is an important clinical parameter that should be performed with precision mainly on the investigation of arterial hypertension. The purpose of this study was to compare ABP values obtained indirectly by Doppler and two kinds of oscillometric methods in normal and overweight dogs.

Thirty healthy adult dogs were selected after physical examination, echocardiographic and laboratory tests. The study groups comprised fourteen overweight dogs with mean body score index (BSI) of 6.9 and sixteen dogs with ideal BSI (4.8). The systolic blood pressure (SBP) was measured in all animals first by Doppler method (A), followed by oscillometric Dixit@® (B) and after by Pet-MAP® (C). The mean and diastolic blood pressure were measured by B and C. The statistical analysis was performed by analysis of variance followed by Tukey’s test.

There was no significant difference between normal and overweight dogs for SBP, but the values were higher (p<0.05) for Pet-MAP® (Overweight dogs: A = 136.2±5.94 mmHg, B=141.57±2.80 mmHg, C= 160.92±6.34 mmHg; Ideal BSI dogs: A = 136.00±5.04 mmHg, B = 136.56±3.96 mmHg, C = 163.68±6.31 mmHg). There was no difference in SBP between normal and overweight dogs: B = 136.2±5.94 mmHg, C = 136.56±3.96 mmHg, and no difference in diastolic blood pressure between normal and overweight dogs: B = 82.35±4.71 mmHg, C = 86.50±2.80 mmHg.

The results suggest that overweight dogs may have normal arterial blood pressure but the method of measurement must be chosen carefully, once that Pet-MAP® may overestimate the systolic and mean blood pressure in normal and overweight dogs.

**ABSTRACT C-41**

**PLASMA LEVELS OF NT-ProBNP AND VENTRICULAR DIASTOLIC FUNCTION ASSESSED BY PULSED TISSUE DOPPLER ECOCARDIOGRAPHY IN OBESE DOGS.** PRR Melo, AM Mazini, VMC de Oliveira, GT Goldfelder, CN Duarte, DS Schwartz, FMVZ-USP (School of Veterinary Medicine and Animal Science, University of São Paulo) São Paulo, SP, Brazil.

Considering the controversial results on Nt-proBNP in obese humans, and the lack of studies in obese dogs, we sought to evaluate the possible role of Nt-proBNP as a preclinical marker of...
cardiac disease in obese dogs, and the relationship with diastolic function parameters assessed by pulsed tissue Doppler echocardiography (TDE).

Forty-eight obese dogs (BCS9/9 and BCS8/9), and 49 dogs with ideal body condition score (BCS5/9) were selected, matched for gender, breed/size and age. Plasma concentrations of NT-proBNP and left ventricular (LV) myocardial TDE derived systolic (Sm), early (Em) and late (Am) diastolic velocities (apical four-chamber view and the lateral mitral annulus region) were assessed.

Obese dogs had higher NT-proBNP levels compared to lean dogs (P = 0.043). Eighty percent of BCS9 and BCS5 dogs had NT-proBNP < 900 pmol/L and 42% of BCS8 dogs were between 900-1800 pmol/L. Based on a ROC curve, obese dogs showed NT-proBNP ≥ 550 pmol/L while the non-obese showed NT-proBNP < 550 pmol/L, with 75% sensitivity and 53% specificity (P = 0.044). Em was decreased (P = 0.006) in obese and Em/Em was increased in BCS8 (P = 0.02) and BCS9 (P = 0.009) compared to lean dogs, suggesting relaxation change and increased ventricular filling pressure. Increased Em/Em ratio was associated to higher NT-proBNP levels (P = 0.032). The similarity of NT-proBNP between BCS9 and BCS5 dogs, despite the presence of preclinical LV diastolic changes, strengthen the need for further studies, especially when considering obese dogs with heart disease similar to that of the human patient, which may need lower NT-proBNP cutoff values in order to differentiate the presence of heart failure as a cause of respiratory distress.

**ABSTRACT C-42**

**EFFECT OF BODYWEIGHT ON ASSESSMENT OF LEFT VENTRICULAR FUNCTION USING TWO-DIMENSIONAL SPECKLE-TRACKING ECHOCARDIOGRAPHY.** HY Chen, HP Huang. Institute of Veterinary Clinical Science, School of Veterinary Medicine, National Taiwan University, Taipei, Taiwan.

The aim of the study was to investigate the effect of body weight on assessment of left ventricular (LV) functions using two-dimensional speckle-tracking echocardiography (2D-DSTE) in 70 clinically healthy dogs. These 70 dogs were categorized into small (<7 kg, n = 35), medium (7 to 20 kg, n = 23), and large (>20 kg, n = 12) dogs. A complete physical examination, non-invasive blood pressure measurements, electrocardiography, thoracic radiography, conventional echocardiography were performed to exclude possible pre-existing cardiopulmonary disease. All dogs underwent 2D-DSTE: longitudinal peak systolic and diastolic tissue velocity (LTV), strain rate (LSR) and peak systolic strain (LS) of 6 segments (basal, middle, and apical segments of interventricular septum and left ventricular free wall), and also septal and lateral corners of mitral annulus were measured from left apical long-axis views. Peak systolic and diastolic radial tissue velocity (RTV), circumferential strain rate (CSR) and peak systolic circumferential strain (CS) of 6 segments (craniocentral, cranial, lateral, caudal, ventral, and septal) were measured from right parasternal short-axis views.

Variables derived from strain rate and strain, peak systolic and diastolic LSR/CSR and peak systolic LS/CS, were not affected by bodyweight among these 3 groups. Variables derived from LV velocity, peak systolic LTV/RTV, peak early diastolic LTV/RTV and peak late diastolic LTV/RTV, were significantly affected by bodyweight (P < 0.001, P < 0.001, P < 0.001, P = 0.004 and P = 0.001, respectively) and positively correlated with bodyweight (P < 0.001, P < 0.001, P < 0.001, P < 0.001, P = 0.039 and P = 0.001, respectively). Variables derived from strain rate and strain were not affected by bodyweight could amend conventional echocardiographic assessment on LV functions in dogs.

**ABSTRACT C-43**

**ECHOCARDIOGRAPHIC FINDINGS IN OBSESE DOGS.** DS Schwartz, PRR Molo, AM Magini, VM de Oliveira, CT Goldfeder, CN Duarte. FMVZ-USP (School of Veterinary Medicine and Animal Science, University of São Paulo) São Paulo, SP, Brazil.

Obesity has an effect on cardiac dimensions and function in humans, and some changes are difficult to be detected on a routine echocardiographic exam. We sought to evaluate several echocardiographic ratios in order to assess cardiac changes in obese dogs compared to non-obese.

Sixty dogs with ideal body condition score (BCS9/9, control) and 60 dogs with BCS8/9 and BCS9/9 (obese) were included, matched for gender, breed/size and age. All dogs were healthy based on clinical-laboratorial evaluation. Echocardiographic variables (left ventricular wall thickness in diastole (LVWd), interven- tricular septum thickness in diastole (IVSd), left ventricular diastolic diameter (LVDd), and left atria dimension (LA)) were assessed and indexed to aorta (Ao) diameter and/or LVDd. Diastolic function was assessed by early to late mitral flow velocity (E/A). Left ventricular mass (LVM) indexed to Ao was estimated as LVM (Troyn=1.05[LVDd + LVWd + III/4]-[LVDd]/3). Sy- tolic arterial pressure (SAP) was assessed by Doppler.

Diastolic function was decreased in obese relative to controls (P = 0.041). The ratios LVWd/LVDd (P = 0.002), IVSd/LVDd (P = 0.001) and (LVWd + IVSd)/LVDd (P < 0.001) were increased in obese compared to controls. IVSd/Ao increased in comparison to BCS5 and BCS9. Ratios IVSd/Ao (P = 0.014) and (LVWd + IVSd)/Ao (P = 0.016) were greater for obese compared to control dogs. Obese dogs had a trend (0.05<P<0.10) to increased LVWd/Ao (P = 0.052) and to indexed LVM (P = 0.005). Aortic diastolic pressure, LA/Ao and LVWd/IVSd were similar among groups.

Although the measurements may be within normal ranges, these results show concentric increased LVW thickness as an adaptation to overload caused by obesity in dogs, already contributing to diastolic dysfunction.

**ABSTRACT C-44**

**CHARACTERIZATION OF GROSS AND HISTOLOGIC MYOCARDIAL LESIONS IN OBSESE DOGS.** E Mehleman, J Boon, J Bright, K Jeckel, C Porsche, M Frye. Colorado State University College of Veterinary Medicine, Fort Collins, CO.

Obesity is the most common nutritional disease in dogs, and it is predicted that prevalence will increase as the number of obese humans continues to rise. Human obesity is associated with left ventricular hypertrophy (LVH), and this structural change increases the risk for heart failure. Unpublished data suggest that canine obesity, in the absence of hypertension, is also associated with LVH; the etiology of this structural change is not known. The objective of this study was to echocardiographically characterize myocardial structure and function in obese normotensive dogs, and examine postmortem tissues from a separate population for evidence of potential contributors to LVH; namely, triacylglyceride (TG) accretion, collagen accumulation and myocyte hypertrophy.

Obese (body condition score > 7/9) and age-matched lean dogs were recruited for echocardiographic examination using electronic notification of students and employees at the Colorado State University Veterinary Medical Center (CSU-VMC). Only normotensive dogs with unremarkable physical examination findings were subsequently included as subjects. The postmortem study was conducted using myocardium from 4 obese and 12 lean dogs with no history of cardiac disease, submitted for necropsy to the CSU-VMC for reasons unrelated to the present study. Samples of left and right ventricles and the interventricular septum were examined for lipid (oil red O staining, TG quantitation) and myocyte cross sectional area (Image J analysis of H&E stained sections).

Echocardiography revealed increased left ventricular free wall thickness in obese dogs during diastole (obese 9.9 ± 0.4 mm, lean 8.7 ± 0.4 mm; p = 0.03) and systole (obese 15.2 ± 0.5 mm, lean 12.9 ± 0.5 mm; p < 0.01). Septal thickness and left ventricular chamber diameter were similar between groups. Isovolumic relaxation time, a measure of diastolic function, was prolonged in 37% (7/19) of obese dogs. Fractional shortening, an indicator of systolic function, was similar between groups. Tissue studies revealed comparable lipid and collagen content, as well as myocyte area, in lean and obese groups.

The findings of this study support the idea that canine obesity is associated with a focal increase in left ventricular thickness.
and possibly diastolic dysfunction, similar to early changes observed in obese humans. Though this study did not reveal a key contributor to gross LVH, trends toward increased TG content and myocyte area observed concomitantly with high variability within groups suggest that larger studies are warranted, controlling for known confounders in humans such as diet, activity and chronicity.

**ABSTRACT C-45**

**TRANSVENOUS PERMANENT PACEMAKER THERAPY IN DOGS: BRAZILIAN EXPERIENCE.** DS Schwartz, DT Fantoni, GT Goldfelder, MHMA Larsson. FMVZ-USP (School of Veterinary Medicine and Animal Science, University of Sao Paulo) Sao Paulo, SP, Brazil.

The use of transvenous cardiac pacemaker therapy for bradyarrhythmias is well established in veterinary medicine mainly in the United States and Europe, but it has been introduced into Brazilian veterinary practice only five years ago. During this period, 16 dogs (11 females; 5 males) were treated with transvenous pacemaker. Most dogs (15/16) had syncope as the main complaint, four had pre-syncopal episodes which progressed to syncope and one had seizures episodes and syncope. The most common arrhythmia was complete atrioventricular block (AVB) (62.5%), followed by sick sinus syndrome (31.25%), and one had advanced second degree AVB. The patients included: three Dachshunds, Pitbulls, and Schnauzers; two Labradors; and one Boxer, Bull Terrier, Cocker, English Bulldogs and Yorkshire. Age ranged from 2 to 10 years (7.5±2.5 years), with 56.25% over 7 years. Two dogs had the implant as an emergency procedure. Two dogs had decreased ventricular function before the implant. The complications observed (25%) were lead dislodgement (1/16); electrode thrombus formation (1/16); increased impulse threshold after 10 months of implant with decrease in battery lifetime and need for generator replacement (1/16); metastatic implant infection and thrombus (1/16). Eight dogs died in this period (18.14±10.24 months post implant). Causes of death were related to neoplasia (3/8), renal failure (1/8), heart failure secondary to mitral valve disease (1/8), myocardial failure associated with ventricular arrhythmias (1/8), seizures (1/8) and myocardial failure during procedure to change device due to infection (1/8). The type and rate of complications are similar to what is reported in the literature.

**ABSTRACT C-46**

**ECHOCARDIOGRAPHIC EVALUATION OF LEFT ATRIAL SIZE IN MAINE COON CATS, FROM APICAL FOUR CHAMBER VIEW.** PH Ikikawa, VM Oliveira, GT Goldfelder, MHMA Larsson. School of Veterinary Medicine and Animal Sciences –University of Sao Paulo, SP, Brazil.

Left atrial (LA) size is considered an important prognostic factor in many cardiomyopathies. In humans, it is known that LA remodeling can occur in different planes, according to the cause. The aim of this study was to evaluate left atrial size, by measuring the apical-basal (ABd) and medio-lateral (MLd) axis and to compare with standard measurements in M-mode (MM) and in bidimensional LA short axis (2Dsax).

Thirty eight healthy adults Maine Coon cats were included. Animals were screened by physical examination, thoracic radiography, electrocardiography, systolic blood pressure, echocardiography and laboratory tests (CBC, biochemical blood urea, creatinine and total T4). LA diameters were significantly different among methods, except between MM and 2Dsax, with higher values obtained from Ap4cv. Posterior similar studies involving cats with different heart disease are recommended.

**ABSTRACT C-47**

**SURVIVAL OF CATS WITH ISOLATED DISCRETE UPPER SEPTAL THICKENING (DUST) VS. CATS WITH AND WITHOUT CARDIOMYOPATHY.** GE Singletary, MA Oyama. University of Pennsylvania, Philadelphia, PA.

Isolated echocardiographic discrete upper septal thickening (DUST) or proximal interventricular septal hypertrophy is occasionally detected in cats but has unknown clinical significance. In humans, isolated DUST does not affect cardiac mortality. We retrospectively evaluated survival in cats with DUST vs. cats with and without cardiomyopathy. We hypothesized that DUST is not associated with increased mortality.

Echocardiograms from cats evaluated during 2009 were segregated into three echo groups, DUST (n=13), cardiomyopathy (CM, n=94), or no cardiomyopathy (no CM; n=44). Median age between groups was significantly different (11.8yrs, 10.4yrs, 7.6yrs, respectively; p=0.004). Median survival time (MST) between the groups was significantly different (DUST, 513d; CM, 432d; no CM >800d; p=0.046).

On univariate analysis, age (p=0.0001), CHF (p<0.0001), thromboembolism (p=0.025), and echo group (p=0.036) were significant risk factors for mortality whereas gender was not (p=0.06). Backwards multivariate regression using all variables identified age (b=1.09, CI=1.04-1.15, p=0.0000), presence of CHF (b=5.34, CI=3.26-8.72, p<0.0001) and thromboembolism (b=2.71, CI=1.07-6.86, p=0.0361) as significant risk factors for mortality. Thus, after adjustment for covariates, echo group did not significantly affect mortality.

CM cats were more likely to die of cardiac-related complications vs. cats with DUST or no CM (CM, 35% vs. DUST/no CM, 0%; p=0.0006). Cats with NT-proBNP >500pmol/L had shorter MST than cats with lower concentrations (>500pmol/L, n=9, 314d vs. <500pmol/L, n=14, >786d; p=0.009), however cats with available NT-proBNP results were few. These results indicate that isolated DUST is not a risk factor for mortality and that cats with DUST are unlikely to die from cardiac-related causes.

**ABSTRACT C-48**

**EFFECT OF ATENOLOL THERAPY ON ECHOCARDIOGRAPHIC PARAMETERS IN CATS WITH HYPTERTROPHIC OBSTRUCTIVE CARDIOMYOPATHY.** MC Machen1, MJ Hezzell2, MA Oyama3. University of Pennsylvania, Philadelphia, PA, 1 Royal Veterinary College, London, UK.

Hypertrophic obstructive cardiomyopathy (HOCM) is commonly diagnosed in cats, and consists of left ventricular (LV) concentric hypertrophy and dynamic LV outflow tract obstruction (LVOTO). Atenolol is commonly prescribed in asymptomatic HOCM, however its effect on LV hypertrophy is largely unknown. We sought to retrospectively evaluate the effects of atenolol on echocardiographic measures of LV hypertrophy and aortic pressure gradient (APG) in asymptomatic cats with HOCM.

A search of medical records from 2005-2011 identified asymptomatic HOCM cats having received atenolol and echocardiographic examinations prior to and after starting atenolol (n=24). Cats with a diagnosis of non-obstructive hypertrophic cardiomyopathy (HCM) not administered atenolol were identified as controls (n=12).
Median follow up time was 221d (range, 83-555d). In cats with HOCM, median atenolol dose was 6.25mg/day (range, 6.25mg-18.75mg/day). Repeated measures linear modeling with compound symmetry covariance structure was used to analyze changes in echocardiographic variables over time (days). There was a significant difference in the rate of change of interventricular septum thickness in diastole (IVSd) between HOCM+atenolol and HCM cats (P = 0.002), with IVSd significantly increasing in the HOCM+atenolol group (B=0.0005, [95% CI: 0.0004 to 0.0006], P < 0.001) but not changing in the HCM group (B = 0.0001 [0.0000 to 0.0004], P = 0.171) (Raw IVSd values: HOCM-pre, median = 0.71cm [IQR, 0.61-0.78cm]; HOCM-post, 0.57cm [0.52-0.66cm] vs. HCM-pre, 0.61cm [0.58-0.66cm]; HCM-post, 0.63cm [0.60-0.70cm]). There was a significant difference in the rate of change of Log[APG] between HOCM+atenolol and HCM cats (P = 0.009), with Log[APG] significantly decreasing in the HOCM+atenolol group (B = -0.0018, [-0.0025 to -0.0012], P < 0.001) but not changing in the HCM group (B = 0.0003 [-0.0011 to 0.0017], P = 0.682) (Raw APG values: HOCM-pre, 76.5mmHg [34.4-95.6mmHg]; HOCM-post, 11.2mmHg [4.1-19.9mmHg] vs. HCM-pre, 3.6mmHg [2.6-13.5mmHg]; HCM-post, 4.9mmHg [3.9-10.8mmHg]). There were no significant differences in the rates of change of left ventricular end-diastolic diameter (EDV) and left ventricular end-systolic diameter in systole (P=0.933), fractional shortening (P=0.304), left ventricular posterior wall thickness in diastole (P=0.933), fractional shortening (P=0.468), or left atrial to aortic root diameter ratio (P=0.081) between groups.

Atenolol therapy appears to decrease dLVOTO and ventricular septal hypertrophy in cats with HOCM. Limitations of this study include relatively low numbers of cats with heart disease. Further studies in larger populations as well as in shelters with different adoption and rehoming policies from those present in this study are warranted.

ABSTRACT C-49

EFFECT OF A HEART MURMUR ON ADOPTABILITY OF CATS IN AN URBAN NO-KILL RESCUE ORGANIZATION.

There are approximately 70 million stray cats in the United States. Many of these cats are rescued and offered for adoption by animal shelter and rehoming organizations, however relatively little is known about the factors that affect the likelihood for successful adoption. Heart health is an important health issue in adult cats, and we sought to determine the effect of heart murmurs or heart disease on adoptability of cats from a large urban no-kill rescue and rehoming organization.

Adult cats that entered a Philadelphia shelter were enrolled over a 60-day period. Cats <1 year of age or with serious concurrent medical conditions such as orthopedic injuries or cancer were excluded. A cardiologist and cardiology resident independently auscultated all cats and those found to have murmurs underwent echocardiography. The knowledge of a murmur and subsequent echocardiographic diagnosis were made available to adoption staff and potential adopters. We examined the effect of the presence of a murmur and/or heart disease on adoption outcome (yes vs. no) 90-days after day of study enrollment using logistic regression.

Ninety cats were enrolled, and 10 (11%) were found to have murmurs. Of those, 2 were found to have significant heart disease on echocardiography, while 8 were found to have murmurs of benign origin. At the end of the study, 80 cats had been adopted. On univariate regression, presence of heart murmur (P = 0.18), heart disease (P = 0.49), gender (P = 0.50), and coat color (black vs. other) (P = 0.19) was not associated with adoption outcome. On multivariate regression, no variable was associated with adoption outcome.

Results of this study show that benign heart murmurs are relatively common in shelter cats and the presence of a murmur does not influence adoptability if echocardiographic study indicates normal underlying heart structure. Limitations of the study include relatively low numbers of cats with heart disease. Further studies in larger populations as well as in shelters with different adoption and rehoming policies from those present in this study are warranted.

ABSTRACT C-50

DETECTION OF OCCULT FELINE CARDIOMYOPATHY USING A PET-SIDE POINT-OF-CARE NT-PROBNP ELISA ASSAY.
MC Machen*, SG Gordon*, JS Buch†, MJ Beall‡, MA Oyama*. University of Pennsylvania, Philadelphia, PA; Texas A&M University, College Station, TX; IDEXX Laboratories Inc., Westbrook, ME.

Detection of asymptomatic (occult) feline cardiomyopathy (OCM) is challenging. Previous study indicates that NT-proBNP identifies cats with moderate to severe OCM. We sought to determine the ability of a pet-side point-of-care ELISA that utilizes SNAP® technology and second generation antibodies to detect moderate to severe OCM.

Asymptomatic cats suspected to be “at-risk” for or known to have OCM were prospectively recruited based upon a prior diagnosis, the presence of a heart murmur, gallop, arrhythmia, and/or a predisposed breed. A group of 16 healthy cats were recruited as controls. All cats underwent physical examination, blood pressure measurement, and echocardiography by an operator blinded to SNAP results. Blood for chemistry profile, T4, and NT-proBNP concentration >110-130pmol/L. Results of this study show that benign heart murmurs are relatively common in shelter cats and the presence of a murmur does not influence adoptability if echocardiographic study indicates normal underlying heart structure. Limitations of the study include relatively low numbers of cats with heart disease. Further studies in larger populations as well as in shelters with different adoption and rehoming policies from those present in this study are warranted.

ABSTRACT C-51

TRICUSPID ANNULAR PLANE SYSTOLIC EXCURSION (TAPSE) MEASUREMENTS IN MAINE COON CATS.
PH Itikawa, GT Goldfeder, VM Oliveira, MHMA Larsson. School of Veterinary Medicine and Animal Sciences – University of Sao Paulo, SP, Brazil.

Assessment of right ventricular (RV) function remains challenging because of complex RV chamber geometry. Recently, in human medicine, many studies have been considered the tricuspid annular plane systolic excursion (TAPSE) a useful tool for RV function evaluation. In that species a good correlation was found...
between VD function, obtained by right heart catheterization, and values of TAPSE. RV studies are important for diseases such as pulmonary hypertension and Arrhythmogenic Right Ventricular Cardiomyopathy in cats. The aim of this study was to evaluate TAPSE and to present initial normal reference range for Maine Coon cats.

Twenty eight healthy adults Maine Coon cats were included. Animals were screened by physical examination, thoracic radiography, electrocardiography, systolic blood pressure measurement, echocardiography and laboratory tests (CBC, biochemical blood urea, creatinine and total T₄). In face of normal results, TAPSE was obtained by apical four-chamber view and an M-mode cursor was placed through the lateral tricuspid annulus in real time. TAPSE was measured as the total displacement of the tricuspid annulus in (centimeters) from end-diastole to end-systole. Data were tested for normality and expressed as mean, standard deviation (± SD) and 95% confidence interval.

TAPSE measurements obtained were: 0.97 ± 0.25 cm and 0.8 ± 0.15 cm, respectively. Posterior similar studies involving more animals, others breeds and cats with different disease are recommended.

ABSTRACT C-52
TRICUSPID ANNULAR PLANE SYSTOLIC EXCURSION (TAPSE) MEASUREMENTS IN DOGS. GT Goldfeder, PH Iitkawa, JR Castro, VM Oliveira, MHMA Larsson. School of Veterinary Medicine and Animal Sciences –University of São Paulo, SP, Brazil.

Assessment of right ventricular (RV) function remains challenging because of complex RV chamber geometry. Recently, in human medicine, many studies have been considered the tricuspid annular plane systolic excursion (TAPSE) an useful tool for RV function evaluation. In that species a good correlation was found between VD function, obtained by right heart catheterization, and values of TAPSE. RV studies are important for diseases such as pulmonary hypertension and Arrhythmogenic Right Ventricular Cardiomyopathy. The aim of this study was to evaluate TAPSE and to present initial normal reference range for dogs.

Sixteen healthy adult dogs with 1 to 20 kg (G1) and nineteen dogs with 21 to 40 kg (G2) were included. Animals were screened by physical examination, thoracic radiography, electrocardiography, systolic blood pressure measurement, echocardiography and laboratory tests (CBC, biochemical blood urea and creatinine). In face of normal results, TAPSE was obtained by apical four-chamber view and an M-mode cursor was placed through the lateral tricuspid annulus in real time. TAPSE was measured as the total displacement of the tricuspid annulus in (centimeters) from end-diastole to end-systole. Data were tested for normality and expressed as mean and standard deviation. Comparisons among the groups were performed by unpaired T test. TAPSE measurements obtained were: 1.22±0.30 cm for G1 and 1.70±0.25 cm for G2. TAPSE measurements were significantly different between groups. Posterior similar studies involving more animals and dogs with different disease are recommended.

ABSTRACT C-53
SURVEY OF SIX POTENTIAL CARDIAC BIOMARKERS IN DOGS WITH HEART DISEASE: CHROMOGRAFIN-A, ENDOGLIN, GALECTIN-3, NT-PROBNP, ST2, AND OSTEO-PONTIN. MA Oyama, MC Machen, DJ Trafny1, GE Singleton, RC Gupta, R Sainger1, HN Sabah2, 1University of Pennsylvania, Philadelphia, PA., 2Henry Ford Health Systems, Detroit, MI.

Biomarkers are substances released into the circulation by the injured heart, and have diagnostic and prognostic potential. Other than NT-proBNP, relatively little is known about circulating biomarkers in dogs with spontaneous heart disease. We examined five additional potential biomarkers in dogs with either degenerative mitral valve disease (DMVD) or dilated cardiomyopathy (DCM), and compared results to those from NT-proBNP assays.

EDTA plasma was obtained from 61 healthy dogs, 22 with DCM, and 65 with DMVD (ISACHC classes 1a/b [n = 53], 2 [n = 16], and 3 [n = 18]). Plasma was stored at -80°C until batch ELISA analysis. Not all assays were performed in each dog due to the volume of blood required.

Plasma concentrations of chromogranin-A (n = 70), a negative inotrope and marker of sympathetic activation; endoglin (n = 35), a soluble TGF-beta receptor; galectin-3 (n = 50), a marker of fibrosis and remodeling; ST2 (n = 69), a marker of remodeling and cardiac stress; and osteopontin (n = 37), a marker of fibrosis, were not significantly elevated in dogs with heart disease vs. controls (P-values of 0.60, 0.15, 0.21, 0.25, and 0.45, respectively). In contrast, median NT-proBNP concentration was significantly increased in heart disease (2,115pmol/L, n = 87) vs. control (33.8±14pmol/L, n = 61, P < 0.0001).

Identification of novel biomarkers in dogs is challenging. Limitations of the study include relatively small numbers of dogs with advanced disease and use of ELISA systems that might not be ideally suited for use in canine samples. Future studies might benefit from more efficient high-throughput screening methods to identify candidate markers for further study.

ABSTRACT C-54
BREED-SPECIFIC VERTEBRAL HEART SIZE FOR THE DACHSHUND. BR Birks, SE Clay, LG Britt, SB Leach, DM Fine. University of Missouri, Columbia, MO.

Heart disease (HD) is common in dachshunds, and is often monitored with radiographs. The radiographic vertebral heart size (VHS) was developed to objectively evaluate the size of the canine cardiac silhouette. A VHS reference range of 9.7±0.5 vertebrae was established using a mixed population of breeds. Subsequent studies have demonstrated that some breeds fall outside this reference range. The aim of this study was to determine a breed-specific VHS for the dachshund and compare results to the established range.

Twenty-four normal control (CON) dachshunds had thoracic radiographs (TXR) and an echocardiogram (Echo) performed. Medical records were reviewed for dachshunds with HD. Twenty-four dogs with a heart murmur, TXR, and an Echo performed on the same day were identified. Five observers of varying levels of clinical training (1 each: senior veterinary student, specialty intern, 3rd year cardiology resident, boarded cardiologist, boarded radiologist) measured VHS for all 48 dachshunds on right and left lateral TXR. Measurements were performed on 2 separate days, at least 1 week apart and were recorded to the nearest 0.25 vertebra. The data was analyzed using Wilcoxon Rank-Sum analysis. The right and left VHS were correlated with Echo 2D long-axis and M-mode left atrial (LA) measurements and M-mode LA to aortic ratio. The Kappa reliability test was used to evaluate inter-observer and intra-observer variability. P < 0.05 was considered significant.

The median (range) for the right lateral CON VHS was 9.75 (8.1–11.0). A small but significant decrease in left lateral CON VHS was seen: 9.5 (8.2–10.5). The median right lateral HD VHS measurement was: 11.0 (9–13.5). There was no difference when compared with left lateral HD VHS, 11 (9.2–13.5). The median VHS of HD was significantly greater than that of CON. A high correlation was seen between the VHS and the 2D LA Echo measurements (Right sided VHS, r=0.824; Left sided VHS, r=0.817). The Kappa inter-observer and intra-observer variability was 0.69±0.03 and 0.76±0.1 respectively.

Results of this study indicate normal dachshunds have a median VHS within the previously published reference range. A VHS > 11.0 vertebrae may be a reliable indicator for the presence of HD. A significant difference was present between right and left lateral VHS in CON dogs, but not in HD. Therefore, serial VHS measurements should consistently be performed with the dog in the same lateral recumbency to limit variability. Although HD VHS was significantly higher than CON VHS, there was overlap between groups, indicating VHS should be
interpreted in conjunction with clinical and echo findings. VHS demonstrated a strong correlation with the 2D LA echo measurement. Inter-observer and intra-observer variability showed substantial agreement for measurements of VHS, indicating that VHS can be reliably performed by observers with varying degrees of experience.

**ABSTRACT C-55**

**IN-HOME BLOOD PRESSURE MONITORING IN DOGS: A PILOT STUDY.** AP Carr, Western College of Veterinary Medicine, Saskatoon, Canada.

In-home blood pressure (BP) monitoring is commonly used in humans and has been found to be equivalent to 24 hour ambulatory blood pressure (ABP) monitoring. Both ABP and in-home measurements generally eliminate “white-coat” effects as well as detect masked hypertension.

This retrospective study was carried out to see if owners could reliably obtain blood pressure readings in dogs and compare these readings to those obtained in clinic. All in-clinic readings had been obtained in an exam room with the owners present to minimize stress. The readings were obtained using an HDO oscilometric blood pressure device (S+bmedVET, Babenhausen, Germany) while monitoring the oscillometric trace using MDS Analyse software. It was recommended that the owners obtain approximately 5 readings with 3 different BP sessions. All BP traces from in-clinic and in-home sessions were evaluated and readings that showed minimal artifact were used for analysis in this study.

A total of 6 dogs were evaluated that suffered from a variety of clinical problems. Systolic hypertension was present in all 6 dogs in clinic (2 moderate and 4 severe risk of target organ damage or TOD) but only 3 at home (1 mild, 1 moderate and 1 severe risk of TOD). Diastolic hypertension was present in 3 dogs (1 mild and 2 moderate risk of TOD) in clinic and in 1 dog at home (moderate risk of TOD). One dog (CRP, PLN) had pressures obtained twice in clinic and at home with very consistent findings (in clinic: 183/85, HR 221 October 2009, 185/81, HR 207 September 2010; at home: 126/81, HR 109 November 2009, 123/62, HR 108 September 2010). One dog (hyperadrenocorticism) had evidence of masked hypertension (in clinic: 174/95 MAP 123 HR 150; at home: 197/110 MAP 140 HR 80). In our pilot study all owners were able to obtain blood pressure readings with minimal artifact. Hypertension was diagnosed less frequently at home than in the clinic, though one case of masked hypertension was diagnosed. It appears that in home blood pressure measurement is a viable option for assessing blood pressure in dogs.

**ABSTRACT C-56**

**LONG-TERM SURVIVAL IN DOGS WITH UNTREATED SEVERE SUBAORTIC STENOSIS.** DB Leeder1, AH Tobias2, CD Stauthammer3, SC Hansen4, TM Härö5, DM Fine6. 1University of Minnesota, St. Paul, MN, USA, 2SylvaniaVet, Sylvania, Ohio, USA, 3University of Missouri, Columbia, MO, USA.

Dogs with untreated severe subaortic stenosis (SAS) are reported to have a poor prognosis. This is largely based on the results of a single retrospective study involving a total of 15 dogs from one institution, which reported median survival of 1.6 years of age. Subsequent studies have evaluated the efficacy of various therapeutic interventions on survival in dogs with SAS; however, none have evaluated untreated control groups. The purpose of this study was to evaluate survival in dogs with untreated severe SAS. The hypothesis was that survival is longer than previously reported.

The retrospective study was carried out to see if owners could reliably obtain blood pressure readings in dogs and compare these readings to those obtained in clinic. All in-clinic readings had been obtained in an exam room with the owners present to minimize stress. The readings were obtained using an HDO oscilometric blood pressure device (S+bmedVET, Babenhausen, Germany) while monitoring the oscillometric trace using MDS Analyse software. It was recommended that the owners obtain approximately 5 readings with 3 different BP sessions. All BP traces from in-clinic and in-home sessions were evaluated and readings that showed minimal artifact were used for analysis in this study.

A total of 6 dogs were evaluated that suffered from a variety of clinical problems. Systolic hypertension was present in all 6 dogs in clinic (2 moderate and 4 severe risk of target organ damage or TOD) but only 3 at home (1 mild, 1 moderate and 1 severe risk of TOD). Diastolic hypertension was present in 3 dogs (1 mild and 2 moderate risk of TOD) in clinic and in 1 dog at home (moderate risk of TOD). One dog (CRP, PLN) had pressures obtained twice in clinic and at home with very consistent findings (in clinic: 183/85, HR 221 October 2009, 185/81, HR 207 September 2010; at home: 126/81, HR 109 November 2009, 123/62, HR 108 September 2010). One dog (hyperadrenocorticism) had evidence of masked hypertension (in clinic: 174/95 MAP 123 HR 150; at home: 197/110 MAP 140 HR 80).

In our pilot study all owners were able to obtain blood pressure readings with minimal artifact. Hypertension was diagnosed less frequently at home than in the clinic, though one case of masked hypertension was diagnosed. It appears that in home blood pressure measurement is a viable option for assessing blood pressure in dogs.

**ABSTRACT C-57**

**COMPARISON OF PIMOBENDAN, BENAZEPRIL, OR METHYLDIGOXIN MONOTHERAPY IN IRISH WOLFHOUNDS WITH OCCULT DCM: A 10-YEAR-STUDY.** AC Vollmar1, N Mohren2, C Trötschel3, PR Fox4. 1Small Animal Veterinary Clinic, Bonn Germany, 2Boehringer Ingelheim Vetmedica GmbH, Germany, 3Boehringer Ingelheim Italia S.p.A., Milano, 4Animal Medical Center, NY, USA.

We prospectively studied cardiac outcome in 66 asymptomatic (ISACHC stage 1B) Irish wolfhound dogs with occult DCM (n=46) or lone atrial fibrillation (AF) (n=20). Cases were allocated at random to receive monotherapy with either pimobendan (0.25 mg/kg q12hr, n = 23), benazepril (0.25-0.33 mg/kg/day, n=22), or methyldigoxin (0.01 mg/kg/day, n=21) in a single-blinded manner. Concomitant diltiazem (slow release formulation, 1-3 mg/kg q12hr; n=8) was given for AF HR control. Diagnosis was made by physical examination, echocardiography, chest radiography, and ECG. Dogs were monitored approximately every 6 months. Primary endpoint was CHF or sudden cardiac death (SD). We assessed median time to CHF/SD (Kaplan-Meier analysis) and between-group comparisons (two-sided log rank tests with Bonferroni-Holm multiple comparisons). Significance level was p < 0.05.

Median age was 4.0 years, range 1.4-8.0 years (37 male, 27 female). Median weight was 70.0 kg (range 47.6 - 90.0 kg). Median study duration was 52.5 months. Endpoint was reached in 5/23 (21.7%) pimobendan; 11/22 (50%) benazepril; 9/21 (42.9%) methyldigoxin cohorts. Median time to CHF/SD was longer for pimobendan (66.4 months) vs. benazepril (33.2 months) (p=0.007) or methyldigoxin (42.1 months) cohorts (p=0.031).

In this long-term study pimobendan monotherapy improved cardiac outcome for Irish Wolfhounds with occult DCM or lone AF vs either benazepril or methyldigoxin alone.

**ABSTRACT C-58**

**ECHOCARDIOGRAPHIC ASSESSMENT OF LEFT VENTRICULAR SIZE AND SYSTOLIC FUNCTION IN HORSES USING LINEAR MEASUREMENTS AND AREA-BASED VOLUME ESTIMATES.** CC Schwarzwald, D Berthoud. Vetsuisse Faculty, University of Zurich, Zurich, Switzerland.

Echocardiographic assessment of left ventricular (LV) size and systolic function in horses is commonly limited to subjective evaluation, measurement of LV diameter in short-axis at the chordal level, and calculation of LV fractional shortening (FS). The goal of this study was to compare the conventional unidimensional indices of LV size and function to LV volume estimates that are based on linear measurements and two-dimensional (area) measurements of the LV.

39 healthy horses (11 (4-23) y; 554 (350-660) kg) [mean (range)] and 96 horses with suspected or confirmed cardiac disease (14 (3-32) y, 550 (315-720) kg) were included in the study. Echocardiograms were recorded by a single observer following a standard protocol (GE Vivid 7 Dimension). The LV internal diameter was measured at end diastole (LVIDd) and at peak systole from a right-parasternal short-axis M-mode recording at the chordal level. The LV volume was estimated at end-diastole (LVIDd) and at peak systole using single-plane Simpson’s model (S) and the area-length method (AL) from a right-parasternal 4-chamber view and using the bundle method (B) based on right-
pa instead of left atrium (LA) and pulmonary artery (PA), respectively]. CO at each level (baseline, high, and low) was measured by lithium dilution and various echocardiographic methods of measuring cardiac output (CO) in adult horses by comparing results to the lithium dilution method. In eight healthy adult horses, CO was manipulated with continuous rate infusions of dobutamine and romifidine to achieve high and low CO, respectively. CO at each level (baseline, high, and low) was measured by lithium dilution and various echocardiographic methods. Images were stored as video loops for review by an individual blinded to the lithium dilution results. Limits of agreement and bias between methods were determined by a two-way ANOVA. A two-way ANOVA was conducted to assess the effect of CO method and level of CO on bias. Significance was set at P < 0.05.

Lithium determinations of CO ranged between 16.6 and 63.0 L/min. There was a significant effect of method of CO measurement (P < 0.001) but no significant effect of CO level (P = 0.089) or interaction between level and method (P = 0.607). The absolute values of the bias of the 4 chamber area-length, Simpson, Doppler from the right ventricular outflow tract (RVOT), and bullet methods were significantly lower than that of Doppler of the left ventricular outflow tract or cubic methods [14.8, 24.3 L/min, respectively]. The 4 chamber area-length, Simpson, bullet and Doppler from the RVOT have acceptable agreement with lithium dilution and provide a non-invasive method for CO estimation in adult horses in a clinical setting.

ABSTRACT E-4

EFFECTS OF PRE-RACE FUROSEMIDE ADMINISTRATION ON PLASMA ELECTROLYTE CONCENTRATIONS AND ACID-BASE BALANCE IN STANDING ADULT HORSES. E McConachie, MH Barton, G Rapoport, S Giguerre. Departments of Large Animal Medicine and Small Animal Medicine and Surgery, University of Georgia, Athens, GA.

Furosemide induces a clinically significant hypochloremic, hypokalemic, hypocalcemic, metabolic alkalosis as well as marked reduction in plasma volume in sedentary horses. We hypothesized that the pre-race administration of furosemide would either augment or mitigate the profound acid-base, electrolyte, and free water changes that occur in horses during and after a simulated race.

Seven Standardbreds (2 to 6 years of age; 4 females, 3 geldings) were fed a typical training diet (DCAD < 200 mEq/kg DM) and trained 5 times a week for 6 weeks using a high-speed treadmill. Furosemide was administered intravenously (IV) at 0, 250 mg, and 500 mg in a randomized cross-over design 4 hours after a simulated race.
before horses underwent a simulated race protocol (SRP) on a high-speed treadmill. Jugular venous blood samples were collected via an indwelling catheter immediately before treatment and periodically up to 90 minutes after the SRP. Plasma Na, K, and Cl concentrations were determined using a Nova 4 analyzer (Nova Biomedical Waltham, MA). Plasma protein concentrations were measured using refractometry and blood pH and gas tensions were determined using an ABL-5 blood gas analyzer (Radiometer Copenhagen, Denmark). Data were analyzed using repeated measures analysis of variance and $P<0.05$ was significant.

Furosemide administration induced hypochloremia, hypokalemia, metabolic alkalosis, and alkalalemia as well as a marked reduction in plasma volume by 4 hours. Pre-race furosemide administration caused a small dose-dependent decrease in plasma chloride concentrations up to 4.5 mEq/L at all time-points from fatigue to 90 minutes post SRP, as well as a dose-dependent increase in plasma total protein concentration of up to 0.7 g/dL at all time-points from fatigue to 90 minutes post SRP. Interestingly, although plasma potassium concentration peaked at 7.1±0.2 mEq/L at fatigue and then rapidly decreased to 2.8±0.2 mEq/L at 90 minutes post SRP in untreated controls, neither dose of furosemide significantly changed plasma potassium concentration during or after the SRP, compared to controls. However, at fatigue, plasma potassium concentration was numerically lower in horses receiving 500 mg (6.6±0.6 mEq/L) or 250 mg (6.5±0.5 mEq/L) of furosemide IV than in untreated controls.

We conclude that the pre-race administration of furosemide (500 or 250 mg, IV) does not markedly alter the profound acid-base and electrolyte changes that occur in horses during and after a simulated race, but does have a small additive effect on the plasma volume reduction that occurs during high intensity exercise. Our results suggest that IV furosemide is unlikely to increase the incidence of cardiac arrhythmias in exercising racehorses induced by changes in plasma potassium concentration.

**ABSTRACT E-5**


Exercise-induced pulmonary hemorrhage is associated with impaired performance but the long term consequences to the health and well being of horses are unknown. We assessed the association between severity of EIPH and duration of racing career in Thoroughbred race horses. Tracheobronchoscopic examinations were performed during 2003 on 744 Thoroughbred horses within 2 hours after completing a race and the severity of exercise-induced pulmonary hemorrhage recorded (Grades 0-4). Race records of horses as of May 1st, 2011 were then reviewed to determine the duration of the horse’s racing career. The association between duration of the racing career and age at enrolment, sex (male or female), and severity of EIPH were evaluated using survival analysis. All models included age and sex.

Median career durations were 18.7, 17.2, 16.3, 19.6 and 5.9 months for the 332, 273, 101, 25 and 13 horses with EIPH grades 0, 1, 2, 3 and 4 respectively. The hazard ratio for EIPH grade $\geq 2$ versus $\leq 1$ was $1.07$ ($P=0.13$). Males had a significantly increased career duration ($P<0.001$) and increasing age reduced the career duration ($P<0.0001$). Hazard ratios for EIPH 1, 2, 3, or 4 vs 0 were $1.05$ ($95\%$ CI $0.9-1.2$, $P=0.93$), $1.04$ ($0.8-1.3$, $P=0.74$), $1.09$ ($0.7-1.6$, $P=0.67$) and $2.06$ ($1.2-3.6$, $P=0.011$), respectively. Only the most severe EIPH was associated with reduced duration of racing career. This could be attributable to racing regulations which mandate a three month withdrawal from racing for horses with EIPH and epistaxis and disqualification from racing after a second episode of EIPH with epistaxis.

**ABSTRACT E-6**

HYPERBARIC OXYGEN THERAPY DOES NOT ALTER mRNA INFLAMMATORY GENES EXPRESSION IN HEALTHY HORSES. M Loogjen, R Dardari, R Leguillette, 1,2 University of Calgary. Faculty of Veterinary Medicine, Calgary, AB, Canada. 2Moore Equine Veterinary Centre, Calgary, AB, Canada

Hyperbaric oxygen therapy (HBOT) induces an oxidative stress over time that may alter the mRNA expression of inflammatory cytokines and housekeeping genes in lung cells of horses. Identifying stable reference genes is necessary to obtain reliable quantitative PCR (QPCR) results. Therefore, the objectives of this study were 1) to identify the most stable reference genes in the bronchoalveolar lavage fluid (BALF) cells of horses treated with HBOT and 2) to evaluate if Th1, Th2 or Th17 inflammatory cytokines expression was increased in the BALF of the horses treated with HBOT.

Eight horses were used in a randomized controlled cross-over design. Treated horses were exposed to 100% oxygen at 3 ATA for 20 minutes for 10 days whereas the chamber was not pressurized for control horses. The mRNA expression of IL-1B, IL-4, IL-5, IL-6, IL-8, IL-10, IL-12p35, IFN-γ, TNF-α and Eotaxin-2 was measured by QPCR in BALF sampled pre- and post-HBOT treatment. Genes’ expression was measured by QPCR after efficiency correction using REST software analysis. The expression stability of four candidate reference genes (GAPDH, HPRT, SDHA and RPL-32) was determined using Normfinder and Genorm.

GAPDH was found to be the most stable reference gene using both Genorm and Normfinder. The number of reference genes used for optimal normalisation included GAPDH and HPRT. The mRNA expression of cytokines was not significantly up- or down-regulated with HBOT, however there was a significant down-regulation for Eotaxin-2 between the HBOT and the control group after HBOT.

**ABSTRACT E-7**

TEMPORAL VIRAL LOAD IN SEVEN HORSES WITH NATURALLY OCCURRING EQUINE HERPESVIRUS-1 MYELOENCEPHALOPATHY. KE Estell, D Dawson, KG Magdesian, S Mapes, E Swain, N Pusterla. School of Veterinary Medicine, University of California, Davis, CA

The pathogenesis of equine herpesvirus-1 myeloencephalopathy (EHM) is poorly understood and is likely a result of viral, host, and environmental factors. It has been hypothesized that the magnitude of viremia is a central factor in the development and severity of EHM; however, temporal viral load has never been reported in a naturally occurring cases. Additionally, progression for grade 4/5 neurologic horses has not been reported. The purpose of this case series is to report the clinical signs, treatment, and temporal viral load in 7 horses with naturally occurring EHM and examine these factors’ association with survival.

Seven horses with EHM presented to the UC Davis VMTH between 5/13/11 and 9/20/11 and were associated with 3 separate outbreaks. All horses were graded on presentation using the neurologic grading scale. Out of 7 horses, 1 horse was grade 5/5, 3 horses were grade 4/5 and 3 horses were grade 3/5. All horses received valacyclovir, flexinil meglumine, DMSO, vitamin E, and supportive care. Urinary incontinence was present in all horses and was treated with bladder catheterization and antimicrobials for the duration of urinary catheterization. All horses presenting with ≥ grade 3/5 neurologic signs received dexamethasone and were maintained in the Anderson sling support device.

All 7 horses were infected with the D352 genotype of EHV-1. Quantitative PCR was performed on nasal secretions and whole blood collected at admission and every 24 hours until horses were negative for ≥2 days, died, or were euthanized. Viral load was quantified and expressed as glycophorin B (gB) gene copies per million cells. Peak viral load in nasal secretion of horses which survived ranged from 6,187-281,102 gB gene copies per million cells (median 5,179); peak viral load in blood was 143-4,338 gB.
gene copies per million cells (median 3,146). The 2 non-surviving horses presented with grade 3/5 neurologic signs and progressed rapidly to recumbency with signs of encephalopathy. Peak viral load was considerably higher in non-survivors with levels in nasal secretions of 192,019.861-221,904,282 gB gene copies per million cells (median 192,019.861) and levels in blood of 20,467-102,491 gB gene copies per million cells (median 47,359). All horses that survived showed cessation of viral shedding in nasal secretions by days 5-7 of hospitalization.

Overall mortality rate was 28.6% (2/7). All horses that did not develop encephalopathy survived. We hypothesize that the magnitude of viral load is associated with outcome. Non-survivors had viral loads that were 1000-fold higher in nasal secretions and 10-fold higher in blood than non-survivors. There was no relationship between severity of clinical signs at presentation with survival, emphasizing the value of supportive care including management in a sling if necessary.

ABSTRACT E-9
EUROPEAN SALMONELLOSIS. THE USE OF AN ENHANCED RAPID TEST SYSTEM (REVEAL® 2.0 SALMONELLA TEST SYSTEM) FOR EARLY DETECTION OF SALMONELLA IN Fecal AND ENVIRONMENTAL SAMPLES. N Slovis1, J Elam. Hagyard Equine Medical Institute, Lexington, KY

In veterinary medicine, a rapid, inexpensive and accurate diagnosis of horses infected with Salmonella spp. is important, so that necessary control and preventative measures can be implemented to reduce the risk of disease transmission to other horses or personnel. Conventional diagnosis of Salmonella spp. is conducted by testing fecal samples using bacteriologic procedures in the laboratory, however, it can take up to 3 to 5 days to obtain laboratory results. Several studies have developed PCR tests for the detection of Salmonella spp. in fecal and environmental samples but there is evidence of an increased frequency of Salmonella-PCR positive results in horses without clinical signs of salmonellosis that test negative to Salmonella spp by culture on multiple fecal samples, perhaps due to the use of primers targeting a non-specific Salmonella spp gene fragment that may cross-react with other enteric or non-enteric organisms. The objective of the study is to assess the diagnostic accuracy of an enhanced rapid test system (Reveal® 2.0 Salmonella test system) for the detection of Salmonella spp. in fecal and environmental samples, compared to bacteriologic culture identification.

The samples were initially plated to a hektoen agar and inoculated in a selenite broth. After 24 hours, the hektoen agar was examined for black or green colonies. The selenite broth was subbed to a selenite broth. After 24 hours, the Reveal test was performed by on any black or green colonies found on either hektoen agar.

Our lab has performed 810 Reveal® tests on suspicious cultures from January 16, 2010 to December 31, 2011. There were 150 Reveal® positive samples and 660 negative samples. There was 100% correlation (100% sensitivity and 100% specificity) of the Reveal® test results to the BBL Crystal identification results. The Reveal® test has been shown in our lab to save 24 hour to 48 hours in notifying the veterinarian of a positive Salmonella culture.

Further studies are warranted with the Reveal® test system on Selenite broths. If similar correlations are noted with the broths then Salmonella results may be able to be obtained in a 24 hour turnaround time.

ABSTRACT E-10
ANTIMICROBIAL SUSCEPTIBILITY OF SALMONELLA ISOLATES OBTAINED FROM HORSES IN THE NORTH-EASTERN UNITED STATES (2001-2010). GA Perkins1, KJ Cummings1,2, SM Khatibzadah1, J Stiler1, LD Warnick1, C Altier1. Cornell University, Ithaca, NY, 2Texas A&M University, College Station, TX

The objectives of this study were to describe the antimicrobial resistance status of equine Salmonella isolates recently cultured in the northeastern U.S. and to identify trends in resistance over time. Data were collected retrospectively for all equine Salmonella isolates with antimicrobial minimum inhibitory concentrations (MICs) that were isolated at the Cornell University Animal Health Diagnostic Center from January 1, 2001 to December 31, 2010. MICs of isolates were determined using the microbroth dilution method (TREK Sensititre).

A total of 459 equine Salmonella isolates with antimicrobial susceptibility testing were retrieved (median of 45 isolates per year; range 20-85). The majority of isolates were from clinical submissions (feces) either from regional veterinarians or the Cornell University Hospital for Animals. Most isolates (98.4-100%) were susceptible to amikacin, enrofloxacin and imipenem. Individual Cochran-Armitage tests showed a significantly decreasing trend over time (p < 0.05) in prevalence of resistance to amoxicillin/clavulanic acid (AUG), ampicillin (AMP), cephalozin, cefoxitin (FOX), cetidifor (TIO), chloramphenicol (CHL) and tetracycline (TET). Increasing resistance was not found for any of the 16 antimicrobials tested. There were 380 isolates that
tested nine available National Antimicrobial Resistance Monitoring System panel drugs. The most common resistance patterns were pan-susceptible (38.2%), AUG-AMP-FOX-TIO-CHL-TET (16.6%), AUG-AMP-FOX-TIO-CHLTET-SXT-Gentamicin (GEN) (11.3%), and AMP-TIO-CHL-TET-SXT-GEN (7.6%).

Judicious use of fluoroquinolones would be appropriate for the treatment of severe salmonellosis in horses in the northeastern U.S. These results suggest that the emergence and dissemination of resistant Salmonella isolates is complex and may not be related to overall antimicrobial use.

**ABSTRACT E-11**

**ROLE OF INTRAOCULAR BACTERIAL INFECTIONS IN HORSES WITH RECURRENT UVEITIS IN LOUISIANA.**

F Polle, RT Carter. School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA

To investigate the role of intraocular bacterial infections in horses with Equine Recurrent Uveitis (ERU), eyes were harvested from donated horses with a history of ocular findings consistent with chronic ERU. Additionally, eyes were collected from horses with normal ophthalmic examinations as a control group. Blood samples were obtained for Leptospira serology using microscopic agglutination test (MAT). Following euthanasia, aqueous and vitreous humor samples were asexptically obtained and submitted for aerobic culture and Leptospira culture, PCR and MAT.

STX17 genotype results of the ocular fluids.

**ABSTRACT E-12**

**GENETIC DETERMINANTS OF MELANOMA SUSCEPTIBILITY IN GRAY HORSES.**

R Teixeira 1, M McCue 1, VHL Scott, JL Williams, J Mickelson 2, S Anderson 2, D Sigler 3, B Buchanan 4, B Coleman 5, F Polle, RT Carter. School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA

Twenty-one control horses (41 eyes) and 15 ERU horses (27 eyes) were available for study. Serology results were available for 35/36 horses: 16/21 control and 13/14 affected horses were positive for at least one serovar; Bratslava was the most common serovar for both groups. *Bacillus sp.* was cultured from one control eye; *Streptococcus sp.* (n = 1) and *Leptospira* (n = 1) from two eyes with ERU. PCR results were positive in 10/27 (37%) eyes from horses diagnosed with uveitis; no control horses were positive by PCR. MAT was positive for 20/26 tested eyes (77%) with uveitis and 1/41 (2.4%) of normal eyes. PCR and MAT results were in agreement for 55/67 (83%) of eyes sampled. Horses with ERU had a high prevalence of *Leptospira* infection based on PCR and MAT results from intraocular fluids compared to controls. *Leptospira* infection should be considered as a cause of ERU in Louisiana. The diagnosis of these intraocular infections was not aided by serology and required specific, invasive sampling of the ocular fluids.

**ABSTRACT E-13**

**EFFECT OF BODY POSITION ON ABDOMINAL PREFERENCES IN ADULT HORSES.**

VHL Scott, Jl Williams, MC Mudge, SDA Hurcombe. The Ohio State University, Columbus, OH

Accurate interpretation of intra-abdominal pressure (IAP) is essential in documenting intra-abdominal hypertension; a significant cause of morbidity in critically ill humans, which has also been described in horses with colic. Body position is known to alter intra-abdominal pressure (IAP) measurements in people, leading to the development of standardized acquisition methodologies to minimize variability. To date, such information is lacking in equine studies. The purpose of this study was to investigate the effect of body position on direct IAP (dIAP) and abdominal perfusion pressure (APP) in normal adult horses.

Nine healthy adult horses were included and a standardized total intravenous anesthetic protocol was used to facilitate patient positioning. dIAP via abdominal cannulation and electronic sphygmomanometry was measured from the left flank (LFI), right flank (RFI) and ventral (V) abdomen with horses randomly positioned into left lateral (LLR), right lateral (RLR) and dorsal recumbencies (DR). Direct mean arterial blood pressure (MAP) was obtained concurrently with dIAP (MAP = P - IAP). Horses were placed in each recumbency twice, repeatability assessed and mean values of IAP/MAP/APP measured in triplicate were used for statistical analysis. Differences in IAP/MAP/APP at specific sites for each body position were assessed by paired t-tests or repeated measures ANOVA. P < 0.05 was significant.

Ventrum dIAP was significantly lower with horses in DR (7 mmHg) compared to values obtained in LLR or RLR (11 mmHg...
and 13 mmHg respectively; P<0.0001. Ventrum APP was not different with horses in all 3 recumbencies (DR = 76 mmHg, LLR = 80 mmHg, RLR = 72 mmHg). MAP was significantly lower when horses were positioned in DR (69 mmHg) compared to LLR or RLR (83 mmHg and 94 mmHg respectively); P<0.0001. LFI dIAP was significantly lower (-5 mmHg) and APP significantly higher (100 mmHg) with horses in RLR compared to DR (15 mmHg and 54 mmHg respectively); P<0.0001 for both dIAP and APP. RFI dIAP was significantly lower (-8 mmHg; P<0.001) and APP significantly higher (91 mmHg; P=0.002) with horses in LLR compared to DR (15 mmHg and 55 mmHg respectively).

Body position directly affects intra-abdominal and hemodynamic pressures. These effects should be considered when evaluating abdominal pressure profiles and visceral perfusion in horses.

**ABSTRACT E-14**

**VOLUME OF DISTENDED SMALL INTESTINE AND IONIC COMPOSITION OF GASTRIC REFUX AND SMALL INTESTINAL FLUID IN HORSES.**

HC Schott II, Michigan State University College of Veterinary Medicine, East Lansing, MI

Distension of the small intestine (SI) is a common finding in horses with obstructive disorders, duodenitis-jejunitis, and postoperative ileus. Removal of fluid accumulated in the stomach, largely SI secretions, via a nasogastric tube is an essential part of management of affected horses and can result in substantial fluid and electrolyte losses. There is little published data on the quantitative amount of water and electrolyte losses that may be lost through nasogastric reflux or with surgical resection of devitalized and distended SI. The purpose of this study was to determine the volume of water that would cause distension of the duodenum and various lengths of jejunum to 6-7 cm diameter as well as the concentration of electrolytes in normal SI ingesta, nasogastric reflux fluid from horses with colic, or fluid in distended SI collected from horses undergoing surgical resection of devitalized SI. First, various lengths (7 to 45 feet) of healthy SI were collected immediately following euthanasia from 15 horses that did not have colic signs and warm (30°C) water was slowly infused to distend the SI to a diameter of 6-7 cm. Water was then drained from the SI and volumes were measured (± 0.5 L) and correlated to the length of the SI that was distended. Second, Na⁺, K⁺, and Cl⁻ concentrations were measured in 23 intestinal fluid samples (10 SI ingesta samples collected from healthy horses, 11 initial spontaneous gastric reflux samples, and 2 SI fluid samples collected during surgery). Correlation analysis revealed that healthy SI is able to hold 0.81 L/foot of warm water (r = 0.92, p < 0.01, n = 15). Concentrations of Na⁺, K⁺, and Cl⁻ are detailed in the table:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Na⁺ mmol/L (range)</th>
<th>K⁺ mmol/L (range)</th>
<th>Cl⁻ mmol/L (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI ingesta, n = 10</td>
<td>21-109</td>
<td>44-102</td>
<td>66-30</td>
</tr>
<tr>
<td>nasogastric reflux, n = 11</td>
<td>77-16</td>
<td>16-11</td>
<td>96-25</td>
</tr>
<tr>
<td>distended SI fluid, n = 2</td>
<td>116-11</td>
<td>12-5</td>
<td>43-27</td>
</tr>
<tr>
<td>Distension</td>
<td>124±</td>
<td>8-15±</td>
<td>24±-62±</td>
</tr>
</tbody>
</table>

Concentrations of Na⁺ were lower (p < 0.01) and Cl⁻ greater (p < 0.03) in nasogastric reflux fluid than in normal SI ingesta or fluid collected from distended SI at surgery. These data can be used to estimate the magnitude of water and electrolyte losses that may occur with SI disorders in order to implement appropriate fluid therapy plans for affected horses.

**ABSTRACT E-15**

**PREVALENCE AND RISK FACTORS FOR ULCERATION OF THE GASTRIC GLANDULAR MUCOSA IN THOROUGHBRED RACEHORSES IN TRAINING IN THE UK AND AUSTRALIA.**

JL Habershon-Butcher 1, Sierkewitz 2, B Sykes 2, IM Bowen 1, B Sykes 2.

1School of Veterinary Medicine and Science, University of Nottingham, UK, 2Upper Orara, NSW, Australia

Equine gastric ulcer syndrome is a common clinical condition which can cause poor performance in racing Thoroughbreds worldwide. Although squamous gastric ulceration has been widely studied, evaluation of the prevalence and risk factors for glandular ulcers has not. The study was performed to determine the prevalence of ulceration in the glandular and pyloric regions in Thoroughbred racehorses in training in the UK and Australia (AUS) and identify associated risk factors. 113 horses from 3 training yards in the UK and 5 training yards in AUS were studied. Gastroscopy was performed on each horse after a period of starvation and under sedation. All squamous, glandular and pyloric regions were assessed for evidence of ulcers. Ulcers were scored 0 to 4 depending on severity (EGUS Council System). A comprehensive questionnaire which included signalment, detailed information regarding training, feeding, general management procedures, race results, recent medication administration and any previous veterinary history was completed by the trainer for each horse. Univariable logistic regression analyses and then multivariable mixed effect logistic regression models were built in a stepwise fashion to identify risk factors for glandular and squamous gastric ulceration. Significance was assumed as p < 0.05.

The overall prevalence of glandular ulceration was 50.4%, squamous ulceration was 73.5% and horses with both squamous and glandular ulceration was 39.8%. There was a significant relationship between glandular and squamous scores (p < 0.001). Horses in AUS had a higher prevalence of glandular ulceration than those in the UK (p < 0.001). The prevalence of squamous ulceration was not different between the UK and AUS horses (p = 0.32). Risk factors for glandular ulceration were gender (p < 0.01; colts were less likely to have ulcers than mares or geldings), trainer (p < 0.001), no grass turnout (p = 0.006), horses in direct contact with each other (p < 0.002), horses fed unprocessed grain (p < 0.003), horses that underwent fast exercise on fewer days of the week (p < 0.001) and that went swimming (p < 0.001). Fewer risk factors were identified for squamous ulceration. Increased squamous ulcer prevalence was noted in horses in work for a longer period of time (p < 0.048; this was not observed for glandular ulceration (p = 0.54)). A lower prevalence of squamous ulceration was also noted in horses aggressive towards humans (p < 0.01). In conclusion, many risk factors were identified that pertained to glandular ulceration; these were different to those for squamous ulceration. The strong association between the concurrent presence of squamous and glandular ulcers has not previously been reported nor have any the regional differences in glandular ulceration prevalence.

**ABSTRACT E-16**

**REGULATION OF HYPOXIA INDUCIBLE FACTOR-1A AND RELATED GENES IN THE EQUINE KERATINOCYTE AND DIGITAL LAMINAE IN EXPERIMENTAL MODELS OF EQUINE LAMINITIS.**

EA Pawluk 1, RJ Geor 1, PJ Johnson 1, S Black 2, TA Burns 4, MR Watts 4, IM Bowen 1, B Sykes 2, JLN Habershon-Butcher 1, GD Hallowell 1.

1University of Massachusetts, Amherst, MA, 2University of Graz, Graz, Austria, 3Rutgers University, New Brunswick, NJ, 4Ohio State University, Columbus, OH, USA

Hypoxia inducible factor-1 alpha (HIF-1A) is a central protein in the cellular response to both hypoxia and inflammatory signaling (i.e. NF B activation via TLR4 signaling). Increased cellular HIF-1A concentrations, occurring most commonly from either increased transcription or decreased proteosomal degradation, lead to the induction of HIF-1A-responsive genes. Hypoxia alone can induce a HIF-1A-mediated increase in genes involved in energy regulation (e.g. glucose transporter 1 [GLUT1], phosphoglycerokinase-1 [PGK1]) whereas NFkB activation is reported to induce a HIF-1A-mediated increase in inflammatory genes e.g. nitric oxide synthase-2 [NOS2] and cyclooxygenase-2 [COX-2].

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Because of the implication of hypoxic and inflammatory events in the pathogenesis of equine laminitis and the specific importance of the basal epidermal keratinocyte in maintaining lamellar function, this study sought to determine the regulation of HIF-1α and HIF-1α-responsive genes in both equine keratinocytes and the equine digital lamina as a whole. Immunohistochemistry (HIF-1α), and real-time-quantitative PCR (HIF-1α, GLUT1, PGK1, NOS2, COX-2) were used to assess gene/protein regulation in 1 cultured equine keratinocytes (skin) exposed to LPS at either normoxic or hypoxic (3%O2) conditions and 2 laminar sections from control animals (CON) and animals at developmental (DEV) and Obel grade 1 lameness (OG1) time points in the carbohydrate and black walnut extract models of laminitis. The laminar keratinocyte was the primary cell type positive for HIF-1α via tissue immunofluorescence, indicating that, similar to skin keratinocytes, the laminar keratinocyte exists in a hypoxic environment. Hypoxic cultured keratinocytes underwent marked increases in cellular concentrations of HIF-1α protein with no change in mRNA concentration. Unlike that reported in many cell types, LPS exposure did not result in increased HIF-1α concentrations in normoxic cultured keratinocytes. Hypoxia alone resulted in increased mRNA concentrations (p < 0.05) of GLUT1 only; however, exposure of hypoxic cells to LPS resulted in increased mRNA concentrations (p < 0.05) of COX-2 and NOS2. Laminar HIF-1α protein concentrations were only increased in the CHO model at the OG1 time point (vs CON, p < 0.05); increased laminar mRNA concentrations were present at DEV and OG1 time points for COX-2 and NOS2 (p < 0.05; no changes occurred in HIF-1α, VEGF, PGK1, or GLUT1 mRNA concentrations). In conclusion, these results indicate that HIF-1α is normally present in the laminar keratinocyte due to the cell constantly being in a slightly hypoxic state, and that increases in HIF-1α and in NF B-responsive HIF-1α related genes (COX-2 and NOS2) in models of laminitis is likely due to a TLR-related induction of NF B signaling resulting in a synergistic increase in inflammatory genes which are responsive to both HIF-1α and NF B signaling.

**ABSTRACT E17**

**LAMINAR INFLAMMATORY EVENTS IN HIGH CARBOHYDRATE FEEDING: IMPLICATIONS FOR PASTURE-ASSOCIATED LAMINITIS.** TA Burns1, MR Watts1, RJ Geor1, LJ McCutcheon1, TK Belknap1 1College of Veterinary Medicine, The Ohio State University, Columbus, OH, 2College of Veterinary Medicine, Michigan State University, East Lansing, MI

A robust laminar inflammatory response, including leukocyte infiltration and inflammatory mediator expression, has been well-characterized in laminitis induced by black walnut extract or enteral carbohydrate overload. Although inflammation has been proposed to also play a role in laminitis associated with equine metabolic syndrome, it has not been critically evaluated. The purpose of this study was to characterize the expression of inflammatory genes and leukocyte infiltration in digital laminar tissue of ponies subjected to a dietary carbohydrate challenge designed to mimic abrupt exposure to pasture rich in nonstructural carbohydrate (NSC). Following 4 weeks of conditioning consisting of a diet of hay chop (NSC ~6% on a DM basis), mixed-breed ponies (body weight 270.9 ± 74.4 kg) were assigned to groups based on body condition scoring (lean vs. obese). Ponies either remained on the conditioning diet (CON diet; n = 5 obese, n = 5 lean) or received the same diet supplemented with sweet feed and oligofructose (CHO diet; n = 42% NSC). Ponies (n = 6 lean) were exposed to both diets for a period of 7 days. At the end of the feeding protocol, dorsal digital laminar tissue samples were collected immediately following euthanasia; samples were formalin-fixed or snap frozen. Laminar immunohistochemistry was performed for CD163 and MAC387/ calprotectin using commercially-available antibodies; the number of immunopositive cells was quantified at 40x magnification (n = 10 fields) for each section by a blinded observer. Real-time-quantitative PCR was used to assess laminar mRNA concentrations of pro-inflammatory cytokine/chemokine genes (TNFα, IL-1β, IL-6, IL-8, MCP-1, MCP-2) and COX-2. There was no effect of diet or body condition on the number of laminar CD163(+) or MAC387(+) cells (p > 0.05); very few laminar MAC387+ cells were present in any group. There was no difference in the laminar mRNA concentrations of TNFα (p = 0.92), IL-1β (p = 0.18), IL-6 (p = 0.28), IL-8 (p = 0.21), MCP-1 (p = 0.25), or MCP-2 (p = 0.67); however, laminar mRNA concentrations of COX-2 (p = 0.01) were increased in ponies fed a high-CHO diet (vs. CON diet). These results suggest that the primary inflammatory events occurring in the marked inflammatory response reported in sepsis models of laminitis, leukocyte infiltration and proinflammatory cytokine/chemokine expression, are not central events in EMS-associated laminitis. As laminar COX-2 expression has been primarily localized to vascular wall components (endothelium and smooth muscle) and laminar keratinocytes in the normal and laminitic equid in previous reports, the increased laminar mRNA concentrations of COX-2 in this study may reflect laminar epithelial dysfunction and/or pathologic vascularization in the affected laminae. Ongoing immunolocalization studies will further clarify the cellular origin of the increased COX-2 expression.

**ABSTRACT E18**

**ABSENCE OF OXIDATIVE STRESS IN THE SKELETAL MUSCLE OF OBESE HORSES.** EB Banse1, D McFarlane1, N Frank2. 1Oklahoma State University Center for Veterinary Health Sciences, Stillwater, OK, 2Tufts University School of Veterinary Medicine, North Grafton, MA

Obesity in people is associated with insulin resistance. In horses, obesity is associated with insulin resistance and the development of laminitis. In people, obesity is associated with increased cellular reactive oxygen species production and local (tissue) and systemic oxidative stress. Increased ROS may interfere with insulin signaling, resulting in insulin resistance. However, measurements of systemic markers of oxidative stress in obese horses have not demonstrated alterations in redox status. Our objective was to determine the relationship between obesity and oxidative stress in skeletal muscle of horses. We hypothesized that obese horses have increased oxidative stress in skeletal muscle compared with non-obese horses, as demonstrated by an increase in thiobarbituric acid reactive substances (TBARS) and a compensatory increase in antioxidant gene expression.

Thirteen light breed horses, 2-24 years of age with a body condition score (BCS) ranging from 4-9 were included. Plasma insulin concentrations were quantified via ELISA. RNA was isolated from biopsy samples of the semi-membranosus muscle for analysis of gene expression. Relative to control, the antioxidant genes, catalase, glutathione synthase, glutathione reductase, glutathione peroxidase, periredoxin, and manganese superoxide dismutase were determined in skeletal muscle by quantitative polymerase chain reaction (qPCR). TBARS were quantified in plasma and muscle using a commercially available kit. Non-normal data was log transformed for analysis. A Pearson’s coefficient of correlation was calculated for body condition score, insulin concentration, gene expression and TBARS. Muscle TBARS were decreased in obese (BCS > 7; n = 7) compared to non-obese (BCS ≤ 5; n = 6) horses (0.44±0.08 versus 1.41±0.26 nmol/mg). Body condition score was negatively correlated with tissue TBARS (r = -0.56) but not plasma TBARS (r = -0.07). Plasma and muscle TBARS were not correlated (r = 0.12). There was a negative correlation between tissue TBARS and plasma insulin (r = -0.56). Antioxidant gene expression was not correlated with body condition score or insulin concentration.

Obese horses demonstrated a decrease in oxidative stress within skeletal muscle, which was not in support of our hypothesis. These findings indicate that obesity in horses, unlike in people, is not associated with increased reactive oxygen species production. Further investigation into the cellular mechanism of insulin resistance in the horse is warranted.
ABSTRACT E-19
THE EFFECTS OF EXPERIMENTALLY INDUCED HYPERGLYCEMIA AND ENDOTOXEMIA ON COAGULATION PARAMETERS IN HEALTHY ADULT HORSES. JF McGovern1, KM Laosola1, SA Smith1, PA Wilkins1, SC Clark-Price1, JH Foreman1, 1College of Veterinary Medicine, Leesburg, VA, USA

Healthy young and geriatric horses (> 20 years of age) and PPID geriatric horses were recruited between May 15th and June 15th in 2010 and 2011. Horses were categorized as PPID by the presence of hirsuitism, and if ACTH > 50 pg/mL and a-MSH > 35 pmol/dL. Horses were classified as normal based upon phenotype and an ACTH <35 pg/ml and >35 pmol/dL. Horses were classified as normal if they were categorized as normal young horses, 8 as normal geriatric horses, and 13 as geriatric PPID horses. The PT in PPID horses was longer than healthy geriatrics (18 ± 1.6 seconds versus 16.7 ±0.7 seconds; p=0.03) but not clinically significant. By study design, ACTH and a-MSH were different between groups (p <0.001). PPID geriatrics were older (p=0.02) than healthy geriatric horses. Older horses and horses with PPID do not appear to develop systemic evidence of hypercoagulability as evaluated by laboratory testing.

ABSTRACT E-20
EVALUATION OF HYPERCOAGULABILITY IN GERIATRIC HORSES WITH/OUT PITUITARY PARAPHYSAL GLANDS. J Mahmood1, MR Paradis2, DM Farlane2, A Sanchez3, LL Price4, E Rozanski4, D Meola1, AM deLaforcade1. 1Tufts Cummings School of Veterinary Medicine, North Grafton, MA, 2Oklahoma State University, Stillwater, OK, 3Tufts University Ambulatory Clinic, Woodstock, CT and 4Tufts Medical School, Boston, MA

Pituitary Pars Intermedia Dysfunction (PPID) is the most common endocrine disorder in geriatric horses, and shares the characteristic of increased ACTH with human and canine pituitary dependent hyperadrenocorticism (PDH). PDH and aging (in humans) has been associated with evidence of systemic hypercoagulability. The goal of this study was to determine if coagulation status differed between normal healthy horses, and geriatric horses with and without PPID.

Healthy young and geriatric horses (> 20 years of age) and PPID geriatric horses were recruited between May 15th and June 15th in 2010 and 2011. Horses were categorized as PPID by the presence of hirsuitism, and if ACTH > 50 pg/mL and a-MSH > 35 pmol/dL. Horses were classified as normal based upon phenotype and an ACTH <35 pg/ml and >35 pmol/dL. Horses were classified as normal if they were categorized as normal young horses, 8 as normal geriatric horses, and 13 as geriatric PPID horses. The PT in PPID horses was longer than healthy geriatrics (18 ± 1.6 seconds versus 16.7 ±0.7 seconds; p=0.03) but not clinically significant. By study design, ACTH and a-MSH were different between groups (p <0.001). PPID geriatrics were older (p=0.02) than healthy geriatric horses. Older horses and horses with PPID do not appear to develop systemic evidence of hypercoagulability as evaluated by laboratory testing.

ABSTRACT E-21
RENNIN-ANGIOTENSIN-ALDOSTERONE SYSTEM (RAAS) RESPONSE AND ACTH/ALDOSTERONE RATIO IN SEPTIC NEWBORN FOALS. KA Dembek1, K Onasch1, SD Hurcombe1, CW Kohn1, NM Smore1, SM Reed2, RE Toribio1, 1The Ohio State University, College of Veterinary Medicine; Columbus, OH, USA, 2Hagyard Equine Medical Institute, Lexington, KY, USA.

Septic is a major cause of mortality in newborn foals. Dysfunction of the hypothalamic-pituitary-adrenal axis (HPAA), manifested as relative adrenal insufficiency (RAI), has been associated with sepsis in foals. The HPAA and RAAS are interactive systems, and a relationship between RAAS activation and RAI is well documented in critically ill children, but limited information exists in septic foals. We hypothesized that in septic foals the RAAS will be activated by inflammation and hypoperfusion and the degree of activation will be associated with severity of sepsis and mortality. We also proposed that ACTH will be associated with aldosterone concentrations.

Blood samples were collected on admission from 49 septic (sepsis score >12), 59 sick non-septic (SNS), and 20 healthy foals of <3 days of median age. Blood concentrations of cortisol, aldosterone, angiotensin-II (ANG-II), ACTH and plasma renin activity were determined by immunoassays.

Aldosterone, ACTH and cortisol concentrations were higher in septic and SNS compared to healthy foals. Septic foals had higher ACTH/aldosterone and ACTH/cortisol ratios than healthy foals. Nonsurviving septic foals had a higher ACTH/cortisol ratio than survivors. No differences in renin activity and ANG-II concentrations were found, but nonsurviving septic foals had lower renin activity. Hyperkalemia and hypochloremia were correlated with hyperaldosteronemia. Hyperfibrinemia was associated with aldosterone, cortisol and ACTH concentrations in septic foals. RAAS activation in critically ill foals is characterized by increased aldosterone concentrations. The high ACTH/cortisol and ACTH/aldosterone ratios in septic foals suggest that RAI is not restricted to the zona fasciculata but also to the zona glomerulosa.

ABSTRACT E-22
EFFECTS OF BLOOD CONTAMINATION ON PARAMETERS OF CEREBROSPINAL FLUID ANALYSIS. M Furr, Equine Medical Center, Virginia-Maryland Regional College of Veterinary Medicine, Leesburg, VA.

Evaluation of cerebrospinal fluid is a key component of the examination of horses with neurologic disease. Contamination of the sample by peripheral blood during collection is a recognized complication of the procedure, and can compromise the assay of the CSF. To date, it is unclear how to evaluate CSF with blood contamination as the magnitude of the effects have not been quantified. The purpose of the study was to determine the effects of blood contamination on selected CSF parameters, and secondly to test a common correction equation for peripheral blood contamination (i.e. proportionality of RBC to WBC counts in whole blood).

To perform the experiment, peripheral blood from a normal horse was diluted 1:2,000-1:10,000 with PBS and used to spike normal CSF (N=6) to result in mean RBC counts of 34 to 1,450 RBC/µL. Following this, CSF was evaluated using conventional clinical laboratory methods. To test the correction calculation, pooled normal CSF with a WBC count of "0" was used. Aliquots of CSF (500 µL) were spiked with WBCs resulting in a concen-
ABSTRACT E-23
THE EPIDEMIOLOGY OF SHIVERS IN HORSES.
A Draper1, J Bender1, AM Firshman1, JD Baird2, S Reed3, J Mayhew4, SJ Valberg5, 1College of Veterinary Medicine, University of Minnesota, St Paul MN, 2Ontario Veterinary College, Guelph, ON, Canada, 3Rood and Riddle Equine Hospital, Lexington KY. 4. Massey University, Massey, New Zealand

Shivers is a poorly defined, chronic equine movement disorder. This study sought to characterize the epidemiology of Shivers.

A standardized web-based survey was used to collect data on signalment, onset, clinical signs, precipitating factors, effect of management, diet and therapies. A standardized video was requested from owners, where possible. Shivers was defined as hyper-flexion or -extension of the pelvic limbs during backwards walking and manual hoof lifting. Diagnosis was confirmed either by video submission [V+] or by reported clinical signs without video [V-]. Two matched case-controls were obtained from V+ owners that were normal, > 4 years old and in close proximity. Analysis was by Chi2 analyses, p<0.05.

Responses included; V+ n = 32, V- n = 62, controls n = 47. V+ had significantly more WBs, TBs and Draft breeds, taller horses (>17hh) and males compared to the controls. Signs frequently began at <10 years of age (V+ and V-). Clinical signs in V+/V- horses included farrier problems (88%/91%), muscle twitching (88%/84%), muscle wasting (44%/33%), weakness (31%/22%) and exercise intolerance (25%/14%). Both groups reported an improvement with increased turnout, exercise and a low carbohydrate diet whereas NSAIDs, muscle relaxants, chiropractic and acupuncture therapy had minimal effect. 50% of V+ horses showed worsening of clinical signs over time, and with stress compared to V- horses.

In conclusion, Shivers often begins before 10 years of age, is more common in male horses over 17hh, shows progressive signs from that expected and a Bland-Altman plot demonstrated limits of agreement up to 150 cells/l, which was considered to be poor performance.

The conclusions were that RBC contamination of CSF up to a value of 1.500 RBC/l does not alter resultant WBC or total protein values. RBC counts greater than 10,000 RBC/l, however are highly correlated with increasing TP and WBC numbers. Further, the standard correction equation for RBC contamination of CSF does not appear to be accurate enough to recommend its routine clinical use.

ABSTRACT E-24
PROGNOSTIC FACTORS ASSOCIATED WITH SHORT-TERM AND LONG-TERM OUTCOME IN HORSES WITH CHRONIC RENAL FAILURE.
N Nogradi, B Toth, MB ND Cohen 1, JR Nerren 1, AJ Burton 1, S Giguere1, Y Al Hamhoom 1, L Warner 1, 734 2012 ACVIM Forum Abstracts College, Guelph, ON, Canada, 3Rood and Riddle Equine University of Minnesota, St Paul MN, 2Ontario Veterinary Medical Teaching Hospital, University of California, Davis, CA

Chronic renal failure (CRF) is considered a devastating clinical syndrome in horses, however prognostic factors have not been determined. The objective of the present study was to describe the most common clinical, clinicopathologic and ultrasonographic findings in horses diagnosed with chronic renal failure and to reveal prognostic factors associated with short-term (discharge from hospital) and long-term (12 months) survival.

Medical records of 58 horses diagnosed with CRF were reviewed. Information on signalment, history, clinical examination findings, laboratory testing, renal ultrasonography and outcome were collected. Long-term outcome was determined by telephone interviews with owners. Statistical analysis included the formulation of multivariate logistic regression models.

Thirty-eight horses (65.5%) were discharged from the hospital after diagnosis and initial treatment. Long-term follow up was available for 24 cases and 14 horses were alive at 12 months after discharge. Both short-term and long-term non-survivors had a significantly higher serum creatinine and blood urea nitrogen concentration when compared to survivors (P<0.01 in both cases) and they more commonly had decreased kidney size detected by ultrasound examination (P=0.02 respectively). Based on the results of the multivariate logistic regression model, the serum creatinine concentration, the presence of hyponatremia and a decreased kidney size on admission were associated with a negative short-term outcome, while no factors were found to be associated with long-term outcome.

Both laboratory and ultrasound findings are important to assess short-term prognosis in horses with CRF, but admission findings do not determine long-term outcome once the horse is discharged form the hospital.

ABSTRACT E-25
IN VIVO ADMINISTRATION OF CPG ENHANCES FOAL NEUTROPHIL FUNCTION.
NC Cohen1, JR Nerren1, AI Bordin1, CC Love1, CE Brake1, M Liu1, KR Kuskie1, M Kogut1, 1College of Veterinary Medicine and Biomedical Sciences, Texas A&M University, College Station, TX, 2USDA-ARS-sparcfsru, College Station, TX

Neonates are particularly dependent on innate immune responses for protection against infection during early life because of deficiencies in adaptive immunity. Neutrophils are primary effector cells of the innate immune response; however, deficiencies in functional responses of neonatal neutrophils exist. Consequently, enhancing neutrophil function in neonates might help to protect newborns against infectious diseases. The goal of this study was to determine whether ex vivo neutrophil function of neonatal foals could be stimulated by in vivo administration of unmethylated CpG oligodeoxynucleotides, agonists for Toll-like receptor 9 (TLR9). CpGs were administered IM to 9 foals on days 1 and 7 of life; an equal volume of saline was administered IM to 9 control foals on days 1 and 7 of life. Neutrophils from CpG-treated foals had significantly more WBs, TBs and Draft breeds, taller horses (>17hh) and males compared to the controls. Signs frequently began at <10 years of age (V+ and V-). Clinical signs in V+/V- horses included farrier problems (88%/91%), muscle twitching (88%/84%), muscle wasting (44%/33%), weakness (31%/22%) and exercise intolerance (25%/14%). Both groups reported an improvement with increased turnout, exercise and a low carbohydrate diet whereas NSAIDs, muscle relaxants, chiropractic and acupuncture therapy had minimal effect. 50% of V+ horses showed worsening of clinical signs over time, and with stress compared to V- horses.

In conclusion, Shivers often begins before 10 years of age, is more common in male horses over 17hh, shows progressive signs in 50% of cases and is best managed by increased turnout, regular exercise and a low carbohydrate diet.

ABSTRACT E-26
EFFECT OF AGE ON THE PHARMACOKINETICS OF A SINGLE DAILY DOSE OF GENTAMICIN SULPHATE IN FOALS.
AJ Burton1, S Giguere1, Y Al Hamhoom1, L Warner1, RD Arnold1, 1University of Georgia, Athens, GA

Therapeutic drug monitoring in a small number of foals indicates that the standard adult dose of 6.6 mg/kg q 24 h for gentamicin is too low and a dose of 12 mg/kg has been proposed. The
pharmacokinetics of this dosage in foals and the ages at which this higher dose should be applied have not been investigated. The objective of this study was to determine the effect of age on the pharmacokinetics of a single 12 mg/kg dose of gentamicin in foals.

Six healthy foals were given a single IV dose of gentamicin at ages 1-3 days, 2, 4, 8 and 12 weeks of age. Plasma concentrations of gentamicin were measured using HPLC-MS. Pharmacokinetic data were analyzed using a noncompartmental approach. Effect of age on each pharmacokinetic parameter was assessed using a one-way ANOVA for repeated measures.

Gentamicin concentrations (mean +/- SD) 1 hour after administration were significantly higher at 8 (68.78 +/- 13.45 µg/mL) and 12 (65.05 +/- 22.81 µg/mL) weeks of age compared to 1-3 days (20.52 +/- 2.07 µg/mL). Trough concentrations were significantly lower at 4, 8 and 12 weeks of age (all < 0.78 µg/mL) than at 1-3 days (1.97 +/- 0.90 µg/mL), consistent with a significantly longer elimination half-life in 1-3 day-old foals compared to other ages. Effect of age on AUC and clearance was not statistically significant.

These data indicate that age has a profound effect on the pharmacokinetics of gentamicin in foals and support the need for a 12 mg/kg dose in neonatal foals.

ABSTRACT E-27
DEMONSTRATION OF ENDOGENOUS INFLAMMATORY CYTOKINE PRODUCTION BY EQUINE ADRENOCORTICAL TISSUE IN AN EX VIVO MODEL. KA Hart, MH Barton, NA Norton, ML Vandenberg, Department of Large Animal Medicine, University of Georgia College of Veterinary Medicine, Athens, GA

Transient adrenal dysfunction characterized by inadequate cortisol responses occurs in 40-60% of septic people and foals. The pathogenesis of this critical illness-related corticosteroid insufficiency (CIRCI) is unknown, but adrenocortical suppression mediated by inflammatory cytokines is believed to be key. Human and bovine adrenocortical cells directly release inflammatory cytokines in response to bacterial endotoxin; this local cytokine production might potentiate adrenal suppression and CIRCI in patients with gram-negative sepsis. The objective of this study was to determine if equine adrenocortical cells directly release inflammatory cytokines in response to bacterial endotoxin. Adrenal tissue was collected from 6 healthy horses to higher grass NFC after ingestion of long-term low NFC hay, then to lower grass NFC after long-term ingestion of high NFC hay.

Three miniature horses were fed nothing but ad-libitum first-cut hay plus a vitamin supplement at all times from 2009 through 2011 rather than 10 days when on pasture. The same hay lot was fed for at least 4 months prior to each experimental period. The horses were sampled hourly over 2 days in August and 2 days in October 2010 via jugular catheters, eating hay the first day and mixed grass pasture the next. The same horses were sampled twice for 3 days each in both August and October 2011. The 2010 pasture contained at least twice the NFC as in the hay; the 2011 pasture contained ½ to 2/3 the NFC as in the hay. In both years, October pasture contained significantly more water than did August pasture. [NFC as % dry matter in hay: 2010 = 9%; 2011 = 5%]. Mean 2010 gentamicin concentration (MPC) on hay was .08 mmol in August and .06 mmol in October. This rose immediately in both months and remained statistically significant through the experiment as long as the horses were on pasture (12h). The 2011 MPC on hay was .05–.06 mmol, rising after 5h on pasture. Peak MPC was reached after 24–26h on pasture. [1st August run = .105 mmol; 2nd August run = .085 mmol; 1st October run = .095 mmol; 2nd October run = .115 mmol]; MPC decreased after 28 hours in all but the 1st August run. Lactate and pyruvate concentrations revealed no statistically significant changes. However, the mean lactate/ pyruvate ratio (L/P) significantly increased on pasture, but not in hay. Basal mean L/P was about 20 in 2010, increasing to 40 within 1h on pasture, and peaking at 70 by the end of the sampling period (12h). The 2011 basal level was about 25, rising to 35 by the 1st sampling in all pasture sessions. L/P/peak values (35–50) were reached by 2.5h in the 1st August session and by 5h in the other sessions. L/P remained only moderately elevated thereafter and returned to baseline by Day 3 in all 2011 sessions.

ABSTRACT E-29
EFFECT OF DIETARY CARBOHYDRATE CHALLENGE ON ACTIVATION OF 5'-ADENOSINE MONOPHOSPHATE ACTIVATED PROTEIN KINASE (AMPK) IN LIVER, SKELETAL MUSCLE, AND DIGITAL LAMINAE OF LEAN AND OBSESE PONIES. TA Burns1, MR Watts1, RJ Geor2, LJ McCutcheon3, JK Belknap3. 1College of Veterinary Medicine, The Ohio State University, Columbus, OH, 2College of Veterinary Medicine, Michigan State University, East Lansing, MI, 3College of Veterinary Medicine, Michigan State University, East Lansing, MI

Systemic insulin resistance and hyperinsulinemia are proposed to be important risk factors for laminitis associated with equine metabolic syndrome (EMS) in horses and ponies. AMPK, a highly conserved enzymatic regulator of cellular energy status, has become a therapeutic target in human MS and EMS due to its reported ability to increase systemic insulin sensitivity. For example, the AMPK agonist metformin has recently been used clinically to treat EMS-affected equids. However, regulation of AMPK activity in both 1) tissues primarily responsible for insulin-mediated glucose disposal (liver, skeletal muscle) and 2) the target tissue for injury in EMS-related laminitis, the digital laminae, is largely unknown. The purpose of this study was to characterize the cellular localization and activation state of AMPK in liver, skeletal muscle, and digital laminae of ponies subjected to a dietary carbohydrate challenge meant to mimic abrupt exposure to pasture...
ABSTRACT E-30
REPEatability OF THE COMBINED GLUCOse AND INSULIN TEST IN HORSES. J. Brojer, A. Alvarsson, J Hedenskog, K. Nostell. Faculty of Veterinary Medicine and Animal Sciences, Swedish University of Agricultural Sciences, Sweden.

The combined glucose-insulin test (CGIT) has been applied as a dynamic test for insulin sensitivity in horses. However, there is limited information on the reproducibility of the test. The object of the study was thus to evaluate the repeatability of calculated variables derived from the CGIT glucose and insulin curves in horses.

Eighteen healthy horses (9 Icelandic horses and 9 Standardbred horses; age 6–20 years) underwent the CGIT on two occasions with 3 weeks between the tests. The area under the glucose and insulin vs. time curves (AUC-glu and AUC-ins), the duration of the glucose decrease of the glucose curve (DPP-glu), and the time duration to reach the insulin concentration 100 mU/L (DIC-100) were determined. There were no significant differences between the two tests (p=0.05). The interday variation expressed as the coefficient of variation (CV) and intraclass correlation coefficient (ICC) was calculated. The CV and ICC was 14.6 % and 0.64 for the AUC-glu and 7.7 % and 0.88 for the AUC-ins. The DPP-glu had CV and ICC values of 44.9 % and 0.61, whereas the corresponding values for DIC-100 were 7.0 % and 0.88.

When the CGIT is used as a diagnostic test to evaluate insulin resistance, the test is considered reliable when the DPP-glu > 45 min or the insulin concentration > 100 mU/L at 45 min. However, the large CV and low ICC for DPP-glu in the present study suggests that normal or impaired insulin sensitivity should not be defined solely on this parameter.

ABSTRACT E-31
DOPAMINE AND TYROSINE HYDROXYLASE CONCENTRATIONS IN PARS INTERMEDIA TISSUE OF HORSES WITH PITUITARY PARS INTERMEDIA DYSFUNCTION WITH AND WITHOUT Pergolide TREATMENT. H. Schott II1, JS Patterson2, EB Howey3, M. Benskey4, JL Grenade, France, 2Department of Pharmacology and Toxicology, Neuroscience Program; 3Michigan State University, East Lansing, MI

Pituitary pars intermedia dysfunction (PPID) develops slowly over a period of years as degeneration of hypothalamic dopaminergic neurons leads to proliferation of pars intermedia (PI) melanotropes through hyperplasia and adenoma formation. Further, concentrations of dopamine (DA) and DA metabolites, as well as tyrosine hydroxylase (TH) immunoreactivity, are markedly reduced in PI tissue of PPID-affected equids. Treatment with the DA receptor agonist pergolide results in notable clinical improvement in PPID-affected horses. Thus, we hypothesized that treatment of PPID-affected horses with pergolide would result in greater DA and TH concentrations in PI tissue collected from PPID-affected horses treated with pergolide, as compared to PI tissues collected from untreated PPID-affected horses. To test this hypothesis, pituitary glands were removed within 30 min of euthanasia (Aug-Nov, 2009) from 18 horses: four untreated PPID-affected horses (28±4 [SD] years), four aged (25±5 years) and four young (5±2 years) control horses without signs of PPID, and six PPID-affected horses (25±3 years) that had been treated with pergolide for 6 months. PPID status was confirmed by immunohistochemical staining for P-AMPK. Pituitary glands were sectioned in a midline sagittal plane with one half rapidly frozen on dry ice and the other half placed in formalin. Using histological findings to outline the PI, an 18 g needle was used to collect core samples of PI tissue from the opposing half of pituitary glands, after thawing. After tissue sonication, supernatant fractions were analyzed for DA and TH concentration by high performance liquid chromatography and standardized to protein concentration in the remaining cell pellet (reported as ng DA/mg protein). TH protein concentration (normalized to β-actin) was determined by Western blot analysis. DA concentration was greatest (p<0.05) in PI tissue collected from young control horses, as compared to tissues collected from the three other groups of horses. In contrast, TH concentration in PI tissue was not different between PPID-affected horses treated with pergolide and both young and aged control horse PI. However, TH concentration was lowest (p<0.05) in untreated PPID-affected horses.

In conclusion, pergolide treatment of PPID-affected horses appears to restore TH concentration in PI melanotropes. Further study is needed to determine whether the persistently low DA concentrations in PI tissue of pergolide treated horses is a real finding or a potential artifact of tissue collection and processing.

ABSTRACT E-32
EFFICACY OF OMEPRAZOLE PASTE IN THE PREVENTION OF GASTRIC ULCERS IN HIGH LEVEL ENDURANCE HORSES. Y. Tamzali1, LM Desmaizieres2, C. Marguet2, M. Birague2, F. Lyazrhi3. 1Equine Internal Medicine, INP-Ecole Nationale Vétérinaire, Toulouse, France, 2La Clinique du Cheval, Grenade, France, 3Educational unit of biostatistics, National Veterinary School, Toulouse, France.

A high EGUS prevalence was shown in elite endurance horses in a recent study with 48% during the current competition season compared to 53% during the competition season with a significant influence of training and performance level on the gastric score. According to these results it was hypothesized that omeprazole preventative treatment may reduce the gastric scores in endurance horses maintained in similar training and performance conditions. 26 endurance horses competing at high level were selected and submitted to two gastroscopic examinations. The first gastroscopy was performed during training period 4 weeks before a planned ride of 90 km minimum and up to 160 km. Subsequently horses received 1mg/kg bw omeprazole paste (Gastroguard) once daily, in the morning for 28 days. The second gastroscopy was performed within two-three days following the ride. Data related to housing, feeding, training system as well as age, breed and gender were recorded for each horse. The prevalence of squamous gastric ulcers was 76.9% during the training period (mean score 1.03±0.87 on a scale from 0 to 4) and 73% following the ride (mean score 0.88±0.76).
ABSTRACT E-33
A COMPARISON OF TWO DOSES OF OMEPRAZOLE IN THE TREATMENT OF GASTRIC ULCERATION IN THOROUGHBRED RACEHORSES. BW Sykes1, GD Hallowell2, MC Woodward1, M Keowen1, C Larson2, FM Andrews *,1. 1Equine Health Studies Program, Department of Veterinary Clinical Sciences and, 2Department of Pathobiological Sciences, School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA, USA.

Equine gastric ulcer syndrome (EGUS) is a well recognized condition in Thoroughbred racehorses. The purposes of this study were to compare the therapeutic efficacy of two doses of omeprazole, and to report the healing rate of glandular EGUS with omeprazole therapy. Thoroughbred racehorses in training with grade II-IV/V glandular EGUS were identified on gastrointestinal examination. Squamous EGUS score was also recorded. Horses were randomised to receive either 2.0 mg/kg (high dose) or 0.8 mg/kg PO SID respectively for a 500 kg horse. Repeat gastroscopy was performed at 33± 7 days and squamous and glandular scoring repeated. Twenty-four horses met the inclusion criteria and were randomised into two equal groups. One horse in the low dose group was lost to follow up for unrelated reasons. All horses, except one in the high dose and one in the low dose group, had grade II-IV/V squamous ulceration at day 0. Data were analysed using McNemar’s Test, Mann Whitney U and Wilcoxon Paired Tests. Significance was assumed at p<0.05. No differences between the groups at enrolment, or in the duration of therapy, were present (p=0.38). Ulcer healing (defined as a return to grade 0-I/IV) occurred in 67% and 44% of the squamous, and 50% and 11% of the glandular, ulcers in the high and low dose groups respectively. A doseeffect for healing was noted for both squamous and glandular ulcer healing (p= 0.003 and p=0.0001 respectively) whereas a dose effect for improvement was only seen for squamous ulcers (p= 0.03; glandular p=0.13). A relationship between healing of squamous and glandular ulcers, wherein glandular ulcer healing, or improvement, was more likely to have occurred if squamous healing, or improvement, had occurred, existed in the high dose, but not low dose group (p=0.005 and p=0.10 for healing, and p=0.04 and p=0.12 for improvement, for high and low dose respectively).

In conclusion, healing of EGUS is commonly incomplete at 33 days and a dose dependent response exists. Control gastroscopy is indicated to ensure healing has occurred, even when a 28 day course has been completed, and a reduction in the omeprazole dose below 4.0 mg/kg PO SID prior to this is likely to result in inadequate healing in a significant number of patients. Healing of glandular ulceration is inferior to healing of squamous ulceration and the current recommendation of 28 days therapy is inadequate. Investigation of complimentary and/or alternative therapies for glandular EGUS is warranted as the response to omeprazole therapy alone is poor.

ABSTRACT E-34
EFFECT OF EGUSIN® 250 AND SLH ON GASTRIC ULCER SCORES, GASTRIC FLUID PH AND TOTAL CARBON DIOXIDE IN HORSES. MC Woodward1, NK Huff2, F Garza Jr3, ML Keowen1, MT Kearney4, FM Andrews1. 1Equine Health Studies Program, Department of Veterinary Clinical Sciences and, 4Department of Pathobiological Sciences, School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA, USA.

Gastric ulcers are common in horses, but current pharmaceutical treatments are expensive and require prescriptions. EGUSIN® 250 (E-250) and EGUSIN® SLH (E-SLH) are commercially available feed supplement for the treatment and prevention of gastric ulcers, but data on their effectiveness has not been reported. The purpose of this study was to evaluate these two formulations for the treatment and prevention of gastric ulcers in stall-confined horses undergoing feed-deprivation.

This study was a blinded two-period partial cross-over study using Nine Thoroughbred and Thoroughbred-cross horses (five geldings and four mares). Treatments consisted of an untreated control and two treatment groups (E-250 and E-SLH) mixed with a sweet feed. Horses were confined to a stall and treated for three weeks, followed by a one-week alternating feed-deprivation period, and then for one week after the feed-deprivation period (five total weeks of treatment). Gastroscopies were performed on horses on day 0 and at the end of week 3, week 4 and week 5. Gastric juice was aspirated and pH was measured. Gastric ulcer number and severity scores were assigned at each gastroscopy. Venous blood samples were collected to detect changes in total CO2 and due to bicarbonate in the supplements. A repeated measures ANOVA using the mixed procedure in SAS was used to analyze the data. When significant differences were found, post-hoc pairwise comparisons were conducted with t tests of least-squares means for main effects, and for interaction effects. A P < 0.05 was considered significant.

Non-glandular gastric ulcer scores significantly increased in all horses from Week 3 to Week 4, as a result of feed-deprivation. There was no significant treatment effect on non-glandular gastric number or severity scores through four weeks of study. However, E-SLH and E-250 treated horses had significantly lower non-glandular ulcer number and severity scores at week 5. There was no significant difference in gastric juice pH between treatment groups at any time during the study. TCO2 was significantly increased in the E-250 and E-SLH treated horses at 24 hours when compared to the 12 hour samples.

No significant treatment effects were seen in the first four weeks of the study. However, one week after feed-deprivation, EGUSIN®-treated (E-SLH and E-250) horses had lower and less severe gastric ulcers. Supplementation with EGUSIN® products may have efficacy in improving gastric ulcers in stall-confined horses undergoing intermittent feeding.

ABSTRACT E-35
EVALUATING REPLACEMENT OF SUPPLEMENTAL INORGANIC MINERALS WITH ZINPRO PERFORMANCE MINERALS ON PREVENTION OF GASTRIC ULCERS IN HORSES. P Lofin1, M Woodward2, W Bidot, J Cartmill1, S Zuccarino3, T Garzarol, M Keowen1, C Larson4, FM Andrews1, 1Louisiana State University, Baton Rouge, LA, 2Zinpro Corporation, Eden Prairie, MN

Non-glandular (NG) gastric ulcers are common in the horse. Zinc is an essential co-enzyme involved in healing of mucosal surfaces and has been used to treat and prevent gastric ulcers in other species. The purpose of this study was to test the efficacy of a feed supplement containing zinc-methionine and other organic minerals (ZPM) to a supplement containing inorganic zinc sulfate (ZS), for prevention of gastric ulcers in horses.

The study was a blinded 2-period non-crossover using adult Thoroughbred horses (n=36). ZPM (400 mg) or ZS (400 mg) milled into pellets was mixed with crimped oats and fed to the horses twice daily for 56 days. Horses were stratified by NG ulcer score, then by sex and assigned to two treatment groups (n=18). There were two 56-day periods, where horses were stall-confined in ambient environmental conditions. Horses received omeprazole paste (GastroGard®, 4 mg/kg, PO, Q24h) from days 1-14, were subjected to alternating feed-deprivation from days 42-49 and allowed to recover for 7 days. Gastroscopy was performed on
days 0, 14, 42, 49, and 56. Gastric juice pH was measured and gastric ulcer number and severity scores were assigned by a masked clinician (FMA). Weather data were collected for the two periods. Gastric ulcer scores were expressed as mean (SD) and an ANOVA for repeated measures was used to compare ulcer scores between groups and over time. A post-hoc Tukey’s test was used to determine differences (P<0.05).

Horses (n=34) were treated for all 56 days. There was no treatment effect in the study; however there was a period effect. Mean NG number and severity scores were significantly lower in the ZPM-treated horses, compared to ZS-treated horses, on days 42, 49 and 56, during period 2. Overall, for both periods, mean NG gastric ulcer scores significantly decreased in both treatment groups by day 14, after omeprazole treatment, compared to days -1, 42, and 56. Mean NG gastric ulcer scores significantly increased on day 42, compared to day 14, but were still lower than on day -1. Mean NG gastric ulcer scores increased significantly by day 49, due to alternating feed-deprivation, then decreased to below pretreatment values by day 56. No significant differences were seen in glandular ulcer scores between groups. Means environmental temperature (68°F vs. 84°F), heat index (82 vs. 90) and relative humidity (74% vs. 79%) were higher during period 2 of the study and may have contributed to the effectiveness of ZPM.

ZPM-treatment resulted in lower gastric ulcer scores in horses participating in period 2 of this study, but when data were pooled there was no treatment effect. ZPM at levels fed in this study may be beneficial in preventing gastric ulcers after omeproc acid treatment in horses housed in stalls and fed intermittently, especially in hot and humid environmental conditions.

ABSTRACT E-36
EVALUATION OF THREE GASTROINTESTINAL PROTECTANTS IN A RODENT MODEL OF EQUINE CANTHARIDIN TOXICOSIS.

HJ Qualls 1, TC Holbrook 2, LL Gilliam 2, KA Hart, CE Sherlock, AJ Davern, >30

ABSTRACT E-39
EFFECTS OF SEDATION WITH XYLAZINE OR ACEPROMAZINE ON THROMBOELASTOMETRY AND ON STANDARD EQUINE COAGULATION PARAMETERS.

Acepromazine and xylazine are administered to horses to reduce anxiety, provide analgesia and enable safe evaluation of the animal. These medications may cause a decrease in hematocrit. Variation in hematocrit can interfere with thromboelastometry (TEM). The purpose of this study was to evaluate changes in thromboelastometry (TEM) and standard coagulation assays in horses after the administration of acepromazine and xylazine.

Using a randomized crossover design 7 healthy adult horses were administered a single dose of xylazine (1.1 mg/kg IV) or acepromazine (0.1 mg/kg IV) with a 3 week washout period between treatments. Hematocrit, total protein (TP), platelet count, prothrombin time (PT), activated partial thromboplastin time (aPTT), TEM and thrombin-antithrombin complexes (TAT) were measured at baseline, 30 minutes and two hours for both medications and at 6 and 12 hours for acepromazine. Repeated Measures ANOVA and Friedman Rank Sum tests were used to evaluate changes in measured parameters with significance set at p<0.05.

At 30 minutes post xylazine administration hematocrit and TP decreased by 20.2% (p=0.004) and 4.3% (p=0.013) respectively. At 2 hours post acepromazine administration hematocrit and TP decreased by 19.7% (p<0.001) and 4.3% (p=0.005) respectively. Changes in TEM included decreased clotting time (Ex-TEM p=0.034) and increased alpha angle (Ex-TEM p=0.034, In-TEM p=0.016) at 30 minutes for horses administered xylazine. No other changes in coagulation parameters were identified.

Changes in TEM parameters after xylazine administration suggest hypercoagulability. The changes in TEM may represent an ex-vivo artifact due to reduced red cell mass rather than a true alteration in coagulation.

ABSTRACT E-38
EFFECTS OF SEDATION WITH XYLAZINE OR ACEPROMAZINE ON THROMBOELASTOMETRY AND ON STANDARD EQUINE COAGULATION PARAMETERS.

B Saia 1, K Lascola 1, S Smith 1, G Zyrkowski 1. 1College of Veterinary Medicine, Urbana, IL, 2College of Medicine, Urbana, IL

N-butylscopolammonium bromide (NBB) is an anticholinergic agent used to treat spasmodic colic in horses. Intestinal smooth muscle spasm also occurs in horses with intraluminal intestinal obstructions such as ileal impactions, and may decrease lumen diameter in such cases. The antispasmodic effects of NBB may be useful in managing ileal impactions, but the effects of NBB on equine ileal smooth muscle are unknown. The objective of this study was to investigate effects of NBB on equine ileal smooth muscle activity using an ex vivo model. Ileal tissue was collected from 6 healthy horses after euthanasia, and isolated and circular and longitudinal smooth muscle was mounted in quadruplicate in organ baths connected to isometric force transducers. After equilibration, the effect of NBB (1mM-100mM) on spontaneous and induced contraction was determined and compared to responses in control tissue. At ≥30mM, NBB inhibited spontaneous contractions in all tissue segments that exhibited spontaneous activity. NBB inhibited carbachol-induced contraction in circular (NBB-treated EC50 1.7x10^(-4) vs. control EC50 1.5x10^(-3)) and longitudinal smooth muscle (NBB-treated EC50 8.5x10^(-3) vs. control EC50 2.0x10^(-3)). Abolishment of carbachol-induced contraction with NBB was observed at 4.5-fold lower concentrations in circular than longitudinal smooth muscle. Pretreatment with NBB inhibited carbachol-induced contraction, as NBB-treated tissue required 7.5-fold greater carbachol concentrations to produce sustained contractions than control tissue. Histamine-evoked contraction was not affected by NBB. NBB inhibited carbachol-induced contraction in circular ileal smooth muscle ex vivo, and may reduce intestinal spasms in equine ileal impactions. Further study is needed to confirm these effects in vivo.
ABSTRACT E-41
PROGNOSIS IN EQUINE COLIC: A RETROSPECTIVE STUDY OF 392 CASES: SHORT-TERM AND LONG-TERM COMPLICATIONS. CM SchulzDVM, N Nolf DVM, AM Connoum-Smith DVM, PhD, Dipl. ACVIM/ECVIM, Equine Center, VETAGROSUP LYON, Marcy L’Etoile, FRANCE.

The purpose of the study is to provide clear data on complications after a surgical or medical treatment of colic.

Three hundred and ninety-two horses admitted to the Equine Clinic (ClinEquin) of the Lyon Vet School (France) for gastrointestinal colic were used in this retrospective study.

History, clinical findings, treatments, outcomes, and complications of 392 colic cases were reviewed. Long-term follow-up data were collected. Complications were described and complication rates were calculated.

The most frequent short-term complication was recurrent colic in both medical and surgical cases (respectively: 5.7% and 22.4%). Thrombophlebitis (21.7%), incisional infection (18.9%), ileus (17.5%), diarrhea (14.7%) and pyrexia (14%) are frequently recorded after laparotomy for colic. Diarrhea (5.7%) and thrombophlebitis (5.1%) are the most common complications, second to recurrent colic, in horses treated medically for colic.

In conclusion, there is still some uncertainties and discrepancies between studies regarding long-term and also short-term complications following colic. Although types of complications are clearly described after a colic treatment, a clear consensus needs to be reached on clinical definitions of each complication, in order to be able to compare results and draw useful conclusions for clinicians.

ABSTRACT E-42
PHYSICOCHEMICAL INTERPRETATION OF ACID-BASE ABNORMALITIES IN 54 HORSES WITH ACUTE COLITIS AND DIARRHEA. DE Gomez1, LG Arroyo2, HR Stämpfli2, LE Cruz1, OJ Oliver1. 1University of Prince Edward Island, Charlottetown, Prince Edward Island, Canada, 2University of Guelpht, Guelph, Ontario, Canada, 1Universidad Nacional de Colombia, Bogotá, Colombia.

Horses with acute colitis often have electrolyte and plasma protein abnormalities which result in significant acid-base imbalances. The quantitative physicochemical approach emphasizes the importance of strong electrolytes (Na, K, Cl, L-lactate), pCO₂ and plasma concentrations of Na, K, Cl, L-lactate and calculated HCO₃⁻ and Base Excess (BE) using a Radiometer 800 Flex analyser. Strong ion difference (SID) was calculated as SID= (Na+ K)-(Cl+ L-lactate), and total protein (TP) was measured using refractometry. Anion gap (AG) and Strong Ion Gap (SIG) were calculated as: AG = (Na+ K)+Cl+ HCO₃⁻; SIG=Cl-L-lactate-A-G. A is net negative charge of plasma proteins; A⁻ = 0.22x [total protein, g/L](1+ 10⁻⁶.65-pH⁻) –¹); Electro-neutrality (EN) EN = SID-HCO₃⁻-A. If BG machine measures accurately and if no additional unmeasured anion present EN should be zero. Means values were measured plasma blood concentrations ± SD: pH = 7.38±0.05; Na= 129±3 mEq/L; K=3.1±0.7 mEq/L; Cl=94±6 mEq/L; HCO₃⁻=24±3.7 mEq/L; BE= -0.22±4.3 mEq/L; SID=35.3±4.4 mEq/L; and Atot= 12,6±3.3 mEq/L; L-lactate = 2.8±0.25 mmol/L; AG = 15.7±5.7 mmol/L; SIG = 2.8±4.8 mmol/L; Calculated AG and SIG were significantly correlated with L-lactate concentration AG=10.4 ±1.36[L-lactate] (R²= 0.44); SIG=1.90-1.17[L-lactate] (R²=0.48). The sensitivity and specificity of AG and SIG to predict hyperlactatemia for AG and SIG were 0.956 (95% CI 0.862-0.993) and 0.938 (95% CI 0.838-0.986)
respectively. Physicochemical interpretation of acid base events revealed that metabolic acidosis (strong ion acidosis) and metabolic alkalosis (hyponatremia) was concomitantly present in 30% of cases.

These results emphasize the importance of strong ions and proteins in the maintenance of the acid-base balance. AG and SIG predict the presence or absence of clinically significant hyperlactatemia. Acid-base and electrolyte abnormalities were not correlated with the outcome of survival. Electroneutrality was excellent indicating that the measuring system is accurate and that other unmeasured strong anions are unlikely present in significant concentrations in horses with colitis.

ABSTRACT E-44
PLASMA HIGH MOBILITY GROUP BOX-1 LEVELS IN HORSES WITH GASTROINTESTINAL DISEASE. JR Bauquier1, L Nath, G Forbes, SR Bailey. University of Melbourne Faculty of Veterinary Science, Werribee, Victoria, Australia.

High mobility group box-1 (HMGB-1) has been established as a late-phase cytokine in the pathophysiology of sepsis in experimental rodent models and clinical human patients. It typically increases in these species approximately 18 hours after the onset of disease, and shows potential as a therapeutic target. It has been characterized in synovial fluid of horses with joint injury, however its presence has not been investigated in horses with colic and endotoxemia. The aim of this study was to determine whether HMGB-1 is increased in horses with colic compared to normal controls. As HMGB-1 is a late-phase cytokine, it may be that more significant results will be obtained from horses with gastrointestinal disease over the course of hospitalization, rather than at admission only. Further studies are needed to determine the potential of HMGB-1 as a therapeutic target for endotoxemia in horses.

ABSTRACT E-45
IN VITRO SCREENING OF FOUR NOVEL ANTI-ENDOTOXIN AGENTS USING EQUINE WHOLE BLOOD ASSAYS. JR Bauquier, SA Bailey. University of Melbourne Faculty of Veterinary Science, Werribee, Victoria, Australia.

Endotoxemia is a common complication in horses, causing stimulation of leukocytes to produce pro-inflammatory cytokines which leads to substantial compromise to the equine patient. Due to the lack of highly effective treatments for endotoxemia in horses, there remains a need for investigation of novel therapies. The aim of this study was to determine the anti-inflammatory effect of four drugs - rolipram, azithromycin, metformin and ethyl pyruvate in equine whole blood stimulated with lipopolysaccharide (LPS). Blood was collected from 4 healthy horses for each drug tested. Drugs were added to aliquots of whole blood over a range of concentrations, after which LPS was added (E. Coli O55:B5; 1 µg/ml). Samples were then incubated at 37°C (98.6°F) for 21 hours. The anti-inflammatory effect was measured by determining tumour necrosis factor-alpha (TNF-a) levels in plasma extracted from the whole blood aliquots, using the murine L929 cell line bioassay. Inhibition of TNF-a production occurred for all drugs, with rolipram being most efficacious; having an IC50 of 1.2 µM (95% CI 0.4-3.5 µM). The IC50 values for azithromycin, metformin and ethyl pyruvate were 7.2 µM (3.0-17.6 µM), 4.5 µM (0.7-27.8 µM), and 59.9 µM (5.6-636.9 µM) respectively. Rolipram and azithromycin produced the greatest maximum inhibition at 97.2±0.6% and 98.5±0.5% respectively. The maximum inhibition caused by metformin and ethyl pyruvate were 40.9±7.5% and 26.9±7.5% respectively. These results show that rolipram, a specific phosphodiesterase inhibitor, was most effective at inhibiting TNF-a production. Further studies are needed in live horse models to determine the potential of rolipram as a therapeutic agent for endotoxemia in horses. Any potential for azithromycin as a treatment for endotoxaemia in adult horses would be limited by its contraindication due to the risk of severe colitis.
Six clinically-healthy Nooitgedacht mares were used in a randomized crossover, prospective study. Mares were assigned to 3 treatment groups and received 10, 20 and 40ml/kg Voluven® infusions with a 2-week washout period. Kaolin-activated TEG and pCP0 measurements were performed before (baseline), immediately after each infusion (0h), and at 1, 6, 12, 24, 48 and 96h. TEG values: reaction time (R), clot formation time (K), maximum amplitude (MA), and angle (g) were evaluated.

Overall mean ± SD values for 40 vs. 20 and 10ml/kg groups were: R = 18.5 ± 5.84min vs. 16.3 ± 3.41 (P = .492) and 13.4 ± 2.91 (P = .041); K = 4.61 ± 1.85min vs. 3.65 ± 0.71 (P = .025) and 3.13 ± 0.74 (P = .011); MA = 55.1 ± 7.43mm vs. 60.4 ± 4.94 (P = .268) and 58.1 ± 3.99 (P = .253); g = 39.8 ± 10.56 vs. 46.1 ± 6.92 (P = .042) and 50.4 ± 6.60 (P = .016). Overall mean ± SD pCOP values for 40 vs. 20 and 10ml/kg were: 24.1 ± 3.59mMg vs. 21.7 ± 2.01 (P = .001) and 21.0 ± 1.78 (P = .001).

For all TEG variables, there were intra-operator (between duplicate samples) and inter-operator (between operators) variabilities were determined for each parameter and cohort (summarized in Table 1). Clinical coagulation status (normal, hypo-, or hypercoagulable) of each horse was performed in duplicate by 2 operators (2 groups of 10 horses) for O1/O2 and O1/O3, respectively. For all TEG variables, there was a significant difference in test results between operators.

In conclusion, intra-operator variability of TEG ranged from 1.2-18% in this study, while inter-operator based variability minimally increased total TEG variability. Clinical coagulation assessment remained well correlated between operators.

Abstract E-48: EQUINE DIARRHEA PANEL TEST RESULTS IN 308 HORSES (2007-2010). HC Schott II1, N Grosjean1, S Bolin2. Department of Large Animal Clinical Sciences; and, 1Diagnostic Center for Population and Animal Health, College of Veterinary Medicine; Michigan State University College of Veterinary Medicine, East Lansing, MI

Establishing an etiologic diagnosis for enterocolitis in horses remains challenging. In an attempt to increase the frequency of an etiologic diagnosis in affected equids, the Diagnostic Center for Population and Animal Health at Michigan State University introduced an “equine diarrhea panel” in 2007 for testing feces and blood from horses with a clinical diagnosis of enterocolitis. The panel included a fecal culture for Salmonella spp, ELISA testing of feces for Clostridium difficile toxins A and B and Clostridium perfringens enterotoxin (TechLab, Blacksburg, VA), and (seasonally) PCR testing of blood and feces for Neorickettsia risticii. From July, 2007 through December, 2011, 322 samples were tested from 308 horses and included 166 samples submitted through the Veterinary Teaching Hospital (VTH) and 156 samples submitted from outside sources (predominantly within the upper Midwest). The most frequent positive result was for PCR testing of feces (41/156 or 26%) and blood (54/152 or 22%) for Neorickettsia risticii followed by positive ELISA results for Clostridium difficile toxins A and B (54/324 or 17%) and Clostridium perfringens enterotoxin (48/324 or 15%). Only 29 horses had positive fecal culture results for Salmonella spp during the sampling period. There were no significant differences in frequencies of positive results from samples collected from horses in the VTH as compared to those submitted from outside sources with the exception of detection of Salmonella spp. Of interest, 16 of the 54 samples with positive ELISA results for Clostridium difficile toxins A and B also had positive ELISA results for Clostridium perfringens enterotoxin. With regard to Potomac Horse Fever (PHF), 19 horses had positive PCR results for Neorickettsia risticii on both blood and feces while 14 and 18 additional horses only tested positive on blood or feces, respectively. All positive PCR results for PHF were found in samples submitted during the late spring through fall (May 13 to October 27); however, this finding is biased by the fact that testing for PHF was less commonly requested in samples submitted during the winter months. Although frequencies for positive ELISA results for clostridial toxins tended to be numerically higher in horses that also had positive PCR results for Neorickettsia risticii infection may allow concurrent induction of toxin production by enteric Clostridium spp.

Abstract E-49: OLFATORY DETECTION OF SALMONELLA ENTERICA SEROVAR NEWPORT IN HORSE FECAL SAMPLES USING GIANT AFRICAN POUCHED RATS: A PROOF-OF-PRINCIPLE STUDY. A Durgin1, RD Nolen-Walston2, N Beyene1, A Mahoney1, C Cox1, B Weetjens3, A Poling4. Anti-Persoonsmijnen Ontmijnende Product Ontwikkeling APOPO,

Table 1. Intra- and inter-operator variability of TEG values grouped by operator or operator pair. All variability values reported as: mean (standard deviation).

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>K</th>
<th>g</th>
<th>MA</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-operator: O1</td>
<td>9.0% (5.1%)</td>
<td>14% (13%)</td>
<td>9.0% (9.2%)</td>
<td>2.6% (2.4%)</td>
<td>6.6% (6.8%)</td>
</tr>
<tr>
<td>Intra-operator: O2</td>
<td>12% (9.5%)</td>
<td>13% (12%)</td>
<td>11% (14%)</td>
<td>2.8% (2.3%)</td>
<td>6.2% (4.7%)</td>
</tr>
<tr>
<td>Intra-operator: O3</td>
<td>13% (10%)</td>
<td>18% (20%)</td>
<td>10% (12%)</td>
<td>1.2% (0.8%)</td>
<td>2.9% (1.7%)</td>
</tr>
<tr>
<td>Inter-operator: O1&amp;O2</td>
<td>13% (5.1%)</td>
<td>15% (7.0%)</td>
<td>12% (9.0%)</td>
<td>3.2% (2.0%)</td>
<td>7.3% (4.5%)</td>
</tr>
<tr>
<td>Inter-operator: O1&amp;O3</td>
<td>17% (12%)</td>
<td>23% (17%)</td>
<td>11% (7.6%)</td>
<td>2.7% (1.2%)</td>
<td>6.9% (4.1%)</td>
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</table>
Nosocomial infections are a major cause of morbidity and mortality in human and veterinary patients worldwide. The rapid identification of such infections is critical in preventing such outbreaks. The hypothesis of the present study was that giant African pouched rats can distinguish rapidly and accurately between Salmonella-free equine fecal samples and those inoculated with Salmonella enterica serovar Newport. Three adult giant African pouched rats (Cricetomys gambianus) were trained using operant procedures to sniff sample pots within a semi-automated circular chamber containing horse fecal samples. Positive indications were defined as the rat keeping its nose in the sniffing hole for ≥ 3 seconds. The rats were initially trained to detect Salmonella in culture medium, then Salmonella-inoculated dried horse feces, and finally Salmonella-inoculated fresh horse feces. Rats were trained over 25 sessions, each session consisting of 50 randomized samples, 9 Salmonella-positive (18%) and 41 Salmonella-negative.

All 3 rats were able to detect Salmonella accurately in all sample types. Across rats and sessions, sensitivity and specificity, respectively, were 100% and 99% when polypropylene squares served as samples; 100% and 96% when dried horse dung was used, and 100% and 96% with fresh horse manure (table 1). These results suggest that rats can discriminate between Salmonella and the profusion of other microbes of equine fecal flora. The use of scent-detecting pouched rats shows potential to provide highly accurate, rapid, and high-throughput detection of pathogens to screen for the presence of Salmonella in samples obtained from veterinary hospitals and elsewhere.

| Table 1. Rate of false positive and false negative detections, and the probability of random positive indication by the rats using binomial distribution with a 0.5 probability of success. |
|---------------------|---------------------|---------------------|
| False (-) | False (+) | Probability of results from random chance |
| Culture medium | 100% | 0.9% | 1.09 × 10^{-15} |
| Dried horse manure | 0.4% | 12.2% | 7.14 × 10^{-11} |
| Fresh horse manure | 0% | 11.9% | 4.01 × 10^{-21} |

**ABSTRACT E-50**
**RISK FACTORS FOR ENVIRONMENTAL CONTAMINATION WITH SALMONELLA ENTERICA IN A VETERINARY TEACHING HOSPITAL.** BA Burgess, PS Morley. Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO

Salmonella enterica is commonly recognized as a cause of nosocomial infections as well as zoonotic infections in veterinary teaching hospitals (VTHs). The objective of this study was to determine risk factors associated with environmental contamination of a veterinary teaching hospital with S. enterica.

Environmental surveillance samples were collected from February 2003 through June 2011, using a commercially available electrostatic wipe, as part of the ongoing infection control program. Sampling sites included both floor and hand contact surfaces throughout the VTH. Risk factors evaluated included hospital case load, hospital use areas, severity of disease, presence of culture positive inpatients and season. Data on risk factors of interest were collected retrospectively from the VTH medical records database. Multivariable logistic regression was used to evaluate associations between hospital risk factors and veterinary hospital environmental contamination with S. enterica.

During the study period, approximately 53 samples were collected monthly, for a total of 5337 environmental samples. Of the samples collected, a total of 7.9% (n = 423) were culture positive for S. enterica using standard culture techniques. In general, environmental samples collected in the Food Animal Hospital and floor samples were more likely to be positive.

Risk factors identified in this study will allow for the refinement of existing infection control programs as well as provide guidance to those in program development. A better understanding of the risk factors associated with environmental contamination will allow for more practical evidence-based preventive measures to be implemented in veterinary hospitals experiencing epidemics of nosocomial infections with S. enterica.

**ABSTRACT E-51**
**METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) COLONIZATION IN HORSES AT A VETERINARY TEACHING HOSPITAL.** JW Stull, JS Weese. Ontario Veterinary College, Guelph, Ontario, Canada

This study evaluated an active surveillance system for MRSA in-place at a veterinary teaching hospital to better understand the epidemiology of equine MRSA colonization and effectiveness of surveillance. MRSA screening of nasal swabs is performed in horses admitted to the Ontario Veterinary College (OVC) on admission, every 7 days in hospital, and on discharge. Data from June 1, 2009 to April 30, 2011 were analysed. Cases were classified as community-associated (CA), community onset-hospital associated (CO-HA), hospital-associated (HA) or indeterminate (IN) using standard definitions.

During the study period there were 2235 admissions (1705 different horses) and 2783 MRSA surveillance samples obtained. For admissions with a duration of at least one day (n = 1277), 728 horses (57%) were screened according to protocol, 511 (40%) were screened, but less frequently than protocol, and 38 (3%) were not screened. MRSA was isolated from 80 samples during 50 visits by 40 horses (first positive visits: CA–19; CO-HA–3; HA–17; IN–1; range 0-7 per month). Overall, 3.0% of horses were positive (monthly range 0-8.6%). The prevalence at admission (CA and CO-HA combined) was 4.7% (monthly range 0-7.1%). Three horses had MRSA infections at admission and all were also colonized. No HA clinical MRSA infections were identified. spa typing was available for 18 of the isolates from different horses; 16 were spa type 064, an ST8 strain commonly found in horses. Results for first-time positive animals were available for only 7 (18%) prior to discharge. However 11 (28%) colonized horses were later re-admitted, and 7 of these were still colonized. Within 6 months of the first positive result, 5 owners of MRSA-positive horses brought 14 additional horses to the OVC, 5 (range 1-4). Three horses from one of these owners were also colonized.

Overall, compliance with MRSA surveillance sample submissions was good. The prevalence of MRSA colonization varied throughout the study period, however the 1.7% admission prevalence is similar to previous reports from this facility. The delay associated with sample processing hampers the effectiveness of screening as most horses have been discharged by the time results are known. However, using screening results to identify subsequent high risk cases can allow for use of enhanced infection control practices while awaiting test results as well as provide important information for assessment about the epidemiology of MRSA in the facility. Ultimately, rapid testing is required to optimize MRSA screening in horses.

**ABSTRACT E-51B**
**SEVOPREVALENCE TO NEOSPORA HUGHESI IN HORSES WITH SUSPECTED EQUINE PROTOZOAL MYELONEUROPATHITALIS.** N Pasterla, E Tamez-Trevino, A White, J VanGeem, AE Packham, PA Conrad. School of Veterinary Medicine, University of California, Davis, CA

Neosporosis, due to Neospora hughesi, is one cause of protozoan myeloneuropathitis (EPM), a progressively debilitating central nervous system disease in horses. There have been several. The incidence of EPM due to N. hughesi is unknown, so is its geographic occurrence. The goal of this study was to describe cases of suspected EPM that tested seropositive for N. hughesi.

**ABSTRACT E-52**
**SEROVARIATION TO IN A VETERINARY TEACHING HOSPITAL.** J VanGeem, AE Packham, PA Conrad. School of Veterinary Medicine, University of California, Davis, CA

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ABSTRACT E-52

A COMPARISON OF BACTERIAL COLONISATION BETWEEN TEFOLON AND POLYURETHANE SHORT TERM INTRAVENOUS CATHETERS, CW Spelta1, RHH Tan2, J Picard2, B Gunnowe2, 1Townville Vet Clinic, Townville, Australia, 2James Cook University, School of Veterinary Science, Townsville, Australia

The effect of catheter material on intravenous catheterisation complications in horses is unknown. Sixteen horses received Teflontm catheters and 19 received polyurethane. Aseptic catheter placement and removal was standardised, however systemic antibiop treatment was case dependant and at the clinician’s discretion. To simulate routine clinical practice, face masks were not worn during placement nor were the catheters bandaged. Catheters were maintained for 74 hours and assessed for clinical evidence of catheter site reaction, phlebitis or thrombosis twice daily. Bacteria were cultured from 69% of Teflon® and 89% of polyurethane catheters. Multiple isolates were found in 31% of Teflon® and 29% of polyurethane catheters. The Fisher exact test showed no difference between the proportion of catheters with colonisation (P = 0.28) or multiple isolates (P = 0.76). The microbes cultured were predominantly gram positive, similar to other equine and human studies. Multiple-drug resistance was seen regularly, regardless of antibiotic treatment. Despite this, no clinical evidence of phlebitis or thrombosis occurred in any horse.

It was concluded, that was no clear association between bacterial colonisation of Teflon® or polyurethane catheters (0.9 < RR < 1.87). The unexpected large proportion of bacterial isolates in the absence of clinical signs was also evaluated and suggests that the equine immune system plays a role in the development of septic phlebitis or thrombosis.

ABSTRACT E-54

PREVALENCE OF SERUM NEUTRALIZING ANTIBODIES TO EQUINE RHINITIS A AND EQUINE RHINITIS B VIRUS (ERV 1 AND ERV 2) IN SELECT REGIONS OF THE UNITED STATES, R Keene1, J Tuttle2, L Mittel2, J Morrow2, F Andrews4, 1Boehringer-Ingelheim Vetmedica, Inc. St. Joseph, MO, 2Animal Health Diagnostic Center, Cornell University Ithaca, NY, 3Equine Diagnostic Solutions, LLC, Lexington, KY, 4Equine Health Studies Program, Louisiana State University School of Veterinary Medicine, Baton Rouge, LA

Equine rhinitis viruses (ERV1&2) have been associated with respiratory disease outbreaks worldwide. ERV I&2 infections cause subclinical signs or respiratory signs including fever, nasal discharge, coughing, anorexia, pharyngitis, laryngitis and enlarged submandibular lymph nodes. Over the past decade, serologic evidence of infection has been documented in Canada, Australia, and Europe. However, recent serologic data does not exist in US horse populations. The purpose of this study was to determine seroprevalence of ERV 1&2 in different regions of the US.

Frozen serum samples were obtained from six US veterinary laboratories, Animal Health Diagnostic Center (AHDC) at Cornell University SVM, Ithaca, NY, Texas Veterinary Medical Diagnostics Laboratory Amarillo, TX, Veterinary Diagnostic Laboratory Lexington, KY, University of California at Davis Veterinary Teaching Hospital, Davis CA, Louisiana Animal Disease Diagnostic Laboratory, Equine Health Studies program, Baton Rouge, LA, and Equine Diagnostic Solutions, LLC Lexington, KY. Samples were selected from horses between 1 to 4 years of age. All samples were shipped to AHDC. Serum neutralizing (SN) antibodies were determined using an established assay. SN titers ≥ 1:96 for ERV1&2 were considered positive.

Serum samples were evaluated in 1021 horses from regions of the US and 451 (44%) were found to have neutralizing antibodies ≥ 1:96 to ERV 1 and 164 (16%) were positive for ERV 2. Seroprevalence of ERV 1 was highest in samples submitted from Louisiana (49%), whereas samples from Kentucky had the lowest seroprevalence rate (14%). Seroprevalence of ERV 2 ranged from 29% in AHDC sample submissions to 15% in Louisiana samples. Specific ages were available for 534 of the samples and seroprevalence for exposure to ERV 1 appeared to increase with age, as positive titers to ERV 1 were found in yearlings (11/126 [9%]), in 2 year olds (44/116 [38%]), 3 year olds (50/163 [31%]), and 4 year olds (52/149 [35%]). ERV has high seroprevalence in several regions of the US. SN antibodies to ERV 1 are more common than ERV 2 in the populations studied and seroprevalence appears to be age dependent. ERV I&2 infections and their relationship to concurrent respiratory disease and respiratory pathogens in horse populations warrant further investigation.

ABSTRACT E-55

PREVALENCE, RECURRENTNESS, RISK FACTORS AND EFFECTS ON PERFORMANCE OF EPISTAXIS IN RACING THOROUGHBREDS IN THE UK: 914489 STARTS (2001-2010), AD Thomas1, MJ Green1, T Morris1, 2, N Bowen GD Hallowell1, 1School Of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington,UK, 2British Horseracing Authority, London, UK

Epistaxis is a severe manifestation of exercise-induced pulmonary haemorrhage, seen in racing Thoroughbreds and other exercising horses worldwide. The objectives of this study were to report prevalence, incidence and recurrence of epistaxis, identify risk factors and report effects of epistaxis upon performance. Features of this study included the large data set, evaluation of recurrence in jump and flat racing, all in a country where race
day medication is prohibited. Cases of epistaxis were identified from all race starts (914,849) in the UK from 2001-2010 using veterinary surveillance, with additional use of stewards reports in 2010. Univariable logistic regression analyses and then multivariable mixed effect logistic regression models were built in a step-wise fashion for different race types to identify risk factors. Significance was assumed as p < 0.05. 2076 cases of epistaxis in 1776 horses were identified. The overall prevalence of epistaxis was 0.23% and 0.32% for 2010. Prevalence was 0.13% in flat race horses, 0.34% in hurdlers and 0.54% in steeplechasers. Incidence was 10.6 cases per 1000 horse cases per year with 2.3% of the racing population affected by epistaxis during the study period. Prevalence and incidence increased over the decade studied. Horses that raced over fences (p < 0.001), were competing over shorter distances (within race types; p < 0.001) and on firmer going (p < 0.001) showed increased prevalence of epistaxis. Increased risk of epistaxis was observed with age only for flat horses (p = 0.004). Horses with epistaxis were likely to have raced over more seasons (p = 0.008), but had a lower number of stars per season (p = 0.03) and a longer period between races (p < 0.0001). The number of days since the last race was higher for epistaxis performances (67 days; p < 0.003) when compared with controls (58 days). 13.5% of horses with epistaxis demonstrated recurrence (15.9%, 10.1% and 17.7% for flat racing, hurdlers and steeplechasers respectively). 71% of the recurring cases of epistaxis occurred within a year of a previous episode. Recurrence within a year was lower in steeplechase (63.7%) races when compared to flat (75.6%; p < 0.001) and hurdle races (76.2%; p < 0.001) All performance indicators which included money won, percentage of the field beaten, length of jumps, and finishing position (either won or placed in the top three) and non-completion of race demonstrated inferior race performance in those horses with epistaxis. A high percentage of horses with epistaxis did not finish (10% flat to 60% over jumps). These findings suggest it is the intensity of racing that affects the prevalence of epistaxis, and this supports either the capillary stress failure or locomotor impact-induced trauma theory.

ABSTRACT E-56

COMPARISON OF AIRWAY RESPONSE OF RECURRENT AIRWAY OBSTRUCTION AFFECTED HORSES FED STEAMED VERSUS NON-STEAMED HAY. CA Blumerich1, VA Buechner-Maxwell1, WK Scarra1, KE Wilson1, C Ricco2, I Becvarova1, J Hodgson1, S Werre1, 1Department of Large Animal Clinical Sciences, 2Department of Small Animal Clinical Sciences, 3Department of Biomedical Sciences and Pathobiology, Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, VA

Recurrent Airway Obstruction (RAO)-affected horses experience bronchoconstriction and airway inflammation in response to inhalation of aerosolized irritants including hay molds. Steaming hay reduces fungal content, but the effect on the antigenic potential of hay has not been investigated. We tested the hypothesis that RAO-affected horses develop less clinical disease when fed steamed versus non-steamed hay and this reduction coincides with decreased hay fungal content.

Six RAO-affected horses in clinical remission were divided into two groups and fed steamed or non-steamed hay for 10 days using a two-way cross-over design. Hay was steamed using a commercial hay-steamer. Clinical assessment was performed daily. Full assessment, including upper airway endoscopy, assessment of mucous scores and measurement of maximal change in pleural pressure, was performed on days 1, 5, and 10. Bronchial fluid sampling and cytology were performed on days 1 and 10. Hay core samples were collected pre- and post-steaming and cultured to determine fungal and bacterial concentrations.

Statistical analysis was performed using SAS® and included repeated measures ANOVA, mixed model ANOVA, Wilcoxon rank-sum and Wilcoxon two sample tests. P-value < 0.05 was considered significant.

Horses fed non-steamed hay experienced a significant increase in clinical score (p = 0.001) and a trend towards total airway neutrophilia (p = 0.0834) during the feeding period, while parameters were unchanged in horses fed steamed hay. Steaming also significantly decreased the number of fungal colony-forming-units in hay.

These results indicate that steaming reduces the RAO-affected horse’s response to hay which coincides with a reduction in viable fungal content of hay.

ABSTRACT E-57

COMPARISON OF AIRWAY RESPONSES IN HORSES FED ROUND BALE VERSUS SQUARE BALE HAY. J Larson1, Buechner-Maxwell VA1, J Dascanio1, S Witonsky1, I Becvarova2, RS Pleasants1, F Elvinger1, J Hodgson1, C Cossaboom1, C Seal1, S Werre2, 1DLACS, VMRCVM, Duckpond Drive, Blacksburg, VA, 2DBSP, VMRCVM, Duckpond Drive, Blacksburg, VA, 3Veterinary students, VMRCVM, Duckpond Drive, Blacksburg, VA

Feed is a major expense associated with horse ownership. Hay packaged as round bales (RB) costs approximately half that of similar square bales (SB). Recent studies indicate that feeding RB increases the risk of horses developing airway inflammation, and it is not known if this response is due to packaging, storage or hay quality differences. In this study we tested the hypothesis that there would be no difference in the respiratory health of horses fed RB as compared to horses fed SB of similar quality.

Hay harvested in mid-August from the same field and packaged as either RB or SB was fed two months later to two groups of 15 horses. RB hay was wrapped in nylon mesh, stacked and stored in an open-faced shed. SB hay was stacked and stored in an enclosed loft. At the beginning and end of a 6-week feeding period, physical and re-breathing examination, upper-airway endoscopy, trans-tracheal wash (TTW) and bronchoalveolar-lavage cytology, and TTW bacterial/fungal cultures were performed on all horses. Nutritional analysis and bacterial/fungal cultures were concurrently conducted on hay samples. Statistical analyses were completed using a mixed model ANOVA, Wilcoxon Two-sample test, Friedman’s Chi-square and a Fisher’s Exact T-test. Data was log transformed as needed. Analyses were performed using SAS® with P < 0.05 considered significant.

Horses fed RB demonstrated an increase in pharyngeal lymphoid hyperplasia (p = 0.0143) and percentage neutrophils (p = 0.0078) in the TTW samples post-feeding as compared to pre-feeding values. No additional significant differences were detected in any other measured parameters. Nutritional analysis of hay and measurements of bacterial/fungal load did not differ over time and/or between hay types.

Following a six-week exposure to RB, normal horses demonstrate subclinical evidence of upper airway inflammation as compared to horses fed SB of similar quality, suggesting that packaging contributes to this response. When eating round bales, horses bury their nostrils in hay. This behavior could result in an increased exposure to respirable particles that induce inflammation, but further studies are required to confirm this prediction.

ABSTRACT E-58

CARDIAC ECHOGRAPHIC EVALUATION OF EQUINE ELITE ATHLETES PRE AND POST ENDURANCE RACE. A Giraudet1, C Robert1, D Maso1, E Barrey1, 1Ecole Nationale Veterinaire d’Alfort, Maisons-Alfort, France, 2INRA-UMR1313, Inserm-U902, France

Equine echocardiography is routinely used in diseased horses or poor performers. Athletes evaluation pre and post an actual competition is less commonly performed.

Ten horses, 6 females and 4 gelding were examined the day before and immediately after an 90km endurance ride. All examined horses successfully completed the race. A partial echocardiographic examination was undertaken on every horses using a
Vivid I (GE, Healthcare). Gray scale 2 D images from right parasternal view with concurrent ECG were collected and stored in 3 full cardiac cycles cine loops for later analysis. Only long axis 4-chamber view were obtained. End systolic volume (measured at T repolarisation) and end diastolic volume (measured at Q onset) were measured and fractional ejection (FE) calculated. During the endocardium contouring process, it was noted that mitral valves closure seemed delayed in post race measurements. Systemic measurements of mitral valves closing time compared with Q onset were performed. To adjust to heart rate variation the mitral valves closing time (MVCT) was divided by the electric systolic duration (NMVCT). Due a non parametric distribution of the calculated values (EF and NMVCT), Wilcoxon Mann Whitney Test was used to compare pre and post race measurements (P 0.05). As previously described, FE was not affected by the endurance race. NMVCT was statistically delayed after the race, confirming a post effort prolonged isovolumetric contraction.

| tempted to 50 mph. Trained human athletes exhibit an increase in plasma ET-1 concentration or ACE activity but horses without EIPH experienced an increase in plasma ET-1 15 min following arterial hypertension. Therefore, we hypothesized that horses with EIPH would exhibit higher plasma ET-1 concentration and ACE activity. Tracheoscopy was performed 15, 30, 60, 90, and 120 min post-SET to grade EIPH severity. Data were analyzed where each horse received 0, 0.5 or 1 g/kg of sodium bicarbonate before participating in a randomized, crossover, controlled trial sized treadmill exercise test (SET).

We concluded that EIPH is not associated with an elevation in pulmonary artery pressure, a mechanism that has been implicated in the pathophysiology of exercise-induced pulmonary hemorrhage (EIPH). Endothelin-1 (ET-1) and angiotensin converting enzyme (ACE) may act either directly or indirectly to cause pulmonary artery hypertension. Therefore, we hypothesized that horses with EIPH would exhibit higher plasma ET-1 concentration and ACE activity compared to horses without EIPH following a standardized treadmill exercise test (SET).

Eight Standardbred race horses were trained for 8 weeks before participating in a randomized, crossover, controlled trial where each horse received 0, 0.5 or 1 g/kg of sodium bicarbonate by nasogastric intubation 4 hours prior to SET performed until fatigue. Venous blood was collected prior to training, prior to SET and 15 min post-SET for ET-1 assay and measurement of ACE activity. Tracheoscopy was performed 15, 30, 60, 90, and 120 min post-SET to grade EIPH severity. Data were analyzed using analysis of variance for repeated measures. Significance level was set at P < 0.05.

Three horses exhibited EIPH. Plasma ET-1 concentration and ACE activity were not significantly affected by training or bicarbonate treatment. Plasma ET-1 concentration increased significantly 15 min after SET in horses without EIPH (0.99 ± 0.55 pg/ml) at which point it was significantly higher than in horses with EIPH (0.64 ± 0.34 pg/ml). ACE activity in plasma was significantly higher 15 min post-SET (69.8 ± 16.3 U/L) than before (53.8 ± 11.9 U/L) in 3 horses. Blood was detected at the carina as early as 15 min post-SET with maximum EIPH score being reached at 30 min. EIPH score 120 min post-SET was significantly lower than at 30 min post-SET. We concluded that EIPH is not associated with an elevation in plasma ET-1 concentration or ACE activity but horses without EIPH experienced an increase in plasma ET-1 15 min following strenuous exercise. Trained human athletes exhibit an increase in ET-1 that peaks 30 minutes following exercise consistent with findings in horses of this study.

**ABSTRACT E-60**

**EQUINE PULMONARY CYTOKINE ENVIRONMENT AND MICROBIAL ACTIVITY OF MACROPHAGES IN FOALS VERSUS ADULTS.** JM Gilbertie, S.A Wiechert, SK Clark, M Bhanda, B Sponser, B Delaire, D Jones, BA Sponser, Iowa State University, College of Veterinary Medicine, Ames, IA

Pneumonia is the most common cause of morbidity and mortality in foals less than 6 months of age; however, adult horses, unless immunocompromised, are not as susceptible to such respiratory infectious agents, including *Rhodococcus equi*. We speculate that the pulmonary cytokine environment differs between the neonate and adult thereby imparting differing phenotypes to pulmonary alveolar macrophages (PAMs). This could result in different pressure of microbial infection. Therefore, we hypothesized that acute monocyte-derived macrophages (MDMs) from blood and pulmonary-alveolar macrophages (PAMs) from bronchoalveolar lavage fluid (BALF). MDMs and PAMs were stimulated in vitro with IFNγ and subsequently infected with *R. equi* transformed with a GFP/tdRed plasmid enabling enumeration by fluorescence. Consistent with our hypothesis, MDMs and PAMs derived from foals yielded a higher bacterial load than in adults. Also, foals exhibited lower levels of peroxynitrite production as compared to the adult. Cytokine profiles, including TNFα and IL-10 from BALF, were characterized by IL-10 and IL-12 production in the supernatant of *R. equi* infected MDMs and PAMs. Taken together, these critical differences indicate that foal macrophages are more susceptible to infection with *Rhodococcus equi* and support the notion that the cytokine milieu impacts the microbicidal response of the macrophage.

**ABSTRACT E-61**

**EQUINE MONOCYTE-DERIVED DENDRITIC CELLS STIMULATE PROLIFERATION AND FOXP3 EXPRESSION IN AUTOLOGOUS, REACTIVE T CELLS.** DJ Cavatoria, MJ Felippe. Cornell University College of Veterinary Medicine, Ithaca, NY

Dendritic cells (DCs) represent a heterogeneous population of innate immune cells specialized in immune surveillance, antigen presentation, and initiation of the adaptive immune response. DCs are uniquely capable of stimulating naïve T cells and can generate a variety of effector responses, anergy, or even tolerance. Therefore, DCs are an essential component of a successful immune response, and a detailed understanding of the interactions between DCs and T cells is relevant to many areas of immunology. We have developed a method of isolating and coculturing relatively pure populations of equine monocyte-derived DCs with autologous, CFSE-stained peripheral blood T cells. The magnitude and nature of the DC-induced T cell response was monitored using multi-color flow cytometry to measure T cell proliferation, surface marker expression, and cytokine production.

We discovered that equine monocyte-derived DCs, but not macrophages, are able to potentiate proliferation of autologous, reactive T cells in the absence of foreign antigen (p < 0.002). This process, termed the autologous mixed leukocyte reaction (AMLR), is a defining feature of DCs not yet described in cells from a domestic animal species. The equine AMLR is contact-dependent (p < 0.005), MHC class I- and II-dependent (p < 0.02), and primarily involves CD3+, CD4+, CD8- T cells. A subset of the proliferating T cells expresses the regulatory T
cell (Treg) transcription factor FoxP3. Many of these DC-stimulated, FoxP3+ T cells can produce effector cytokines, indicating that FoxP3 expression in the horse, in contrast to the mouse, is required similarly in FoxP3+ T cells that may play an important role in immune regulation. Furthermore, we anticipate that future antigen-specific analyses of the interactions between DCs and T cells in this manner will enhance our knowledge of the equine immune system and promote the development of improved immunotherapeutic strategies.

ABSTRACT E-62
ARE BLOOD EQUINE NEUTROPHILS INHERENTLY RESISTANT TO GLUCOCORTICOIDS? G Hirsch, A Lavoie-Lamoureux, J-P Lavoie. Université de Montréal, St-Hyacinthe, QC/CA

Human neutrophils are considered poorly responsive to glucocorticoids (GC). The reported increase in survival caused by GC on this cell population partly supports this assertion. In heaves-affected horses, the persistent airway neutrophilia after GC administration may be explained by this process. However, it was recently shown that dexamethasone exerts potent anti-inflammatory effects on equine peripheral blood neutrophils through both genomic and non-genomic pathways.

...Because objective support for the corticosteroid resistance of neutrophils is lacking, we assess the effects of three glucocorticoids on apoptosis of equine blood neutrophils and compare their transcriptional effects on neutrophils and mononuclear cells. To determine if these effects are species specific, data obtained from horses were compared with those of human neutrophils and mononuclear cells.

Peripheral blood neutrophils and mononuclear cells were isolated from 6 healthy horses. To assess apoptosis, neutrophils were incubated 20h with hydrocortisone, prednisolone or dexamethasone (10^-6M - 10^-8M). Quantification of Annexin V-APC, and 7-AAD binding was performed by flow cytometry. To evaluate transrepression effects, neutrophils and mononuclear cells were incubated 5h with or without LPS (100ng/mL) alone or combined with GC. IL-8, IL-1β and TNF-α mRNA expression was quantified by qPCR. Transrepression effects of dexamethasone on human neutrophils and mononuclear cells were also studied.

Stimulation with all three GC resulted in a significant increase in equine neutrophil survival. They also significantly down-regulated the LPS-induced mRNA expression of the three genes of both equine and human neutrophils and mononuclear cells. These effects operate in a dose-dependent manner and dexamethasone appears to be the most potent drug.

These results indicate that glucocorticoids increase survival in equine neutrophils but that these cells appear at least as responsive as mononuclear cells to glucocorticoids.

ABSTRACT E-63
HEMATOPOIESIS IN THE EQUINE FETAL LIVER SUGGESTS IMMUNE PREPAREDNESS. JM Battista, T Stokol, MJB Felippe. College of Veterinary Medicine, Cornell University, Ithaca, NY

Our laboratory studies the development of the immune system of the horse. Though B lymphocyte development is one of the best-studied hematopoietic pathways, little is known about its origin in the equine fetus, although it can produce antigen-specific immunoglobulins around 200 days of gestation. Studies in other species show that hematopoietic stem cells (HSC) generated in the aorta-gonad-mesonephros region and yolk sac seed the fetal liver, which becomes the main hematopoietic organ and supports the development of B lymphocytes during fetal life.

The purpose of our study was to learn how B cell hematopoiesis and immunoglobulin production develop in the equine fetus during gestation. Our hypothesis was that hematopoiesis occurs in the liver at early gestation with the generation of B cells with limited immunoglobulin diversity. Equine fetal liver cells were harvested around 100 days of gestation, and the presence of hematopoietic stem cells and leucocytes were investigated at the molecular and cellular levels.

The mRNA expression of molecules and transcription factors involved in early lineage-specific hematopoietic differentiation including c-KIT, CD34, IL7R, CXCL12, IRF8, PU.1, PAX5, NOTCH1, GATA1, CEBPA were detected using RT-PCR. Immunohistochemistry and flow cytometric analysis indicated that approximately 5% of the cells were positive for the HSC marker CD34, whereas 1-5% of cells stained positive for T lymphocyte markers (CD2, CD3, CD4, CD5, CD8) and B lymphocyte markers (CD19, IgM) in equine fetal liver. In addition, a subset of cells expressed myeloid markers (CD11b, CD172a). To characterize the pre-immune B cell repertoire, heavy and lambda immunoglobulin light chain V(DJ) segments were cloned, sequenced, and analyzed. The fetal liver sequences had similar V(DJ) gene segment usage and complementarity determining region 3 (CDR3) amino acid length, but had a higher degree of nucleotide identity with germine sequences compared to those isolated from adult horse bone marrow.

Our study demonstrates, for the first time, active B cell hematopoiesis in the equine fetal liver around 100 days of gestation, with a diverse, albeit in lower magnitude, pre-immune immunoglobulin repertoire in comparison to the adult horse. The immunoglobulin diversity develops in an essentially sterile environment, appears more extensive than other reported species, and may have implications in equine neonatal immune-compliance and response to vaccines.

ABSTRACT E-64
VERTEBRAL OSTEOMYELITIS AND DISKOSPONDYLITIS IN FOALS. MC Coleman1, MK Chatlin1, J Griffin1, WV Corapi1, TE Norman1, NM Slovis2, AL Johnson2, KG Magdesian2, CL Clark2, TM A&M College of Veterinary Medicine, College Station, TX, 2Hagyard Equine Medical Center, Lexington, KY, 3University of Pennsylvania New Bolton Center, Kennett Square, PA, 4University of California School of Veterinary Medicine, Davis, CA, 5Peterson and Smith Equine Hospital, Ocala, FL

There are several cases reports in the literature of vertebral osteomyelitis and/or diskospondylitis in the foal; however, to the authors’ knowledge there are no large studies evaluating the clinical features and outcome of this disease in foals.

The objective of this study was to describe the signalment, clinical signs, results of clinicopathologic testing, results of diagnostic imaging (radiography, CT, ultrasonography) and necropsy examination, results of microbiologic testing, location of lesions, treatment, and outcome of foals less than 1 year of age affected with vertebral osteomyelitis and/or diskospondylitis.

Data from 15 foals, from 5 different referral centers were retrospectively evaluated. Foals less than 1 year of age with radiographic and/or necropsy findings consistent with osteomyelosis were included in the study. Foals ranged in age from 2 weeks to 4 months. There were 11 males and 4 females with a variety of
breds represented. The most common clinical signs included fever, tachycardia, tachypnea, anorexia, and lethargy. Spinal ataxia and recumbency were noted in 1/2 and 1/5 of foals, respectively. Clinicopathologic features were variable, with an elevated white blood cell count in half of the cases. Lesions in the cervical vertebral body were most common. Evidence of a septic process of another body system was noted in less than half of the cases. Seven foals survived to discharge.

In conclusion, vertebral osteomyelitis and diskospondylitis are uncommonly reported in foals. Clinical signs and clinicopathologic features are variable. Prognosis is guarded for affected foals.

ABSTRACT E-65
VERTEBRAL OSTEOMYELITIS AND DISKOSPONDYLITIS IN ADULT HORSES, MC Coleman1, MK Chaffin1, J Griffin1, WV Corapi1, TE Norman1, AL Johnson2, KG Magdesian3. 

Vertebral osteomyelitis is uncommonly reported in adult horses. While there are several case reports of vertebral osteomyelitis and/or diskospondylitis in the literature, to the authors' knowledge there are no large studies evaluating the clinical features and outcome of this disease in adult horses.

The objective of this study was to describe the signalment, clinical signs, results of clinicopathologic testing, results of diagnostic imaging (radiography, CT, ultrasound) and necropsy examination, results of microbiologic testing, location of lesions, treatment, and outcome of adult horses affected with vertebral osteomyelitis and/or diskospondylitis.

Clinical data from 3 different referral centers were retrospectively evaluated. Cases with radiographic and/or necropsy findings consistent with osteomyelitis were included in the study. Cases consisted of 11 males and 8 females, ranging in age from 2-24 years. A variety of breeds were represented. The most common clinical signs included stiffness and poor performance. Neurologic deficits were noted in 1/3 of cases, all characterized by symmetric ataxia in all four limbs. Clinicopathologic features were variable, with a normal white blood cell count in 80% of the cases. Lesions in the cervical vertebral body were most common. No significant differences were observed for latencies and intercol of stimulation (11.33 Hz/70 dBNHL; 11.33 Hz/90 dBNHL; 90 Hz/70 dBNHL).

In conclusion, vertebral osteomyelitis and diskospondylitis are uncommonly reported in horses. Clinical signs and clinicopathologic features are variable. Prognosis is guarded to fair.

ABSTRACT E-66
CLASSIFICATION AND PREDICTIVE FACTORS OF SEIZURES IN HORSES, VA Lacombe1,2, M Mayes2, S Mosseri3, SM Reed4, TH Ou5. 1Department of Veterinary Clinical Sciences, 2College of Pharmacy, The Ohio State University, Columbus, OH, 3The Equine Clinic, Peyrolles, France, 4Rood & Riddle Equine Hospital, Lexington, KY, 5The University of Michigan College of Pharmacy, Ann Arbor, MI

Although many studies have been performed to classify seizures in humans and small animals, similar epidemiologic study is lacking in horses. The purpose of this study was to characterize seizures based on their type in 104 horses presented for seizure disorders at The Ohio State University Veterinary Medical Center in a retrospective case series.

Seizures were classified based on ictal phenomenology and seizure type, according to most recent accepted definitions in both human and small animal epileptology. History, clinical and neurologic observations, diagnostic investigations (e.g., electroencephalograms, cerebrospinal fluid analysis and computed tomography imaging of the head) and postmortem examinations, when available, were recorded for univariate and multivariate logistic regression analyses.

Seizures were categorized as primary generalized in 24% of horses, simple and complex partial without secondary generalization in 45% of cases, secondary generalized in 20% of cases, and unclassified in 11% of cases. Status epilepticus was recorded in 2% of cases. Seizure type was not associated with etiology. For a horse with recurrent seizures (i.e., epilepsy), the odds of having partial seizures was higher (P < 0.05) compared to a similar horse with generalized seizures in the multivariate logistic regression analysis.

This study provided a comprehensive classification of seizures by type in a referral-based equine population. Similar to human and small animal classification, the majority of the seizures described were partial seizures with or without secondary generalization. Predictive factors of epilepsy in horses were similar to those reported in other species and may assist the clinician with the early diagnosis of epilepsy.

ABSTRACT E-67
BRAINSTEM AUDITORY EVOKED RESPONSE IN FOALS UP TO 6 MONTHS OLD: REFERENCE VALUES AND EFFECT OF AGE, RATE OF ACUSTIC STIMULATION AND NEUROLOGICAL DEFICITS, L Lecoq, M Gains, JL Habershon-Butcher, JL Habershon-Butcher, IM Bowen, GD Hallowell. School Of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington,UK

Age and rate of acoustic stimulation affect peak latencies in human auditory evoked responses (BAER) to human. Those effects are unknown in foals. The goals of this study were to 1) establish references values for BAER in foals using 3 different stimulation protocols, 2) evaluate the effects of age and rate of stimulation on BAER traces in foals up to 6 months old, and 3) compare the data with BAER obtained from foals with CNS disorders.

Thirty nine foals neurologically normal and 16 foals with neurologic diseases. BAER were recorded using 3 different protocols of stimulation (11.33 Hz/70 dBNHL; 11.33 Hz/90 dBNHL; 90 Hz/70 dBNHL). No effects of age were observed in normal foals (p > 0.005). No significant differences were observed for latencies and interpeak latencies (IPL) when neurologic foals were compared to normal foals (p > 0.05). Increasing the stimulation rate did not improve the detection of CNS disorders. All neurologically abnormal foals had latencies and IPL within reference values but 78.6% had an asymmetry in their traces, reflecting a difference in conduction time between the left and right size of the brainstem.

We provide reference values of BAER for foals up to 6 months using 3 different protocols. Further investigations are needed to conclude on the use of an increased rate of acoustic stimulation in foals. Most importantly, most foals with neurologic deficits had also an abnormal BAER. This proves BAER is useful is the early diagnosis of neurological disorders in foals.

ABSTRACT E-68
VALIDATION AND RELIABILITY OF ORTHOGONAL ULTRASONOGRAPHIC PROJECTION DIMENSIONS OF THE KIDNEY IN THE HORSE, JL Habershon-Butcher, IM Bowen, GD Hallowell. School Of Veterinary Medicine and Science, University of Nottingham, Sutton Bonnington,UK

The aims of this study were to evaluate a novel translumbar (TL) ultrasonographic method for assessment of renal dimensions, to establish a normal reference range and to assess reliability of renal dimensions obtained using this new approach when compared with a conventional transabdominal (TA) ultrasonographic technique and measurements obtained at postmortem. Six Thoroughbred or TB cross horses, weighing 513 to 580Kg, were examined prior to slaughter. Both kidneys were imaged in short and long axis using the TL and conventional TA projections. Both cranial and caudal poles of the right kidney were assessed. A minimum of twelve ultrasonographic cine-loops were obtained and stored for later analysis from both the left and right kidneys. The overall length, width and depth were determined, as were the thickness of the cortex, medulla and
pelvis. The measurements were repeated in cadaveric material. All measurements were undertaken by two observers to assess reproducibility and measured on three separate occasions by one observer to evaluate measurement repeatability. Measurements were compared using Student’s T-test, ANOVA and post-hoc Bonferroni and coefficient of variation and reliability was assessed using repeated measures ANOVA and intra-class correlation coefficients (ICC’s).

Both kidneys were consistently identified by both methods in the 15-17th intercostal spaces (ICS) and paralumbar fossa with maximal dimensions as obtained for the left kidney in the 16th ICS and for the right kidney in the 15th ICS. Image quality was good to excellent for both techniques. There was no difference between dimensions obtained by TA or TL projections and good correlation between ultrasound dimensions and post-mortem measurements (Table 1: ICC > 0.8). Excellent repeatability and reproducibility (ICC > 0.80) was obtained for all measurements. Reliability was better for larger structures. The TL technique is easily performed and produces reliable dimensions that may assist with the diagnosis of renal disease in horses.

Non-steroidal anti-inflammatory drugs are widely used in equine practice, exerting their therapeutic effect by decreasing cyclooxygenase (COX) activity and thereby limiting production of pro-inflammatory prostaglandins. However, prostanooids mediate a number of protective mechanisms which are particularly important for gastrointestinal and renal homeostasis. It has been hypothesised that drugs which selectively target COX-2, the induced isorm of this enzyme, may be safer analgesic and anti-inflammatory agents than non-selective COX inhibitors. The present study was undertaken to compare the effects of meloxicam, a COX-2 selective non-steroidal anti-inflammatory drug (NSAID), with those of the non-selective drug phenylbutazone on renal responses of healthy adult horses to furosemide, dobutamine and exercise in healthy horses. SL Raidal, KJ Hughes, AL Charman, S Nielson, GK Noble. School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga, NSW, Australia

Ureteral catheterisation was used to determine urine flow and to collect samples for determination of exogenous creatinine clearance during three hours of confinement following administration of placebo, phenylbutazone (PBZ, 4.4 mg/kg PO) or meloxicam (MEL, 0.6 mg/kg PO) to nine lightbreed mares. Treatment order was randomised and a Latin square design utilised such that each horse received all treatments. Thereafter, the effect of NSAID treatment on responses of these horses to the subsequent administration of furosemide (1 mg/kg IV), dobutamine (5 μg/min/kg IV for 30 minutes) and submaximal exercise were assessed over a similar time period in three consecutive studies.

Consistent with previous studies, NSAID administration had no significant effect on baseline renal function of horses. Prior treatment with PBZ or MEL attenuated increases in urine flow.
ABSTRACT E-71
EFFECT OF BUTORPHANOL ON THERMAL NOCICEPTIVE THRESHOLD IN HEALTHY PONY FOALS, KT McGowan1, JR Ellenbein1,2, SA Robertson1, LC Sanchez2, 1University of Florida College of Veterinary Medicine, Gainesville, FL, 2Texas A&M University College of Veterinary Medicine and Biomedical Sciences, College Station, TX

Analgesia is an important component of foal medical care, and no objective data currently exist regarding the analgesic efficacy of opioids in foals. The study objective was to evaluate the somatic anti-nociceptive effects of butorphanol in healthy foals. The hypothesis was that thermal nociceptive threshold would increase following intravenous butorphanol but not intravenous saline administration in neonatal and older pony foals.

Seven healthy neonatal pony foals, 1-2 weeks of age, and 11 healthy older pony foals, 4-8 weeks of age were evaluated. Some foals were used during both age periods. Interventions, which included butorphanol (0.018 mg/kg) and butorphanol (0.013 mg/kg) and butorphanol (0.1 mg/kg) were administered in a blinded, randomized cross-over design with at least 2 days between interventions. Each dose was adjusted with saline to a total volume of 0.5 mL. Response variables included thermal (TT) nociceptive threshold, skin temperature (ST) and behavior score. Each was recorded prior to and at 15, 30, 45, 60, 90, 120, 150, and 180 minutes following treatment.

A significant (P<0.05) increase in thermal threshold, relative to time 0, was noted following butorphanol (0.01 mg/kg) administration at times 15-60 and 120-150 minutes in neonates and at times 15-90 and 150 minutes in older foals. Significant time effects were noted within other treatments in either age group. No significant time or treatment effects were apparent for skin temperature. Significant time, but not treatment, effects were evident for behavior score in both age periods.

Butorphanol shows analgesic potential in both neonatal and weanling age foals.

ABSTRACT E-72
SYSTEMIC AND ANTI-NOCICEPTIVE EFFECTS OF PROLONGED CONTINUOUS RATE INFUSIONS OF ANALGESIC COMBINATIONS IN HEALTHY HORSES, JR Ellenbein1,2, SA Robertson1, RJ MacKay1, LC Sanchez2, 1University of Florida College of Veterinary Medicine, Gainesville, FL, 2Texas A&M University College of Veterinary Medicine and Biomedical Sciences, College Station, TX

Analgesic combinations are used to treat horses with severe signs of pain. The purpose of this study was to determine the effects of prolonged constant rate infusions (CRI) of lidocaine (L), butorphanol (B), and ketamine (K) alone and in combination on gastrointestinal transit, behavior, and thermal nociceptive threshold in healthy horses.

Eight healthy adult horses, each equipped with a gastric cannula for purposes of other studies were used. Interventions were saline, L, K, B, LB, BK, and LBK as an intravenous CRI for 96 hours in a randomized cross-over design with investigators blinded to treatment. Drugs were mixed or diluted in saline; CRI rate was 0.15 mL/kg/hr (Table). Two-hundred plastic beads were administered intragastrically by nasogastric tube immediately prior to the bolus. Feces were collected every 2 hours, weighed, and beads manually retrieved. Behavior was scored every 2 hours, vital parameters every 6 hours, and wireless thermal threshold every 12 hours for 96 hours.

Four of 64 trials (3 LBK, 1 BK) were discontinued early due to mild colic. There were no apparent differences between groups in vital parameters or thermal threshold. Transit time was delayed for LB and LBK with a corresponding decrease in fecal weight. Analgesic combinations cause a delay in gastrointestinal transit in healthy horses without substantially affecting somatic nociception at the doses studied.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Bolus (15 minutes)</th>
<th>CRI</th>
</tr>
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<tbody>
<tr>
<td>Saline</td>
<td>60 mL</td>
<td>0.15 mg/kg/hr</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>1.3 mg/kg</td>
<td>3 mg/kg/hr</td>
</tr>
<tr>
<td>Butorphanol</td>
<td>0.018 mg/kg</td>
<td>0.013 mg/kg/hr</td>
</tr>
<tr>
<td>Ketamine</td>
<td>0.55 mg/kg</td>
<td>0.5 mg/kg/hr</td>
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</tbody>
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ABSTRACT E-73
FIROCOXIB LOADING DOSE TRIAL IN HORSES, S Cox, C Sommardahl, J Yarbrough, A Amicucci, K Reed, D Breeding, T Doherty, University of Tennessee, College of Veterinary Medicine, Knoxville, TN

The objective of this study was to determine if a single loading dose, three times the label dose of firocoxib oral paste, followed by nine maintenance doses at the current label dose achieves and maintains near steady state concentrations. Six healthy, adult mares received 0.3 mg/kg of firocoxib on Day 0, followed by 0.1 mg/kg administered at 24 hours on Day 1, and at 24 hour intervals Day 2 through Day 9, for a total of 10 doses. Blood samples were collected at 0 (prior to treatment), 0.25, 0.5, 1, 2, 4, 6, and 12 hours post treatment on Day 0, prior to treatment on Day 1, and at the same times as Day 0. Blood samples were also collected prior to each treatment on Days 2-9 and at 0.25, 0.5, 1, 2, 4, 6, 12, 24, 48, 72, 96, 120, 144, and 168 hours post treatment on Day 9. Samples were centrifuged and plasma stored frozen until analyzed by a validated HPLC-MS method.

After the initial loading dose of 0.3 mg/kg (3X label dose), the average maximum concentration was 199 ng/mL. After the first maintenance dose of 0.1 mg/kg the maximum average concentration was 171 ng/mL. At steady state (after the last dose) the maximum average concentration was 183 ng/mL. This indicates near steady state concentrations are achieved after the first dose. The maximum and minimum plasma concentrations (Cmax and Cmin) at steady state ranged from 110-243 ng/mL and 50-168 ng/mL, respectively. There was no indication of unexpected accumulation. The average AUC (0-tau) was 150 ng/mL*days.

ABSTRACT E-74
SAFETY AND PHARMACOKINETICS OF TOPICAL 1% DICLOFENAC SODIUM CREAM IN HEALTHY NEONATAL FOALS, S Barnett, D Seldon1, M Hines1, D Neelis1, R Mealey1, H Knycz1, R Keene1, 1Washington State University, Pullman, WA, 2University of California-Davis, Davis, CA, Boehringer Ingelheim, St. Joseph, MO

This study evaluated the biochemical, renal, and gastrointestinal effects of topical 1% diclofenac sodium cream (Surpass®) in healthy neonatal foals.

A randomized, blinded, controlled, clinical trial was performed on 12 healthy Arabian or part-Arabian foals that were 2-14 days of age and weighed 27-54 kilograms on day 1 of the study. Cream (7.3 mg [1.3 cm strip] of diclofenac or equivalent volume of Cetaphil® hand moisturizer) was applied to a clipped area over the left tibiotarsal joint twice daily for 7 days. Serum chemistry, CBC, urinalysis, urine gamma-glutamyltransferase:urine creatinine (uGGT:uCr), renal and right dorsal colon ultrasound,
and gastric endoscopy were evaluated on the first and last days of study. Foals were monitored daily and showed no signs of systemic illness during the study. Venous blood was obtained at specific time points for pharmacokinetic analysis. Data was compared using 2-sample t-test or ANOVA as appropriate. No adverse events related to diocleoean treatment occurred. No statistically significant differences (p < 0.05) between groups were observed. Changes in uGTF:Co ratios, which were considered the most sensitive parameters, were not different between groups (p = 0.93). Skin and hair growth were normal at the application site throughout the study and at 2-6 months following the study. Plasma concentrations of diocleoean were low but detectable in treatment foals throughout the study. 

Diocleoean sodium applied to clipped skin of healthy neonatal foals at 7.3 mg twice daily for 7 days was a safe dosing regimen. Evaluation of efficacy in reducing pain and inflammation in the equine neonate is warranted.

**ABSTRACT E-75**

**PHARMACOKINETICS OF GALLIUM MALTOLATE IN HEALTHY AND LAWSONIA INTRACELLULARIS-INFECTIOND RABBITS.** F Sampieri1, J Alcorn1, AL Allen1, CR Clark1, FA Vannucci2, N Pusterla2, KR Ball2, PM Dowling2, LM Dowling3, LR Bernstein3, CJ Gebhart3, DL Hamilton1. 1Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, SK, Canada, 2College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, SK, Canada, 3College of Veterinary Medicine, University of Minnesota, Saint Paul, MN, 4School of Veterinary Medicine, University of California, Davis, CA, 5Canadian Light Source, Saskatoon, SK, Canada, 6Terrametrics, Menlo Park CA, USA

We hypothesized that gallium maltolate (GaM) may prove efficacious as a novel antimicrobial agent for weaning foals affected by equine proliferative enteropathy (EPE), caused by *Lawsonia intracellularis* (LI). This is one of a series of experiments where, in a rabbit infection model of EPE, we addressed pharmacokinetics (PK) and pharmacodynamics characterization of GaM. Since gallium may interfere with iron uptake pathways, we compared PK and intestinal tissue (IT) concentrations of elemental gallium [Ga] and iron [Fe] after oral administration of GaM to LI-infected and uninfected rabbits. The Animal Research Ethics Board of the University of Saskatchewan approved these studies.

Twelve, 8 to 9 wk old pathogen-free New Zealand White does, 2 to 2.5 kg, were divided into 2 groups of 6 animals: uninfected group (control) and LI-infected group (EPE). Both groups were treated once intragastrically with LI (approx. 2.5 x 10^8 LI/rabbit) and then assigned to 3 groups (8 animals each): untreated (CON-LI), medium-only treatment, q 24h, orally; GaM-treated (GaL-LI) 50 mg/kg q 48h orally; and doxycycline-treated (DOXY-LI) 5 mg/kg q 24h, orally. Treatment started 7 days post-infection for each group. Tissues were collected daily from each group and blood was collected from each doe once weekly for serology. A week from the first treatment, all rabbits were sacrificed and gastrointestinal tissues (GIT) were collected from intestinal tracts characteristically affected by EPE. All GIT samples were frozen at -20°C and or immediately fixed in 10% phosphate buffered formalin. In all groups, EPE was confirmed via detection of LI-specific antibodies using immuno-peroxidase monoclonal assay, quantitative PCR on feces and EPE-specific antibodies on intestinal and GIT tissues. Tissues were stained with H&E and EPE lesions were stained via IHC in mid and end-late stages of the infection.

GaM-dosed EPE rabbits not only have reduced Ga concentrations in GIT and blood (Ga-LI), but also reduced Fe, despite its constant availability in the diet. Furthermore, GaM-dosed EPE rabbits not only have reduced Ga in GIT and blood but also reduced Fe, despite its constant availability in the diet.

**ABSTRACT E-76**

**EFFICACY OF GALLIUM MALTOLATE AGAINST LAWSONIA INTRACELLULARIS INFECTION IN A RABBIT MODEL.** F Sampieri2, A.L Allen1, J Alcorn2, CR Clark2, FA Vannucci3, N Pusterla2, KR Ball2, PM Dowling2, L Thompson2, LR Bernstein3, CJ Gebhart3, DL Hamilton1. 1Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, SK, Canada, 2College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, SK, Canada, 3College of Veterinary Medicine, University of Minnesota, Saint Paul, MN, 4School of Veterinary Medicine, University of California, Davis, CA, 5Canadian Light Source, Saskatoon, SK, Canada; 6Terrametrics, Menlo Park CA, USA

Rabbits act as a time-compressed infection model for weanling foals affected by equine proliferative enteropathy (EPE), due to *Lawsonia intracellularis* (LI). As gallium maltolate’s (GaM) anti-microbial efficacy against LI is difficult to evaluate in vitro, we administered GaM to LI-infected rabbits (GAL-LI). Also, we compared GaM efficacy with untreated LI-infected controls (CON-LI) and doxycycline-treated LI-infected positive controls (DOXY-LI), as doxycycline is the leading treatment in clinical cases. The Animal Research Ethics Board of the University of Saskatchewan approved this study.

Twenty-four, 5 to 6 wk old, pathogen-free New Zealand White does, 1.2 to 1.5 kg, were infected intragastrically with LI (approx. 2.5 x 10^8 LI/rabbit) and then assigned to 3 groups (8 animals each): untreated (CON-LI), medium-only treatment, q 24h, orally; GaM-treated (GaL-LI) 50 mg/kg q 48h orally; and doxycycline-treated (DOXY-LI) 5 mg/kg q 24h, orally. Treatment started 7 days post-infection for each group. GaM was administered once weekly for serology. A week from the first treatment, all rabbits were sacrificed and gastrointestinal tissues (GIT) were collected from intestinal tracts characteristically affected by EPE. Samples were frozen at -20°C, or immediately fixed in 10% phosphate buffered formalin. In all groups, EPE was confirmed via detection of LI-specific antibodies using immuno-peroxidase monoclonal assay, quantitative PCR on feces and EPE-specific antibodies on intestinal tissue. Tissues were stained with H&E and EPE lesions were stained via IHC in mid and end-late stages of the infection. As gallium maltolate’s (GaM) anti-microbial efficacy against LI is difficult to evaluate in vitro, we administered GaM to LI-infected rabbits (GAL-LI). Also, we compared GaM efficacy with untreated LI-infected controls (CON-LI) and doxycycline-treated LI-infected positive controls (DOXY-LI), as doxycycline is the leading treatment in clinical cases. The Animal Research Ethics Board of the University of Saskatchewan approved this study.

EPE lesions were typically stained via IHC in mid and end-late stages of the infection and cecum, but no difference due to treatment was detected in the said GIT (p values 0.35; 0.77; 0.74 respectively).

**ABSTRACT E-77**

**PHARMACOKINETICS OF INTRAVENOUS CONSTANT RATE INFUSIONS OF CEFTIATUR SODIUM IN THE ADULT HORSE.** S Khalfan, S Edwards SL Ridal. School of Animal and Veterinary Sciences, Charles Sturt University, Wagga Wagga, NSW, Australia

Ceftiatur is a time dependent bactericidal antimicrobial. As such, plasma concentrations should be maintained above the mean inhibitory concentration (MIC) of target organism(s) for greater than 80% of the inter-dosing interval. Many Gram negative pathogens have MICS approaching or exceeding 1 – 2 µg/mL, concentrations which are unlikely to be maintained in vivo by the use of intermittent dosing. In human patients, β-lactum
antimicrobials are often administered as a continuous rate infusion (CRI) to ensure that plasma concentrations are maintained at high levels for the duration of treatment. For hospitalised equine patients, a CRI is readily implemented and may offer a therapeutic and economic advantage over bolus treatments. Cefiotetan sodium (285 µg/kg/h) was administered by CRI to six healthy thoroughbred / standardbred mares (age 3 to 9 years, body weight 488 to 630 kg) for 48 hours following a 3.2 mg/kg IV loading dose. Plasma samples were collected for determination of desufuryceftiotrione concentrations prior to loading and at 1, 5, 10, 15, 30 and 60 min following commencement of treatment, and then at regular intervals throughout the duration of infusion. Plasma samples were also collected after 48 hours of treatment and at 1, 2, 3, 4, 8, 12 and 18 h following completion of CRI. Synovial fluid samples were collected from intercarpal and radiocarpal joints after 48 h CRI, and at 2, 8 and 18h following completion of treatment. CRIIs were well tolerated by all horses. Appetite, demeanour, faecal output and consistency were unaffected by treatment. No changes were observed in haematological or serum chemistry parameters post-infusion, when compared with values obtained prior to infusion. Peak plasma desufuryceftiotrione concentrations (28.2 ± 8.3 µg/mL, mean ± sd; range 20.4 to 41.7 µg/mL) were observed 1 h following administration of the loading dose. Thereafter plasma concentrations plateaued by 3 to 4 h hours after commencement of CRI and remained constant at 6.3 ± 1.3 µg/mL. Synovial fluid concentrations at 48 h were 2.0 ± 0.8 µg/mL. The total amount of cefiotetan administered to each horse was approximately 46% of the total dose administered by bolus dosing at 10 mg/kg q 12h.

**ABSTRACT E-78**

**USE OF COMBINATION OF TAZAROTENE CREAM AND IMIQUIMOD CREAM IN THE TREATMENT OF EQUINE SARCOIDS: A 20 CASE RETROSPECTIVE STUDY.** Y Tamzali, M Boidot. INP-Ecole Vétérinaire de Toulouse, Université de Toulouse, France

Sarcoïdes are the most common cutaneous neoplasms of horses. Despite the numerous types of treatments that have been developed, none is universally effective, and the rate of recurrence of surgical excision is usually high. Successful management has been achieved with the use of radiotherapy and chemotherapy, and more recently with the use of electrochemotherapy. However biosafety constraints restrict their use to qualified equine structures. Topical treatments could be used in ambulatory practice at the owners place could offer a valuable alternative to these treatments. Imiquimod, an imidazoquinolizinone, is an immune response modifier with antitumoral and antiviral activity successfully used in humans in the treatment of cutaneous tumours such as melanomas, carcinomas and actinic keratosis. In equine medicine, a 5% imiquimod cream has been tested successfully in the treatment of equine sarcoïdes and aural plaque. Tazarotene normalizes the behaviour of the keratinocytes, which is used for its keratolytic activity on verrucaus (warty) form of equine sarcoïdes. The aim of this study was to confirm the efficacy of 5% imiquimod in treatment of equine sarcoïde, and to evaluate the benefit of a prior treatment with a 0.1% tazarotene cream. 24 cases were treated from June 2007 to June 2010. 20 cases totaling 83 tumours (T0 to T3 according to Owen’s classification) met the criteria for inclusion in the study. The four remaining cases were excluded because of lack of treatment compliance. Animals were also required to have complete medical records and a minimum follow-up of 12 months. Two large tumours (one T3 and one T4) were subjected to prior debulking. Tazarotene 0.1% cream was applied daily for two weeks prior to imiquimod 5% cream which initial prescription duration was every other day for 12 weeks and pursued until complete resolution of tumours if necessary. All tumours responded well with a complete response rate of 63% at 12 weeks, 87% at 16 weeks and up to 100% at 21 weeks. There was no influence of the tumour size on the duration of treatment (p= 0.153). 35% of lesions resulted in persistent alopecia after treatment but alopecia was significantly correlated (p=0.0001) with keratinization (verrucaus sarcoïdes) which resulted in pretreatment alopecia. In 53% of tumours hair regrowth was observed while leucotrichia was observed in 12% of treated tumours. The major side effect was inflammation and pain at the treatment site especially in thin skin regions. This was controlled in most cases with NSAIDs administration but was also the cause of some treatments lack of compliance. This study provides additional evidence of the effectiveness of imiquimod on superficial sarcoïdes and suggests that the combination of tazarotene and imiquimod topical treatments may improve the results compared to previous studies.

**ABSTRACT E-79**

**REDUCED CARDIAC OUTPUT IN HORSES ANESTHETIZED AFTER DANTROLENE ADMINISTRATION.** E McKenzie1, S Di Concetto2, M Payton1, R Mandsager1, M Akers2, Oregon State University, Corvallis, OR, 2St George’s University, Grenada, West Indies, 3Oklahoma State University, Stillwater, OK, 4University of Ljubljana, Ljubljana, Slovenia

Dantrolene may prevent post-anesthetic myopathy in horses. This study examined the effect of dantrolene on cardiac output (CO) and other variables in healthy horses under general anesthesia, and on the duration and quality of anesthetic recovery.

In a randomized cross-over trial, six horses were administered dantrolene (6 mg/kg in 2L of water) or water (2L) via nasogastric tube one hour before commencing 90 minutes of isoflurane anesthesia. CO was measured via lithium dilution technique seven times during anesthesia concurrently with analysis of plasma potassium concentration. Anesthetic recovery was scored by two anesthesiologists blinded to treatment groups. Serum creatinine (CK) was measured before and 4, 8 and 12 hours after anesthesia. Data were analyzed by repeated measures ANOVA (p < 0.05).

Dantrolene caused significantly lower CO (L/min) at the 2nd (30.5±2.8 vs. 24.4±2.1), 3rd (28.1±1.3 vs. 20.9±3.0) and 4th (27.9±0.9 vs. 20.9±2.5) measurements after which time difficulty obtaining valid measurements in dantrolene-treated horses suggested further decline. Plasma potassium (mEq/L) was significantly higher after dantrolene at the 5th (4.5±0.3 vs. 5.2±0.3), 6th (4.5±0.2 vs. 5.3±0.5), and 7th (4.5±0.2 vs. 5.9±0.7) measurements. Cardiac arrhythmias necessitated premature recovery of two dantrolene-treated horses. Recovery time was not different between treatments but quality score was superior after dantrolene. Serum CK (U/L) was significantly lower 4 hours (2873±1721 vs 325±79) and 8 hours (3159±2073 vs 351±88) after anesthesia with dantrolene.

In conclusion, dantrolene reduces muscle damage in horses undergoing general anesthesia without inhibiting anesthetic recovery, but decreases cardiac output and can precipitate hyperkalemia and arrhythmias.

**ABSTRACT E-80**

**RESPONSE OF ACTIVATED EQUINE CHONDROCYTES FROM CARPAL AND HOCK JOINTS TO AN AVOCADO/SOYBEAN UNSPAROFILABLES, GLUCOSAMINE, CHONDROITIN SULFATE, PENTOSAN POLYSULFATE, AND N-ACETYL GLUCOSAMINE COMBINATION.** LF Heinecke1, AC Mrozinski1, MW Grzanna2, S Hilliard1, LF Heinecke1, AC Mrozinski1, MW Grzanna2, Y Tamzali, M Boidot. INP-Ecole Vétéranie de Toulouse, Université de Toulouse, France

The pathogenesis of osteoarthritis (OA) has been attributed to up-regulation of pro-inflammatory molecule expression in chondrocytes and other joint tissues. These molecules include prostaglandin E2, cytokines, and chemokines. Expression of these genes is regulated by the transcription factor nuclear factor-kappa B (NF-B). Inhibition of their up-regulation is a major objective for the management of OA. While OA affects articular cartilage in different joints, little is known whether the inflammatory response of chondrocytes varies from different sites. In the present study, we compared the response of chondrocytes isolated from carpal and hock cartilage to cytokine stimulation. We also evaluated whether these stimulated chondrocytes would display similar responses to the mixture of avocado/soybean unsaponifiables.
ABSTRACT E-81
LAMINAR ANTIOXIDANT GENE EXPRESSION IN EXPERIMENTALLY-INDUCED EQUINE LAMINITIS: A COMPARISON OF TWO MODELS. TA Burns1, MR Watts1, T Westerman2, JK Belknap1. 1College of Veterinary Medicine, The Ohio State University, Columbus, OH, 2College of Veterinary Medicine, Oregon State University, Corvallis OR

Oxidative stress reportedly plays an important role in sepsis-induced organ dysfunction/failure in many species. While oxidative events are also likely to occur in laminae in sepsis-associated laminitis, we have recently reported minimal evidence of end-stage oxidative tissue injury in models of sepsis-related laminitis. A robust antioxidant response to oxidative events might underlie the lack of oxidative tissue modification observed in the digital laminae of horses with experimentally-induced laminitis. The laminar antioxidant response to experimentally-induced equine laminitis has not been fully characterized, and this response has not been directly compared between the black walnut extract (BWE) and enteral carbohydrate overload (CHO) models of laminitis. Antioxidant enzymes likely to be present in laminar tissue include superoxide dismutase 1 (SOD1)/cytosolic SOD, SOD2/ mitochondrial SOD, SOD3/extracellular SOD, glutathione peroxidase 1 (GPX1, cytosolic), and GPX4 (membrane-associated). We hypothesized that these genes would be expressed at higher concentrations in the laminae of laminic animals compared with that of control animals. Archived digital laminar tissue collected at various time points from adult horses subjected to BWE (n = 15) and CHO (n = 20) induced laminitis were used for this study. Laminar antioxidant gene expression was evaluated at both the transcript (RT-qPCR) and protein (Western immunoblot) levels. In the CHO model, no change in mRNA concentration of GPX1 (p = 0.91), GPX4 (p = 0.43), SOD1 (p = 0.56), or SOD3 (p = 0.29) was detected at the developmental or OG1 time points when compared with controls. The concentration of SOD2 mRNA, however, was significantly elevated at the OG1 time point when compared with controls (p = 0.0019). In the BWE model, laminar mRNA concentrations of GPX4 (p = 0.018) and SOD2 (p = 0.0004) were significantly increased at the OG1 time point when compared with samples from both control and developmental time points. Concentrations of SOD1 and SOD3 mRNA were significantly lower at the OG1 time point compared with the developmental time point in this model (p = 0.0075 and p = 0.021, respectively). The protein concentration of SOD2 within digital laminar tissue was increased at the developmental and OG1 time points in both models; this was the only gene that demonstrated a change in protein concentration. These results of this study suggest that up-regulation of antioxidant genes within the digital laminae may play a role in mitigating the extent of oxidative tissue modification that occurs in the setting of experimentally-induced laminitis; future studies including assessments of non-enzymatic antioxidants and total reductive capacity of laminar tissue would further our understanding of the laminar antioxidant response.

E-82B
IMMUNOLOGIC AND PHYSIOLOGIC RESPONSE TO VACCINATION AGAINST ANGIOTENSIN II IN ADULT HORSES. RC Carmichael1, TC Holbrook2, G Jennings2, P Maurer2. 1Oklahoma State University, Stillwater, OK. 2Cytos Biotechnology, Schlieren, Zurich Switzerland

Hypertension is documented in equine diseases including metabolic syndrome, laminitis and other conditions. Although effective treatments for hypertension in the horse are limited. The purpose of this study was to investigate the immunologic response of normotensive adult horses to vaccination with Ang-Qb, a modified angiotensin II structure linked to virus-like particles, and determine its effect on arterial blood pressure. Six adult horses were vaccinated intramuscularly with 900 µg of AngQb on three different occasions, one month apart. Serum samples for anti-angiotensin II antibody titer determination were used to describe test characteristics and to identify appropriate cut-off values. C ANP was higher in horses with heart disease (103.0 [13.5-488.0] pg/mL, median [range]) compared to healthy controls (65.0 [22.0-92.0] pg/mL; p = 0.01). When considering all 4 groups, the difference was only significant between control horses and group 4 (137.0 [13.5-488.0] pg/mL). At a cut-off value of 95.5 pg/mL, C ANP had a sensitivity of 57% (95% CI: 44-70%) and a specificity of 100% (95% CI: 78-100%) for diagnosing heart disease in horses. However, the test did not allow discrimination between groups 2, 3 and 4.

In conclusion, C ANP increases with heart diseases affecting chamber function. Using the RIA applied in this study, C ANP can be used as a biomarker to identify horses with heart disease with high specificity but low sensitivity. The diagnostic value of this biomarker is compromised by the large overlap in C ANP between healthy horses and horses with heart disease.
ABSTRACT E-83

HYPERTENSIVE CARDIOMYOPATHY IN HORSES.
C Navas de Solís , J Slack , V.B Reef .
New Bolton Center, University of Pennsylvania, Kennett Square, Pennsylvania

The objective was to describe the clinical presentation, physical examination, prognosis, echocardiographic and autopsic findings of horses with hypertensive cardiomyopathy. Records from cases presented between 1995 and 2011 diagnosed with cardiac hypertrophy and systemic hypertension (systolic and mean non invasive blood pressure > 144 and 116 mmHg respectively) were studied retrospectively.

Five horses met the inclusion criteria (0.26% of horses evaluated for cardiac disease). There were 3 geldings and 2 mares of multiple breeds with a mean±SD age of 18±4 years (range 13-24). The main diagnoses were chronic laminitis in 3 cases and chronic renal failure in two. Persistent tachycardia, hypertension, chronic laminitis or a combination of these prompted the cardiac evaluation. Non invasive blood pressure was determined by ELISA and pathologic findings of horses with hypertensive cardiomyopathy. Records from all horses that underwent necropsy with both mean (R = - 0.24; P = 0.03) and diastolic (R = - 0.22; P = 0.05) arterial pressure. While a robust immunologic response to AngQb vaccination was demonstrated, additional studies are warranted to evaluate arterial blood pressure responses in hypertensive horses.

ABSTRACT E-84

OXIDATIVE METABOLISM AND IN VITRO IMMUNE RESPONSE OF HORSES SUPPLEMENTED WITH VITAMIN COMPLEX ADE.
RW Weigel, M Mirian Souza, FN Fernandes, WR Della Libéra, AMMP Sucupira M.C.A..
University of São Paulo, Brazil

Horses working at explosive exercise are subject to oxidative stress. Animals unable to balance the production of reactive oxygen species (ROS) and antioxidant reaction can lose performance and have longer recover time. The aim of this study was to evaluate oxidative metabolism and in vitro immune response of polo players equines treated or not with parenteral ADE vitamin complex.

Twenty horses, crossbred, 7.0 (± 1.7) yrs of age, trained for equestrian polo matches were used. They were randomly distributed in two groups. Control group received 10 mL of physiologic saline solution, IM, and the Treated group received 1mL/50kgBW IM of the supplement containing vitamins A (27 000 000 IU / 100mL), D₃ (8 000 000 UI/100mL) e E (8 000 mg/100mL). The horses were at rest 60 days before the game. The research began with an application 30 and 15 days before the start of training. At the first training blood samples were collected before the game (M0), 15 minutes (M1), 90 minutes (M2) and 3 hours (M3) after the only chukker. Plasma was assayed for malondialdehyde (MDA). Superoxide dismutase (SOD) concentration was determined in red blood cells. Reduced glutathione (GSH) and burst-phagocytosis were determined in total blood. The burst-phagocytosis was performed by flow cytometry. Treatments were compared by ANOVA (Tukey test) and Pearson coefficient was determined between variables using Statistical Software MINITAB®.

There were no differences in the concentrations of MDA, SOD, GSH and burst-phagocytosis between Control and Treated groups (P > 0.05). Only the SOD concentration and phagocytic intensity were negatively correlated (r = -0.302 and P = 0.1). In this study parenteral ADE supplementation didn’t make a difference in the oxidative metabolism and in vitro immune response in horses trained for polo matches.

ABSTRACT E-85

ASSESSMENT OF VITAMIN E LEVELS IN A POPULATION OF HEALTHY ADULT HORSES.
K Vander Werf, E G Davis, C Blevis. Kansas State University, Manhattan, KS

Equine Motor Neuron Disease (EMND) is associated with chronic vitamin E deficiency resulting in neuromuscular weakness, hyperhidrosis, preferred recumbency, and muscle fasciculation. Among 7 clinical cases presented within the past 3 years, 57% had adequate serum vitamin E levels (ref. range: 2.0-4.0 µg/mL).

Serum tocopherol levels in 50 healthy, adult horses maintained on dry lots and 50 horses maintained on pasture for at least 1 year were analyzed at a commercial laboratory. Variables examined included vital parameters, environment (dry lot vs pasture), duration in environment, and concentrate supplementation. Horses were excluded if in the current environment for less than 1 year.

Vitamin E levels of horses maintained on pasture (5.44 ± 2.26 µg/mL) and those maintained on dry lot (mean: 3.99 ± 2.84 µg/mL) were significantly different (p = 0.0003). Additionally, there was a significant positive correlation between age and tocopherol level (r = 0.30, p = 0.0026). Geldings maintained on dry lots had significantly lower tocopherol levels than mares maintained in the same environment or geldings and mares on pasture (p = 0.03). There was no significant correlation between breed, brand of pelleted feed, or duration in current environment and serum vitamin E levels.

Horses maintained on dry lots should be monitored for signs of EMND and should have vitamin E levels measured on a regular basis. Geldings appear to be at risk of low vitamin E levels when maintained in dry lot environments. Supplementation with vitamin E is recommended for horses with levels less than 2.0 µg/mL.

SMALL ANIMAL – ENDOCRINOLOGY

ABSTRACT EN-1

RESTORATION OF EUTHYROIDISM IN MEDICALLY TREATED HYPERTHYROID CATS WITH IATROGENIC HYPOTHYROIDISM (IH) IMPROVES RENAL FUNCTION.
TL Williams, J Elliot, HM Syne. Royal Veterinary College, London, UK

IH is reported to increase the incidence of azotemia in hyperthyroid cats following treatment. IH is also associated with a decreased heart rate (HR), packed cell volume (PCV) and plasma alkaline phosphatase activity (ALP). Hypothyroidism reduces glomerular filtration rate (GFR) in other species, and treatment of hypothyroidism in dogs is reported to increase GFR. There-
fore, it could be postulated that adjustment of anti-thyroid medication in cats with IH to achieve euthyroidism would also improve GFR, and hence reduce plasma creatinine concentration and the incidence of azotemia. This study aimed to compare renal function in cats with IH before and after dose adjustment of anti-thyroid medication (methimazole or carbimazole) to achieve euthyroidism.

Medically treated hyperthyroid cats with documented IH (plasma total thyroxine concentration (TT4) < 10 nmol/l) in combination with plasma cTSH > 0.15 ng/ml) were prospectively recruited into the study between July 2009 and March 2011. Dose adjustments were made to anti-thyroid medication every four weeks until euthyroidism was restored (TT4 10-40 nmol/l). If restoration of euthyroidism was achieved more than eight months after documentation of IH, the cat was excluded from further analysis. Body weight (BW), body condition score (BCS), systolic blood pressure (SBP), PCV, HR and plasma concentrations of urea, creatinine, cholesterol, total calcium and plasma activities of alanine aminotransferase (ALT) and ALP were recorded at baseline and once euthyroidism was achieved. Continuous data are presented as median [25 th, 75th percentile]. Clinical pathological parameters were compared at baseline and following restoration of euthyroidism using the Wilcoxon signed rank test. Statistical significance was defined as P<0.05.

Twelve cats were eligible for inclusion. Baseline TT4 and cTSH of the cats were <4.0 [<4.0, 6.1] nmol/l and 3.45 [0.48, 5.93] ng/ml respectively. At baseline, 9/12 cats were azotemic (plasma creatinine concentration >2 mg/dl). TT4 following dose adjustment was 24.9 [15.4, 26.6] nmol/l. Restoration of euthyroidism resulted in a significant decrease in plasma creatinine concentration (2.50 [1.92, 3.16] mg/dl vs. 2.07 [1.42, 2.66] mg/dl; P = 0.005), and azotemia resolved in 3/9 cats. Restoration of euthyroidism also resulted in a significant increase in plasma ALP (20.8 [15.8, 30.8] U/l) vs. 31.5 [23.2, 45.7] U/l; P = 0.004) and HR (186 [174, 204] beats per minute (bpm) vs. 214 [182, 225] bpm; P = 0.034), and a significant decrease in BW (3.91 [3.36, 4.15] kg vs. 3.70 [3.23, 4.16] kg; P = 0.026). No significant changes in BCS (P = 0.603), SBP (P = 0.875), PCV (P = 0.329), plasma concentrations of urea (P = 0.239), cholesterol (P = 0.530), total calcium (P = 0.182) or plasma ALT activity (P = 0.388) were observed following restoration of euthyroidism.

Restoration of euthyroidism in cats with IH improves renal function, evaluated using plasma creatinine concentration, and decreases the incidence of azotemia, although changes in BW could influence plasma creatinine concentrations. Measurement of GFR in cats with IH before and after dose adjustment is warranted.

**ABSTRACT EN-2**

**THYROID SCINTIGRAPHY FINDINGS IN 917 CATS WITH HYPERTHYROIDISM.** ME Peterson 1, MR Broome 2.

Animal Endocrine Clinic, New York, NY; 2Advanced Veterinary Medical Imaging, Tustin, CA

Thyroid scintigraphy provides valuable information regarding both thyroid anatomy and physiology and plays an integral role in the diagnosis, staging, and management of feline thyroid disease. Recently, Harvey et al (Scintigraphic findings in 120 hyperthyroid cats. JFMS 2009;11: 96) reported that nearly 1 of 5 hyperthyroid cats had multiple areas of increased radionuclide uptake (IRU) visible on thyroid imaging, commonly with intra-thoracic tissue that could not be palpated. Many of those cats, however, were referred for persistent or recurrent hyperthyroidism so this may not represent what is seen in general practice. In this study, we performed thyroid imaging on 917 consecutive hyperthyroid cats that were referred for radioiodine therapy between January and December 2009. Scintigraphy was performed as part of our staging protocol in which thyroid volume is estimated for 131I dose estimation (Vet Radiol Ultrasound 1996;27:141).

Of the 917 cats, 594 (65%) had bilateral thyroid lobe uptake in the "expected" neck location, whereas 279 (30%) had unilateral thyroid uptake. The remaining 44 cats (4.8%) had multiple areas of IRU or areas of ectopic tissue not in the neck area. Of the 917 cats, areas of IRU ranged from 1-5 (median 2), with 39 (4.2%) cats having >3 (Table 1). Areas of IRU were located in the neck in 906 (98.8%), thoracic inlet in 105 (11.5%), and in the thorax in 44 (4.8%); 22 cats (2.4%) had IRU in all 3 locations (neck, thoracic inlet, thorax). The estimated size of thyroid tumor(s) in the 917 cats were small (<2.5 cm³) in 517 (56%), medium-sized (2.5-5 cm³) in 243 (26%), and large (>5 cm³) in 166 (18%). Cats with large thyroid tumors had a higher pretreatment median serum T4 value (20.6 μg/dl) than did cats with medium-sized (13 μg/dl) or small masses (6.4 μg/dl). Cats with large tumor volumes had been hyperthyroid for longer (median, 12 mos) than were cats with small or medium-sized tumors (1 mo). Of the 157 cats with large thyroid masses, 14 were suspected of having thyroid carcinoma, with an overall incidence of 1.7%. Ectopic thyroid tissue was diagnosed in 30 (3.3%) cats; of these, large tumor size was found in only 6 cats (20%).

In conclusion, results of this study confirm that multiple areas of hyperfunctional thyroid tissue do develop in hyperthyroid cats, but at an incidence much lower than previously reported. Ectopic thyroid tissue occurs in 1-2% of hyperthyroid cats, many with only mild to moderate hyperthyroidism. Thyroid carcinoma develops in 1.5% of cats, but these cats characteristically have huge goiters, very high serum T4 values, and long-standing hyperthyroidism.

**ABSTRACT EN-3**

**AMINO ACID, IODINE, SELENIUM, AND COAT COLOR STATUS AMONG HYPERTHYROID, SIAMESE, AND AGE-MATCHED CONTROL CATS. BR Sabatino 1, CA Kirk 1, BW Rohrbach 1, PJ Armstrong 2. 1University of Tennessee College of Veterinary Medicine, Knoxville, TN; 2University of Minnesota College of Veterinary Medicine, St. Paul, MN**

Hyperthyroidism is common among older cats, but its pathogenesis remains poorly understood. Siamese and Himalayan cats have a reduced risk of hyperthyroidism compared to other cats. Tyrosine is the amino acid precursor for thyroxine and melanin. Earlier studies reported tyrosine as a limiting amino acid in some cat foods resulting in poor coat melanin production in dark-coated cats. Because Siamese and Himalayan cats have unique tyrosine metabolism responsible for a pointed coat color, this study evaluated the relationship of tyrosine, phenylalanine, iodine, or selenium levels in hyperthyroid cats compared to normal cats and if light or pointed coat color is protective with greater tyrosine availability due to lowered use for melanin production.

**Table 1.** Plasma tyrosine, plasma phenylalanine, serum iodine, and serum selenium levels in hyperthyroid cats compared to control cats (range; median value).

<table>
<thead>
<tr>
<th>Group</th>
<th>Tyrosine (nmol/mL)</th>
<th>Phenylalanine (nmol/mL)</th>
<th>Iodine (ppm)</th>
<th>Selenium (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperthyroid (n=12)</td>
<td>56-88; median 61</td>
<td>61-91; median 82</td>
<td>0.13-0.46; median 0.19</td>
<td>0.37-0.55; median 0.48</td>
</tr>
<tr>
<td>Control (n=15)</td>
<td>38-95; median 67</td>
<td>62-126; median 93</td>
<td>0.08-0.30; median 0.17</td>
<td>0.36-0.60; median 0.47</td>
</tr>
</tbody>
</table>
Twenty-seven client-owned cats with \( n = 12 \) and without \( n = 15 \) hyperthyroidism were studied. Coat color (9 white or pointed; 18 dark), breed, and diet history were recorded. Whole blood was collected for CBC, serum chemistry, total thyroxine (TT4), serum iodine, serum selenium, and plasma amino acid determination in fasted cats. A mixed model ANOVA with cat and group included as class variables was used to evaluate the relationship between group study factors (significance = \( P \leq 0.05 \)).

Chemistry and CBC values were similar among groups except for TT4 levels. Tyrosine, phenylalanine, iodine, and selenium levels were not significantly different among light or dark cats or cats with or without hyperthyroidism. Altered tyrosine metabolism associated with coat color does not explain the reduced risk of hyperthyroidism in pointed or light coat colored cats.

**ABSTRACT EN-4**

**EFFECT OF THE STAGE OF CHRONIC KIDNEY DISEASE ON SERUM TOTAL THYROIDINE IN CATS**

AB Vieira, MCN Castro, M Salomão, LC Gershony, AMB Soares, AMR Ferreira. College of Veterinary Medicine, Universidade Federal Fluminense, Rio de Janeiro, Brazil

Non-thyroidal illnesses, such as chronic kidney disease, are one of the factors that can affect total thyroxine and hinder the diagnosis of hyperthyroidism in cats. Cats with chronic kidney disease are currently staged according to the degree of azotemia based on the IRIS (International Renal Interest Society) guidelines. The purpose of the present study was to determine the influence of chronic kidney disease stage on serum total thyroxine (TT4) in cats.

Total thyroxine was measured by chemiluminescent immunoassay in the serum of 32 healthy cats and 33 cats with various degrees of chronic kidney disease. Nineteen cats were classified as IRIS stage 2, nine cats as IRIS stage 3 and four cats as IRIS stage 4.

Cats with chronic kidney disease had significantly lower \( (p < 0.0001) \) mean serum TT4 concentrations than clinically healthy cats. Mean serum TT4 concentration decreased 34.73% in the IRIS stage 2 group, 41.67% in the IRIS stage 3 group and 55.58% in the IRIS stage 4 group when compared to the control group. Even though mean TT4 concentrations decreased with the increase of azotemia in the CKD groups, values were only significantly different when compared to cats in the control group.

The results of the present study suggest that any stage of chronic kidney disease can lead to the suppression of total thyroxine concentration in cats.

**ABSTRACT EN-6**

**DETERMINATION OF REFERENCE VALUES FOR CASUAL BLOOD GLUCOSE CONCENTRATION IN CLINICALLY-HEALTHY, AGED CATS MEASURED WITH A PORTABLE GLUCOSE METER FROM AN EAR OR PAW SAMPLE.**

MK Reeve-Johnson, JS Rand, S Anderson, RD Marshall, D Vankan. Centre for Companion Animal Health, School of Veterinary Science, University of Queensland, Australia. The Cat Clinic, Brisbane, Australia. School of Biomedical Science, University of Queensland, Australia.

Pre-diabetes is used to describe an intermediate stage between normal glucose homeostasis and type 2 diabetes. Pre-diabetes is estimated to be 4 times more prevalent than diabetes in the human population and pre-diabetic patients are at high risk of developing diabetes. Criteria for diagnosis of human pre-diabetes are either impaired fasting glucose (>6.1 to < 7 mmol/L; >110 to >126 mg/dL) or impaired glucose tolerance (7.8 < 11.1 mmol/L; 140mg/dL two hours following an oral glucose load). A casual—or non-fasted—blood glucose concentration can be used as a screening test; scores >11.1 mmol/L (200mg/dl) are considered abnormal. The incidence of pre-diabetes in cats is unknown, and there is a need to develop diagnostic criteria and screening tests for this in cats. Such criteria are especially important for aged cats because they are most at risk of diabetes. As cats are susceptible to stress hyperglycemia and fasting samples are often impractical to obtain, the diagnostic methodology should minimize stress and be based on casual blood glucose concentrations. Previous studies in cats have documented no statistical difference in blood glucose concentrations in capillary blood and venous blood.

The aim of this study was to determine reference values for casual blood glucose concentration in samples obtained in healthy cats \( > 8 \) years old from a paw or ear sample (study method), and to compare these values with values obtained from a jugularsample after a physical examination (traditional method). Clinically healthy cats \( n = 74 \) aged \( > 8 \) years old were recruited for the study; 8 cats were excluded due to concomitant medical problems or owner withdrawal, and 66 cats were enrolled. A casual blood sample was taken from the ear or paw at the beginning of the consultation. Blood glucose was measured immediately after sample collection using a portable blood glucose meter calibrated for feline blood (AlphaTRAK, Abbott Laboratories). A physical examination was performed before a further blood sample was taken from the jugular vein.

The inter- and intra-assay coefficients of variation for the glucose meter were 2% and 3.3% respectively. Mean blood glucose was 5.6 mmol/L (100.8 mg/dl) range 3.5-10.3 mmol/l) for the study method and 6.4 mmol/L (115.2 mg/dl) range 4.2-10.7 mmol/l) for the traditional method. The upper limit of the 90% confidence interval for blood glucose for the study method was 9.7 mmol/L (174 mg/dl) for all breeds excluding Burmese, and 10.1 mmol/L (182mg/dl) for Burmese cats. Blood glucose concentrations were 0.7 mmol/L (13 mg/dl) lower (95% confidence interval 0.39 to 1.0 mmol/L; \( p < 0.05 \)) when measured by the study method compared with the traditional method (72% of cats had a lower value). This study is the first to report the upper reference value for casual blood glucose concentration in aged, healthy cats, and demonstrates a simple method for screening for pre-diabetes in cats.

**ABSTRACT EN-7**

**EARLY-ONSET HYPOADRENOCORTICISM IN A KINDRED OF POMERANIANS.**

ET Mooney, TN Hammond, OM Mahony. 1Tufts Veterinary Emergency Treatment and Specialties, Walpole MA, 2Cummings School of Veterinary Medicine at Tufts University, North Grafton, MA

Hypoadrenocorticism (Addison’s disease) is an uncommon endocrine disorder in dogs that typically affects middle-aged females. Familial hypoadrenocorticism has been demonstrated in several breeds including leonbergers, standard poodles, Nova Scotia duck tolling retrievers and Portuguese water dogs. The
purpose of this report is to describe a family of pomeranians with early-onset hypoadrenocorticism.

Three pomeranians, full siblings from two litters, were presented at 12 months, 17 months, and 26 months of age with clinical signs and laboratory findings consistent with hypoadrenocorticism including cardiovascular collapse and severe hyponatremia (125 mmol/L, 118 mmol/L, and 115 mmol/L). One dog was female and the others were male. ACTH stimulation testing confirmed hypoadrenocorticism in all dogs. Dogs were treated with intravenous fluid resuscitation and glucocorticoid and mineralcorticoid replacement and made a complete recovery. Both parents and the other 4 siblings are currently healthy, and have never exhibited signs of hypoadrenocorticism.

This is the first report of an early-onset hypoadrenocorticism in pomeranians. An inherited basis is proposed to be the cause however further documentation will be required to confirm a breed predisposition.

**ABSTRACT EN-8**

**CLINICAL FEATURES OF HYPOADRENOCORTICISM IN SOFT-COATED WHEATEN TERRIERS: 72 CASES (1979-2011)**

RL Haviland, RL Toaff-Rosenstein, MP Reeves, MP Littman. University of Pennsylvania School of Veterinary Medicine, Philadelphia, PA

This retrospective study evaluated the clinical features of spontaneous hypoadrenocorticism in Soft-coated Wheaten Terriers (SCTW) and with increased risk clinical records of 98 client-owned SCTW from North America diagnosed with hypoadrenocorticism were reviewed. Inclusion criteria were met in 72 cases (39 male, 33 female) including ACTH stimulation test results consistent with hypoadrenocorticism (pre-, post-cortisol >2.0 ug/dl), serum electrolyte values recorded at diagnosis, and absence of exogenous corticosteroid administration >1 month prior to diagnosis. Signalement, history, clinical signs, physical examination (PE) findings, clinicopathologic data, survival time, and concurrent disease were reviewed. Median age at diagnosis was 4.6 years (range 0.5-11.4 years). Common clinical signs were lethargy (77%), anorexia (74%), vomiting (66%), and diarrhea (30%). The PE was unremarkable in 41% of cases; common abnormalities were dehydration (24%), depressed mentation (17%), thin body condition (15%), and bradycardia (4%). Electrolyte findings included Na/K ratio ≤50 (96%), Na/K ratio ≤27 (85%), hyperkalemia (77%), hyponatremia (63%), or no abnormalities (12%). The lymphocyte count was ≥2.0 x 10^3 in 49 of 58 patients (84%). Median survival time following diagnosis was 3.2 years (range 0.8-6.6 years). Cause of death was largely unrelated to hypoadrenocorticism. The most common concurrent disease was protein-losing nephropathy (19%). Compared with prior studies concerning the general canine population with spontaneous hypoadrenocorticism, this study population showed no gender predisposition, less likelihood of serum electrolyte abnormalities and concurrent disease were reviewed. Median age at diagnosis was 4.6 years (range 0.5-11.4 years). Common clinical signs were lethargy (77%), anorexia (74%), vomiting (66%), and diarrhea (30%). The PE was unremarkable in 41% of cases; common abnormalities were dehydration (24%), depressed mentation (17%), thin body condition (15%), and bradycardia (4%). Electrolyte findings included Na/K ratio ≤50 (96%), Na/K ratio ≤27 (85%), hyperkalemia (77%), hyponatremia (63%), or no abnormalities (12%). The lymphocyte count was ≥2.0 x 10^3 in 49 of 58 patients (84%). Median survival time following diagnosis was 3.2 years (range 0.8-6.6 years). Cause of death was largely unrelated to hypoadrenocorticism. The most common concurrent disease was protein-losing nephropathy (19%). Compared with prior studies concerning the general canine population with spontaneous hypoadrenocorticism, this study population showed no gender predisposition, less likelihood of serum electrolyte abnormalities at the time of diagnosis, and shorter median survival time.

**ABSTRACT EN-9**

**THE EFFECT OF SURGERY ON THE PITUITARY-ADRENAL AXIS IN DOGS.** EJ Skovira, EN Behrend, L Palmer, LG Martin, RJ Kempainen, HP Lee, Y Ueda. Auburn University, College of Veterinary Medicine, Auburn, AL

Pituitary-adrenal response to surgery has received limited study in dogs. Studies in humans indicate surgery activates the axis and may serve as a model for acute, moderate stress. In addition, it is important to know the level of axis activation upon post-operative entry into an intensive care unit in case testing of the axis is performed. Thus, our objective was to assess and compare the effect of surgery on serum cortisol, aldosterone, and ACTH concentrations in dogs.

Fifty healthy dogs undergoing laparotomy for veterinary student surgical laboratories were used. Blood samples were obtained pre-operatively prior to administration of any medication and at the completion of the surgery with an average surgery time of 3 hours. Baseline samples were collected at least 4 hours prior to the start of surgery. Cortisol, aldosterone, and endogenous ACTH concentrations were measured using previously validated radioimmunoassays. Delta concentrations (pre-operative concentration subtracted from the post-operative) were calculated for each hormone. Data were analyzed using the paired t-test, Wilcoxon signed rank test, and Spearman correlation or linear regression. Significance was set at p<0.05.

Cortisol, aldosterone, and ACTH concentrations increased significantly during surgery (p<0.001 for all). However, while cortisol and aldosterone concentrations rose during surgery in all dogs, ACTH concentrations decreased in 26%. All dogs had a basal cortisol concentration within the reference range pre-operatively, but 63% had cortisol concentrations above the reference range post-operatively. A weak non-linear correlation was detected between pre-operative cortisol and ACTH concentrations; no correlation was evident post-operatively. A weak correlation between post-operative cortisol and aldosterone concentrations (linear regression, p<0.001, R^2=0.27) and a moderate correlation between the delta cortisol values were detected (linear regression, p<0.001. R^2=0.34). No relationship was detected between changes in either cortisol and aldosterone concentrations with ACTH.

In conclusion, laparotomy stimulates adrenocortical secretion of cortisol and aldosterone in dogs. In the majority of dogs, pituitary secretion of ACTH rises, but not in all. The lack of correlation between cortisol and ACTH concentrations post-operatively suggest the possibility that ACTH-independent mechanisms are responsible for the increase in post-operative cortisol values, or that an early increase in ACTH caused a sustained release of cortisol. The same mechanism may be at play, however, in causing increases in both cortisol and aldosterone secretion. Further studies are indicated to evaluate the effects of various anesthetic protocols and minimally invasive surgical techniques on the stress response.

**ABSTRACT EN-10**

**LONG-TERM FOLLOW-UP OF RENAL FUNCTION IN DOGS WITH ACTH-DEPENDENT HYPERADRENOCORTICISM, PMY Smets1, HP Lefebvre1, BP Menj1, S Croubels1, E Meyer1, I Van de Maele 1, S Daminet1. 1Ghent University, Ghent, Belgium., 2Ecole Nationale Vétérinaire, Toulouse, France., 3Utrecht University, Utrecht, The Netherlands**

Systemic hypertension and proteinuria are frequent complications in dogs with Cushing’s syndrome and do not always resolve after treatment of hypercortisolism. Therefore, these patients may be at risk for renal dysfunction.

Objectives were to assess renal function in dogs with ACTH-dependent hyperadrenocorticism (ADHAC) before and after treatment. A total of 19 dogs with ADHAC were included. Renal function was assessed before, and at 1, 3, 6, and 12 months after treatment. Twelve dogs were treated with trilostane and 7 dogs by transsphenoidal hypophysectomy. Routine renal markers were measured and urinary albumin (uALB), immunoglobulin G (uIgG), and retinol-binding protein (uRBP) were assessed by ELISA. Urinary N-acetyl-b-D-glucosaminidase (uNAG) was determined colorimetrically. All urinary markers were indexed to urinary creatinine concentration (c). Plasma clearance of creatinine (Clcreat), exo-iohexol (Cl exo), and endo-iohexol (Cl endo) were used to measure glomerular filtration rate (GFR). Data were analyzed using a linear general model.

Serum creatinine and urea concentration increased post treatment, but remained within reference ranges. Plasma Clcreat and Cl exo were significantly increased post treatment, whereas Cl endo was not different. Urinary protein-to-creatinine ratio, uALB/c, uIgG/c, and uRBP/c were decreased post-treatment, but at 12 months 5/13 dogs remained proteinuric. Urinary NAG/c did not change significantly.

The decrease in GFR and persistent proteinuria post-treatment underline that canine ADHAC is associated with renal glomerular and tubular changes which do not always reverse after therapy. (ESVE Award Winner).
ABSTRACT EN-11
EVALUATION OF A LONG-ACTING SOMATOSTATIN RECEPTOR LIGAND FOR THE TREATMENT OF FELINE ACROMEGALY. J Timian, KF Lunn. Department of Clinical Sciences, Colorado State University, Fort Collins, CO

This study was designed to evaluate whether long-acting octreotide (Sandostatin LAR®) is an effective medical therapy for cats with acromegaly.

Seven cats were diagnosed with acromegaly, based on physical changes, the presence of insulin-resistant diabetes mellitus (diabetes poorly regulated on ≥5 units of insulin BID), elevated insulin-like growth factor 1 (IGF-1) levels, and no evidence for other causes of insulin resistance. Cats received monthly long-acting octreotide IM at an escalating dose of 2 mg for 3 months, 3 mg for 1 month, and 4 mg for 2 months. Body weight, insulin dose, biochemistry profile, IGF-1 level, and fructosamine were obtained before and after each injection, and at one month after the last injection of long-acting octreotide.

Four cats received medication for 6 months; 3 cats received medication for 3 months (1 cat euthanized due to progressive disease; 1 cat withdrawn by the owner; 1 cat still enrolled). Mean serum IGF-1 levels, before and after the course of therapy, were 334 nmol/l and 339 nmol/l, respectively. Mean serum fructosamine values before and after therapy were 426 µmol/l and 435 µmol/l respectively. Mean insulin doses before and after therapy were 1.4 units/kg and 1.1 units/kg respectively. A paired t-test showed no significant differences between any of these parameters before and after therapy (p=0.94; p=0.77; p=0.14, respectively). One cat became non-insulin-dependent, coinciding with marked obtundation; necropsy revealed hemorrhage within and around a pituitary tumor. Six cats remained significantly insulin resistant. Long-acting octreotide does not appear to be an effective treatment for feline acromegaly.

ABSTRACT EN-12
BASAL ALDOSTERONE CONCENTRATIONS AND RESPONSE TO ACTH STIMULATION IN HEALTHY AND CRITICALLY ILL DOGS. LG Martin, EN Behrend, RJ Kemppainen, HP Lee. Auburn University, College of Veterinary Medicine, Auburn, AL

Critical illness-related corticosteroid insufficiency (CIRCI) has been recognized in veterinary patients. In humans diagnosed with CIRCI, it is generally accepted that aldosterone insufficiency is not a part of the syndrome. The same is suspected to occur in dogs with CIRCI, but has not been documented. Furthermore, aldosterone concentrations and its response to ACTH are infrequently measured in ill dogs despite the life-threatening effects of aldosterone insufficiency. The purpose of this study was to determine basal aldosterone concentrations and their response to ACTH in clinically healthy and critically ill dogs, and to determine the relationship between cortisol and aldosterone insufficiency in dogs with CIRCI.

Basal and post-ACTH aldosterone concentrations were determined in 10 healthy and 32 critically ill dogs diagnosed with sepsis, trauma, or GDV. (Cortisol data reported in Martin LG et al, JVIM, 2010.) Each dog was given cosyntropin (5 µg/kg IV) and blood samples for assay of aldosterone and cortisol concentrations were obtained before and 60 minutes after administration. Serum sodium and potassium concentrations as well as sodium and cortisol concentrations (the difference between stimulated and basal concentrations) were also determined. Data were analyzed using Kruskal-Wallis one-way ANOVA, Mann-Whitney rank sum test, Wilcoxon signed rank test, and Spearman rank order correlation. Significance was set at α ≤ 0.05.

Undetectable basal or post-ACTH aldosterone concentrations were found in 18/32 (56%) critically ill dogs. Ten of the critically ill dogs met biochemical criteria for the diagnosis of CIRCI based on their cortisol concentrations. Only 2/10 had either a low basal or post-ACTH aldosterone concentration. None of the dogs diagnosed with CIRCI or aldosterone deficiency had hypokalemia or hyperkalemia. Median basal aldosterone concentrations in dogs with GDV were significantly lower when compared to healthy and septic dogs. In septic and trauma dogs, no difference was detected between median basal and post-ACTH aldosterone concentrations. Median delta aldosterone concentrations in the trauma dogs were lower than those of healthy dogs. No relationship was detected between basal, post-ACTH, and delta aldosterone and cortisol concentrations or between basal aldosterone and electrolyte concentrations.

In conclusion, low aldosterone concentrations were common in this population of critically ill dogs. The majority of dogs with CIRCI did not have decreased aldosterone concentrations; thus, canine CIRCI may be similar to the human syndrome. The etiologies for low aldosterone concentrations in this population of critically ill dogs are unknown at this time, but do not appear to be due to abnormalities in sodium or potassium. Future studies are needed to determine the effects of critical illness on adrenocortical aldosterone secretion and the significance of the aldosterone deficiency.

ABSTRACT EN-13
EVALUATION OF ONCE-DAILY ADMINISTRATION OF INSULIN GLARGINE IN DOGS WITH NATURALLY OCCURRING DIABETES MELLITUS. Aly Kim, K Cho, S Noh, J Paek, M Lee, D Chang, MP Yang, JH Kang. Chungbuk National University College of Veterinary Medicine, Cheongju, Chungbuk, Republic of Korea

The objective of this study was to evaluate the efficacy of once-daily administration of insulin glargine in dogs with diabetes mellitus (DM). Sixteen client-owned dogs with DM were enrolled, all of which had been previously treated with neutral protamine Hagedorn (NPH) insulin for at least 4 weeks following diagnosis of DM. Nine of these dogs (Group A) had DM that was well-regulated by twice-daily administration of NPH insulin. In the other seven dogs (Group B) NPH showed short-duration of action at the lowest dose. Dogs received insulin glargine (Lantus®) every 24 hours and were fed the recommended prescription diet. Evaluations were performed prior to treatment with insulin glargine and 1, 2, 4, 6, and 10 weeks after the administration of insulin glargine. Evaluations included clinical signs, blood glucose curves and serum fructosamine concentrations. Adjustments in dosage of insulin glargine were made as needed to control glycaemia.

The 24-hour mean blood glucose (MBG) and serum fructosamine concentrations in Group A were significantly elevated 2 weeks and 4 weeks after initiating the treatment, respectively, as compared to levels prior to the administration of insulin glargine. In Group B, by 4 weeks after initiation of treatment there were no significant differences in MBG and serum fructosamine concentrations as compared to prior to treatment, and no recurrence of polyuria/polydipsia. Maintenance of successful glucose control was attained in only seven of all dogs (one dog in Group A and six dogs in Group B). The once-daily administration of insulin glargine is not generally effective in diabetic dogs but may possibly be used as an alternative treatment in diabetic dogs in which insulin has only a short-duration of action at the lowest dose.

ABSTRACT EN-14
CHROMATOGRAPHIC ANALYSIS OF THE LIPID FRAC¬TIONS IN OBESE CLIENT-OWNED DOGS. MM Jericó1, FC Chiquito1, F Fusco2, S Catanzaro2, VS Nunes2, ER Nakandakar2, AN Murchumb University and Cruzeiro do Sul University, SP, Brazil. 1Lipids Laboratory LIM 10 of Faculty of Medical Sciences of the University of Sao Paulo, SP, Brazil

Obesity, a metabolic disease of multifactorial origin, impairs the health and longevity of individuals. Dyslipidemia, a common condition in obese animals, is usually associated to a variety of
FOOD ANIMAL

ABSTRACT FA-1
SKILLS REQUIRED OF ENTRY LEVEL VETERINARIANS: A SURVEY OF DAIRY PRACTITIONERS. C Luby,
K McIntyre, M Jelsinski. Western College of Veterinary Medicine, Saskatoon, SK

To provide the optimal training experience for veterinarians, it is important to determine the skills expected at graduation. The purpose of this study was to determine skills required of entry-level veterinarians for dairy practice in Western Canada.

We performed a survey of Western Canadian veterinarians involved in dairy practice. The survey included questions regarding respondent’s clinical activity, demographics, skills performed in practice, open ended questions and space for comments. All work was approved by the University of Saskatchewan Behavioural Research Ethics Board.

Response rate for the surveys was 39.3% (281/714 mailed out). Of these, five were excluded due to inconsistencies in answers. Of the respondents, 43.8% were involved in dairy practice with a median 15% (0.5 – 100%) of practice time involving dairies. Respondents were classified as either mixed practitioners (<25% time in dairy practice) or dairy practitioners (>75% time in dairy practice). For both groups, individual animal medicine and surgery skills were performed more commonly than production medicine skills. The most important skills identified were pregnancy diagnosis by rectal palpation or ultrasound, correction of displaced abomasum, physical examination and treatment of common disorders.

These results demonstrate the continued importance of individual animal skills in dairy practice. Training programs for veterinarians should provide high quality training in individual animal medicine, showing that ACVIM diplomates can provide an important role in preparing students for dairy medicine.

ABSTRACT FA-2
METAGENOMIC EVALUATION OF THE INTESTINAL MICROBIOME IN VEAL CALVES AND THE INFLUENCE OF ORAL TETRACYCLINE. MC Costa, HR Staempflí, LG Arroyo, FLF Feitosa, JS Weese. University of Guelph, Guelph, ON, Canada, Universidade Estadual Paulista, Aracatuaba, Brazil

The intestinal bacterial population (the microbiome) is a complex polymicrobial community that has an important role in many aspects of health and disease. While there has only been superficial study of the intestinal microbiome in most species, recent advances in molecular technologies have allowed for comprehensive evaluation of the microbiome, including unculturable bacteria not identified before, and detailed investigation of changes in the microbiome in response to various factors, such as antimicrobials. The objective of this study was to characterize the intestinal microbiome of veal calves by high throughput sequencing technology, and to investigate the impact of oral tetracycline on the intestinal microbiome.

Fecal samples were collected from 22 healthy Holstein male calves (2-7 days of age) within 24h after arrival on a commercial veal farm. 12 calves were then treated with oxytetracycline (6.6 mg/kg PO for 5d) and 10 control calves did not receive any antimicrobials. A 2nd fecal sample was collected 2 days after treatment was finished. DNA was extracted and PCR of the 16S rRNA gene was performed. Amplicons were sequenced by high throughput sequencing technology with the use of a 454 sequencer. The MOTHUR package of algorithms was used to clean data and align sequences with the SILVA 16S rRNA reference database, with taxonomic classifications obtained from the Ribosomal Database Project. Sequences were assigned into operational taxonomic units (OTUs) using the average neighbor algorithm.

From 133,943 sequences obtained, 110,274 high quality sequences remained after data cleaning. For OTU classification, a minimum of 2,324 sequences per calf was used, which
excluded 3 calves from the analysis. Bacteroidetes was the main Phylum among control and treated calves before use of oxytetracycline (65.7 and 46.9%, respectively) with Firmicutes being the second most prevalent (33 and 29%, respectively). There was a profound decrease in abundance of Bacteroidetes in both control (P = 0.003) and treated (P = 0.014) calves at the 2nd sampling time, with post-treatment abundances of 0.6 and 1.6%) and a concurrent increase in Firmicutes in control (P = 0.012) and treated (P = 0.035) calves to 60.8 and 92.4%, respectively. Different communities were found between 1st and 2nd sampling in both control (P < 0.013) and treated calves (P < 0.001), as well as between the two groups at the 2nd sampling (P = 0.001).

While there was difference between treatment and control groups, the fecal microbiome changed dramatically in the 7 day period after farm arrival irrespective of tetracycline exposure. Multiple factors may be involved in fecal microbiome alterations and these must be considered when assessing the impacts of antimicrobial therapy or other potential modifying factors.

**ABSTRACT FA-3**

**A PROSPECTIVE CONTROLLED STUDY ON PREVALENCE OF CLOSTRIDIUM DIFFICILE IN VEAL CALVES RECEIVING AND NOT RECEIVING ORAL OXYTETRACYCLINE.** MC Costa, H Staempflí, LG Arroyo, FLF Feitosa, Canada

_Clostridium difficile_ is the major cause of antibiotic associated diarrhea in humans. While the role of this bacterium in disease in calves is still unclear, public health concerns have been expressed because of its presence in food animals and food. Epidemiologic studies have shown an increase on the prevalence of _C. difficile_ in veal calves after arrival on the farm, which coincides with antimicrobial treatment. Whether this increase is physiological or due to treatment remains uncertain. The objective of this prospective trial was to compare the prevalence of _C. difficile_ in veal calves treated with oral oxytetracycline compared to age matched controls.

Twenty-two bull calves (2-7 days) arriving on a veal farm were enrolled. They were clinically normal and housed in individual pens. Twelve received oral oxytetracycline (6.6mg/kg PO for 5d) starting at arrival, and ten calves were left untreated. Feces were collected by rectal digital stimulation at arrival, 3 days into treatment and 2, 10 and 27 days after treatment. Selective culture for _C. difficile_ was performed. Fisher’s exact test was used to determine the relationship between treatment with oral oxytetracycline and the shedding of _C. difficile_.

The prevalence of _C. difficile_ in both groups at the different sampling times is presented on Table 1. No significant statistical differences were found between groups at any sampling times. The prevalences found at the first two samplings were consistent with previous reports in the literature. Interestingly, an increase occurred at the fifth sampling, which coincided with the moving of the calves to collective pens (groups of 10) in another room and therefore submitted to stress.

Administration of oral oxytetracycline seems to have no impact on the prevalence of _C. difficile_ in calves and the changes in prevalence that have been noted may be due to other factors, such as environmental exposure, external stressors and other factors that may affect the intestinal microflora.

| Table 1. Prevalence of _C. difficile_ in veal calves and _P_ values before and after administration of oral oxytetracycline. |
|:--------:|:----:|:----:|:----:|:----:|:----:|
| Control (%) | 5/10 | 5/10 | 8/10 | 1/10 | 4/10 |
| Treatment (%) | 1/12 | 6/12 | 7/12 | 3/12 | 7/12 |
| _P_ value | 0.056 | 1.000 | 0.381 | 0.594 | 0.670 |

ABSTRACT FA-4

**INCREASED STRONG ION GAP IN DAIRY CALVES WITH DIARRHEA IS LIKELY DUE TO D-LACTATE.** HR Staempflí, PD Constable, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

Physicochemistry emphasizes the importance of strong electrolytes (Na, K, Cl, L-lactate, D-lactate), pCO2, and plasma protein concentrations in determining plasma pH. We recently determined that the physicochemical approach provided a clinically useful method to predict the dependent variables (pH, HCO3) in critically ill horses by using a Radiometer 800 Flex blood gas analyzer to measure the plasma concentration of strong electrolytes and refractometry to measure total protein concentration (TP) (_J Vet Intern Med_ 25 2011 p674). The situation in calves with diarrhea might differ from that in horses in that calves frequently develop strong ion (metabolic) acidosis due to elevation of unmeasured strong anions such as D-lactate.

Eighty-three venous blood gas analysis samples obtained anaerobically from 20 calves aged 2 days to 1 month presented to the Veterinary Teaching Hospital for dehydration and acid base abnormalities associated with diarrhea were analyzed. Na-benzylized blood samples were analyzed for pH (pHm), pCO2 and concentrations of Na, K, Cl, and L-lactate using a Radiometer 800 Flex blood gas analyzer; Strong Ion Difference (SID4 = Na + K - Cl - Lac) was calculated and TP was estimated using refractometry. Plasma pH values (pHm) were calculated using Constable’s 6 factor simplified equation (_J. Appl. Physiol., 1997, 83, 297-311_). Anion gap (AG) and Strong ion gap (SIG) were defined as: AG = (Na + K + Cl + HCO3); SIG = [(0.34xTP)/ (1 + 10^-7.10-pH)]-AG. Linear regression analysis was used to compare pHm to measured pHe, as well as AG and SIG to blood L-lactate concentrations.

Measured pH ranged from 6.66 to 7.59 (7.27±0.16, mean±SD); measured SID4 ranged from 22.1 to 56.3 mEq/L (36.6±6.1 mEq/L); TP concentration ranged from 32-98 (53.5±13.3 g/L). pHm was poorly associated with pHe (r = 0.10; p = 0.315 + 5.09). The intercept estimate of -4.4 mEq/L is the major cause of antibiotic associated diarrhea in humans. While the role of this bacterium in disease in calves is still unclear, public health concerns have been expressed because of its presence in food animals and food. Epidemiologic studies have shown an increase on the prevalence of _C. difficile_ in veal calves after arrival on the farm, which coincides with antimicrobial treatment. Whether this increase is physiological or due to treatment remains uncertain. The objective of this prospective trial was to compare the prevalence of _C. difficile_ in veal calves treated with oral oxytetracycline compared to age matched controls.

Twenty-two bull calves (2-7 days) arriving on a veal farm were enrolled. They were clinically normal and housed in individual pens. Twelve received oral oxytetracycline (6.6mg/kg PO for 5d) starting at arrival, and ten calves were left untreated. Feces were collected by rectal digital stimulation at arrival, 3 days into treatment and 2, 10 and 27 days after treatment. Selective culture for _C. difficile_ was performed. Fisher’s exact test was used to determine the relationship between treatment with oral oxytetracycline and the shedding of _C. difficile_.

The prevalence of _C. difficile_ in both groups at the different sampling times is presented on Table 1. No significant statistical differences were found between groups at any sampling times. The prevalences found at the first two samplings were consistent with previous reports in the literature. Interestingly, an increase occurred at the fifth sampling, which coincided with the moving of the calves to collective pens (groups of 10) in another room and therefore submitted to stress.

Administration of oral oxytetracycline seems to have no impact on the prevalence of _C. difficile_ in calves and the changes in prevalence that have been noted may be due to other factors, such as environmental exposure, external stressors and other factors that may affect the intestinal microflora.

**ABSTRACT FA-5**

**ANTIMICROBIAL RESISTANCE TRENDS AMONG SALMONELLA ISOLATES OBTAINED FROM DAIRY CATTLE IN THE NORTHEASTERN USA, 2004-2010.** KJ Cummings, GA Perkins, SM Khatabradze, JD Siler, LD Warnick, Cornell University, Ithaca, NY

The objectives of this study were to describe the antimicrobial resistance status of _Salmonella_ isolates recently obtained from dairy cattle in New York and other northeastern states and to identify trends in resistance to various antimicrobial agents over time.

Data were collected retrospectively for all bovine _Salmonella_ isolates that were obtained from samples submitted to the Cor-
The effect of ammonium chloride treatment as a long term preventative approach for urolithiasis in goats and a comparison of continuous and pulse dosing regimens. P Sprake, AJ Roussel, R Stewart, WT Bissett. Texas A&M University, College Station, Texas

Long-term oral treatment with ammonium chloride in goats to acidify urine as a mechanism to prevent phosphatic urolithiasis has been observed to lose clinical effectiveness. Clinically, pulse dosing has been utilized in order to prevent the failure to achieve acidification of urine as seen with continuous daily dosing.

We hypothesized that continuous daily dosing of ammonium chloride would lose clinical effectiveness, pH < 6.5, within 7 days, and that pulse therapy (3 days of treatment followed by 4 days rest) would result in repeated attainment of target pH during the 3-day treatment periods.

10 wether goats fed a commercially available concentrate feed containing 0.1% ammonium chloride and supplemented with alfalfa hay, were treated with ammonium chloride as continuous daily dosing and pulse regimes in a cross over study design. The dose of ammonium chloride was titrated for each goat, starting at 200 mg/kg q 12 hours, and increasing to 250 mg/kg and/or 300 mg/kg q 12 hours in order to determine a dose that decreased the pH to below target within 3 days. Urine was collected twice daily at each treatment time by use of a cup collection system and pH was determined using a 3-pad indicator strip and pH meter. Once an effective dose had been determined for each goat, continuous twice daily dosing was administered for 10 days, and pulse dosing was continued for 3 treatment cycles. Basic descriptive statistics were performed for this data.

The median urine pH for all goats during the pre-treatment period was 8.3. Twenty four hours after starting continuous twice daily treatment, 88% (8/9) of the goats had urine pH below the target, achieving a median pH nadir of 5.49 (range 4.32-7.61). Following 4 days of continuous dosing, only 50% (4/8) goats had urine pH < 6.5. Mean urine pH remained above the target pH for subsequent treatment days, until 8.5 days after starting treatment when median urine pH returned to below the target pH. 60 hours after ammonium chloride treatment was discontinued, all goats had urine pH of > 6.5. During the pulse treatment regime, target median urine pH was achieved in cycles 1 and 3, 30 hours after initiating treatment each, 4/10 goats achieved urine pH < 6.5 for all treatment cycles. All received pulse dose as the first treatment regime suggesting that treatment order influenced urine pH.

These results showed that ammonium chloride is an effective method of acidifying urine in goats if the dose is titrated for each individual. The data demonstrated re-alkalization does occur in goats receiving continuous daily dosing of ammonium chloride, as has been suggested by previous literature. In this study, re-alkalization occurred at day 4 of ammonium chloride treatment. For some goats pulse dosing repeatedly achieved urine pH to below the target, and therefore pulse dosing regimens may be effective in prolonging the treatment effect of ammonium chloride in the prevention of phosphatic urolithiasis.
ABSTRACT FA-10
UTERINE NEOPLASIA IN SMALL RUMINANTS: RETROSPECTIVE STUDY (1991-2011). M. Heller, University of Missouri College of Veterinary Medicine, Columbia, MO

Literature concerning uterine neoplasia in small ruminants is limited. The goal of this retrospective study is to add to our understanding and aid in the diagnosis of uterine neoplasia in sheep and goats by identifying common presentations, physical exam findings, and diagnostic results. Medical records of sheep and goats diagnosed with uterine neoplasia from 1991 to 2011 were reviewed. A total of 19 cases were reviewed for presenting complaints, history, physical exam findings, clinical pathology findings, diagnostic imaging results and histopathologic diagnosis. Cases lacking a definitive diagnosis were excluded. Age at presentation ranged from 4-14 years old with a mean of 9.16 years and a median of 10 years. All cases except one were female, with the most common breed being Pygmy goats (74%). The most common presenting complaints were anorexia (63%) and vaginal discharge (70%), followed by straining (47%). On physical examination 46% of cases had palpable masses in the caudal ventral abdomen with 2 cases also being palpable in the paralumbar fossa area as well. Concurrent udder enlargement or inappropriate lactation was observed in 56% of cases. No distinct trends were noted upon analysis of CBC or serum biochemistry. However for the subset of patients who urinalysis performed 8 of 9 had proteinuria and/or hemoproteinuria ranging from trace to 3+. Diagnostic imaging results were also analyzed, uterine abnormalities were visualized in 14 out of 15 cases undergoing abdominal ultrasonographic exam. Four of the 7 cases for which abdominal radiographs were taken had evidence of abnormal mass. The most common histopathologic diagnosis was uterine adenocarcinoma (56%), other tumor types diagnosed were leiomyoma, leiomyosarcoma and leiomyofibroma. Interestingly, several of the adenocarcinoma cases had concurrent cystic endometrial hyperplasia as well as two cases who had previously undergone ovariohysterectomy for chronic cystic endometrial hyperplasia and were both diagnosed with adenocarcinoma of their uterine stumps. Thus endometrial hyperplasia may represent a pre-cancerous condition in goats. Uterine neoplasia should be a differential diagnosis for goats presenting with straining and vulvar discharge, particularly those with a history of udder enlargement not associated with pregnancy. Abdominal ultrasonography is a useful diagnostic tool for evaluating reproductive tract of small ruminants.

ABSTRACT FA-12
COMPARISON OF THREE IMMUNOGLOBULIN G (IgG) ASSAYS FOR DIAGNOSIS OF FAILURE OF PASSIVE TRANSFER IN NEONATAL ALPACAS. T Pinn1, T Stokol1, LF Gagliardo2, SR Purdy1, JA Appleton3. 1Cornell University College of Veterinary Medicine, Ithaca, NY. 2James A. Baker Institute for Animal Health, Cornell University, Ithaca, NY. 3University of Massachusetts Amherst, Hadley, MA

Measurement of serum IgG is used for assessment of passive transfer of immunity in neonatal crias. While an IgG concentration below 1000 mg/dL is suggestive of failure of passive transfer (FPT) in Peruvian herds, this cut-off remains undefined in United States herds. The purpose of this study was to determine whether three commercially available assays yielded comparable results for IgG in crias. Serum samples from 91 crias submitted to Clinical Pathology for routine IgG measurement were used. Samples were stored frozen until batch analysis on the same day with the three assays. IgG was measured by radial immunodiffusion (assay A) and 2 immunoturbidimetric methods - one is configured for automated chemistry analyzers (assay B) and the other is a farm-side test (assay C). Median IgG concentrations were significantly different between the three assays. Assays A and B, which used the same standard, yielded higher IgG values than assay C,
resulting in a lack of concordance in 7-18% of samples at 1000 mg/dL IgG. Protein electrophoresis revealed that assay A and B standards contained mostly albumin (>60%), whereas assay C standard consisted of beta and gamma globulins. Median results from assay B after calibration with the assay C standard were not significantly different from those of assay C and diagnostic concordance between these 2 assays improved. Our results indicate that camelid IgG results are highly dependent on the assay standard and are not directly comparable between assays, potentially resulting in under-diagnosis of FPT in some cases.

**ABSTRACT FA-13**

**BIOAVAILABILITY AND PHARMACOKINETICS OF ORAL MELOXICAM IN LLAMAS.** AJ Kreuder1, PJ Plummer3, LW Wulf1, JA Schleining1, B KuKanich2, LL Layman1, JF Coetzee1.

South American camels in the United States have rapidly developed into an important agricultural industry in need of veterinary services. Pain management is challenging in camels because there are no drugs currently approved by the Food and Drug Administration for use in these species. Dosage regimens used for many therapeutic drugs have been extrapolated from other ruminants; however, the pharmacokinetics in camels may differ from those of other species. Studies investigating the pharmacokinetics, in camels, of non-steroidal anti-inflammatory drugs considered to be cyclooxygenase-2 (COX-2) selective are deficient in the published literature.

The aim of this study was to evaluate the oral bioavailability and pharmacokinetics of meloxicam in llamas in comparison to intravenous (IV) meloxicam. Six adult llamas (121-168kg) were administered either a 1mg/kg dose of oral or a 0.5mg/kg dose of IV meloxicam in a randomized cross-over design with an 11 day washout period between treatments. Plasma samples collected up to 96 hours post-administration were analyzed by high pressure liquid chromatography and mass spectrometry detection (HPLC-MS) followed by noncompartmental pharmacokinetic analysis (results summarized in Table 1 below). No adverse effects in the llamas were associated with either treatment modality.

The mean bioavailability (F) of oral meloxicam was 76% indicating excellent gastrointestinal absorption. Plasma meloxicam concentrations >0.2 µg/mL were maintained for up to 72 h after oral administration; >0.2 µg/mL is considered to be the concentration of meloxicam required for analgesic effects in other species such as the horse. These data suggest that a single dosage of oral meloxicam at 1mg/kg could potentially maintain therapeutic concentrations in plasma for up to 3 days in adult llamas.

| Table 1. Pharmacokinetic parameters. Mean (minimum - maximum). |
|-----------------------------|-----------------|-----------------|---------------------|-----------------|
|                            | AUC (h*µg/mL)  | Clearance (mL/min/kg) | C<sub>MAX</sub> (g/mL) | T<sub>MAX</sub> (hr)  | T ½ (hr) | F (%) |
| IV                          | 43.96           | 0.190            | 6.163               | 17.4             | 76.6  |
| (0.5 mg/kg)                 | (31.4-45.3)     | (0.15-0.35)     | (5.26-9.76)         | (16.2-24.8)     | 74    |
| PO                          | 68.35           | 0.248            | 1.314               | 21.4             | 22.7  | 76    |
| (1.0 mg/kg)                 | (52.4-72.7)     | (0.2-0.32)      | (0.83-1.78)         | (24.0-30.8)     | 92    |

In conclusion, both Nuflor<sup>®</sup> and NuflorGold<sup>®</sup> may be erratically absorbed following s.c. administration in adult llamas, based on the observed variability in most measured pharmacokinetic parameters. Plasma concentrations of NuflorGold<sup>®</sup> reached higher therapeutic concentrations, yet were associated with fewer systemic complications following long term use.

**ABSTRACT FA-14**

**FLORFENICOL PHARMACOKINETICS IN HEALTHY ADULT ALPACAS, EVALUATING TWO COMMERCIALl AVAILABLE DRUG FORMULATIONS.** D Bedenice1, MG Papich2, K Thane1, K Holmes1, Cummings School of Veterinary Medicine at Tufts University, North Grafton, MA, North Carolina State University, Raleigh, NC

Single-dose florfenicol pharmacokinetics were compared using 2 commercially available drug formulations (Nuflor<sup>®</sup>, NuflorGold®) in 6 healthy adult alpacas, administered at 40 mg/kg subcutaneously (s.c.) using a randomized, cross-over design. Subsequently, each formulation of florfenicol was injected s.c. every 48 hours for 10 doses (40 mg/kg) to evaluate long-term effects. Clinical parameters were monitored daily in addition to weekly hematological analyses. Plasma drug concentrations were obtained via high-performance liquid chromatography at 0, 0.5, 1, 2, 3, 4, 5, 6, 8, 12, 18, 24, 36, 48, 60, 72, 96 and 120 h post-injection for single-dose studies, and at 0, 2, 4, and 8 h after the last dose for multi-dose studies. The florfenicol plasma concentrations vs. time plots were analyzed using a non-compartmental analysis (Nuflor® or 2 compartment model (NuflorGold®), and commercial software (Phoenix WinNonlin 6.0). All data are presented as mean ± standard deviation; hematological parameters were compared between time points using repeated measures ANOVA and paired samples t-test post hoc.

Maximum plasma florfenicol concentrations (C<sub>MAX</sub>) were achieved rapidly following single dose injections. Comparative pharmacokinetic parameters are listed in Table 1 below:

- Maximum plasma concentrations of 4.48±1.28 and 7.62±1.65 µg/mL were achieved at steady state for Nuflor® and NuflorGold®, respectively, after 10 doses. The following hematological parameters decreased significantly between weeks 0 and 3, following repeated Nuflor® injection: total protein [TP] (6.38 vs. 5.61 g/dL, P<0.0001), globulin (2.76 vs. 2.16g/dL, P=0.0003), albumin (3.61 vs. 3.48g/dL, P=0.0038), white blood cell count [WBC] (11.89 vs. 9.66×10³/µL, P<0.044), and hematocrit (27.25 vs. 24.88%, P<0.0349). Significant clinical illness was observed in one alpaca. Similarly, the following parameters significantly decreased after 10 doses of 40mg/kg NuflorGold®: TP (6.65 vs. 5.98 g/dL, P=0.009), globulin (2.82 vs. 2.29g/dL, P=0.004), WBC (14.75 vs. 9.27×10³/µL, P=0.001). No clinical illness was observed in the latter group.

In conclusion, both Nuflor® and NuflorGold® may be erratically absorbed following s.c. administration in adult alpacas, based on the observed variability in most measured pharmacokinetic parameters. Plasma concentrations of NuflorGold® reached higher therapeutic concentrations, yet were associated with fewer systemic complications following long term use.

**ABSTRACT FA-15**

**EVALUATION OF POINT OF CARE GLUCOSE METERS IN ALPACAS.** O Beemer, S Byers, A Bohn. Colorado State University, College of Veterinary Medicine and Biomedical Sciences, Fort Collins, CO

Hospitalized alpacas are often hyperglycemic requiring repeated blood sampling to monitor glucose levels and response.
to insulin therapy. Point-of-care (POC) glucometers are commonly used to measure whole blood glucose concentrations due to the rapid results and low expense. There is one POC glucometer currently marketed for use in animals; however this meter has not been validated for use in alpacas. Therefore human meters are used but also have not been validated or compared to clinical pathology laboratory glucose values for alpacas. Potential sources of variation include meter accuracy, hematological variations, and drug interactions. The purpose of this study was to compare 3 commercial glucometers to laboratory glucose readings.

Four alpacas were used in this randomized cross-over study. The alpacas were given either 0.4 U/kg of regular insulin intravenously or 500 mg/kg of dextrose IV with a 1 week washout between crossover periods. Blood samples were obtained from a jugular catheter at specific time periods starting at 10 minutes before drug administration until 6 hours post administration. Whole blood and plasma samples were measured on 3 glucometers, and serum glucose was measured on a laboratory chemistry analyzer.

The POC meters had variable results compared to the serum glucose and results also varied based on testing plasma or whole blood. All 3 meters had either proportional or constant bias but the human serum glucose was not considered clinically relevant. The POC meters can be used for alpacas but if more accurate blood glucose values are desired, reference intervals should be established.

### ABSTRACT FA-16

**RISK FACTORS AND PROGNOSTIC VARIABLES FOR SURVIVAL IN 61 SICK NEONATAL NEW WORLD CAMELIDS**, FR Bertin, JM Squire, JE Sojka-Kritcheksky, SD Taylor. Purdue University, West Lafayette, IN

Neonatal New World Camelids (NWC) are more common among large animal patients, but information pertaining to clinical presentation and outcome is limited. The objective of this retrospective study was to describe the signalment, clinical signs, clinicopathologic values, antimicrobial use, and survival status in neonatal NWC presented to Purdue University Veterinary Teaching Hospital, and to identify variables for prediction of survival. Inclusion criteria were NWC less than 30 days of age with complete medical records that presented between 2000 and 2010. Cases were categorized by outcome, and groups were compared.

Sixty-one patients met the inclusion criteria (36 alpacas and 25 llamas). The median age at presentation was 1 day. There was a significant overrepresentation of females (69%, P < 0.01). The most common clinical findings included clinical sepsis (49%), failure of transfer of passive immunity (41%), and congenital defects (41%). Ophthalmologic (21%), gastrointestinal (15%), musculoskeletal (11%), respiratory (10%) and neurologic (10%) abnormalities were also reported. The most commonly administered antimicrobials were penicillin G (39%), trimethoprim-sulfadiazine (26%), amikacin (21%) and cefottio (10%).

Sixty-four percent of NWC survived to discharge. Clinicopathologic findings on admission were variable and nonspecific but albumin and TCO₂ were significantly lower in nonsurvivors (P < 0.05). The only independent factors associated with survival were absence of congenital disorders (P < 0.01), administration of hyperthermia (P < 0.05), and antimicrobial treatment. The POC with penicillin G (P < 0.05) or trimethoprim-sulfadiazine (P < 0.05).

We conclude that congenital disorders are common in NWC, and that hyponatremia and congenital disorders were predictors of nonsurvival. Plasma administration and antimicrobial treatment were associated with survival.

### ABSTRACT FA-17

**EVALUATION OF THE USE OF INFRARED THERMOGRAPHY IN THE NASAL CANTHUS OF THE EYES OF HOLSTEIN CALVES WITH OR WITHOUT CLINICAL SIGNS OF Enteritis**, FCG Morelli, TS Polô, LG Avilia, B Gerardi, FLF Feiota, LCN Mendes, JR Peiró. FMVA – Univ Estadual Paulista (UNESP), Araçatuba, SP, Brazil

The purposes of this study were to establish the pattern of infrared temperature in the nasal canthus of the eyes of Holstein calves with or without clinical signs of enteritis before 0 and 7 days old; observe whether calves with clinical signs of enteritis have elevated temperature in the nasal canthus compared with the healthy calves, and determine the correlation between the temperature of nasal canthus of the eye and rectum temperature of calves with or without signs of enteritis. Twenty Holstein calves, from two dairy farms were divided into two groups: without (control group) and with clinical signs of enteritis (experimental group). The animals were subjected to measurement of temperature in the nasal canthus of both eyes by infrared thermography, and rectum temperature by a digital thermometer. The animals were evaluated at birth and 1, 3, 5 and 7 days after birth. The reference values for the nasal canthus of the left (LE) and right (RE) eye were established for each group. There was no difference in rectal temperature between groups (P = 0.6190). The temperature in the nasal canthus did not significantly change in the LE (P = 0.3892) or RE (P = 0.2491) of calves in the control or experimental groups over 7 days of evaluation. The correlation between the temperature of the nasal canthus of calves the rectal temperature was r = 0.0007. We conclude that the reference values for IRT in the nasal canthus of eyes of calves with or without clinical signs of enteritis were generated. The use of the nasal canthus of eyes of calves has a significant correlation with the rectal temperature. Thus, the temperature of the nasal canthus of eyes of calves might be used to evaluate the body temperature of Holstein calves.

### ABSTRACT FA-18

**DEVELOPMENT, SAFETY, AND EFFICACY OF AN AUTOTGENOUS VACCINE FOR *Mycoplasma ovipneumoniae* IN DOMESTIC SHEEP**, JC Ziegler, TE Besser, KK Lahmers, GM Barrington. Washington State University College of Veterinary Medicine, Pullman, WA

Epizootic pneumonia is a major rate limiting factor in the re-establishment of bighorn sheep (BHS) populations in western North America. *Mycoplasma ovipneumoniae* (Movi), which is carried by domestic sheep (DS) as a normal upper respiratory tract commensal flora, is the primary epizootic agent that triggers epizootic pneumonia of bighorn sheep. Our hypothesis is that interventions to reduce/eliminate Movi in DS will reduce transmission to BHS. The objective of this preliminary study was to evaluate the safety and immunogenicity of two subcutaneous Movi vaccine formulations in DS: 1) live Movi without adjuvant at 0 and 30 days, and 2) Movi in oil adjuvant at 0 and 30 days. Injection sites were monitored and samples were collected periodically for complete blood count, PCR, bELISA, and peripheral blood mononuclear cell lymphocyte stimulation assay. Biopsies of the injection sites were performed 14 days post-inoculation. Vaccination with live Movi without adjuvant yielded no adverse reactions locally or systemically. Vaccination with live Movi and oil adjuvant showed mild local inflammation and fibrosis, but no adverse reactions were noted systemically. Neither vaccine formulation showed evidence of immunogenicity.

The vaccine formulations examined in this study were demonstrated to be safe for use in DS, but didn't exhibit immunogenicity or protection in the sheep inoculated. Alternative approaches toward improving immunogenicity must be explored, such as utilizing a different adjuvant. Another safety study would need to be performed before efficacy testing in a larger population.
ABSTRACT FA-19

TEMPERATURE EVALUATION OF SHEEP SUBMITTED TO EXPERIMENTAL ENDOTOXEMIA. EM Panelli, B Gerardi, LG Avila, RF Araujo, MG Carvalho, JR Peiro, SHV Peixoto. LCN Mendes. DCCRA – FMVA – unesp – Univ Estadual Paulista, Brazil.

The present study aimed to assess by thermometry and thermography, changes in temperature affected by endotoxemia in sheep experimentally induced by inoculation of LPS from E. coli (400 ng / kg body weight). For this, eight sheep were used, with two years of age, obtained from commercial Araçatuba region. Of the eight animals used, four (group 1) were inoculated with LPS (Escherichia coli 055: B5, Sigma, St. Louis, MO) at a dose of 400 ng / kg and four (group 2) were inoculated with 2 ml of saline 0.9% Sodium Chloride (NaCl). We conducted a physical examination of animals at the time of admission and data recorded on individual sheets. After the physical examination was performed thermographic examination on admission of animals and the 2, 4, 6, 12, 24, 36, 48 and 60 hours after administration of LPS or saline. We analyzed the following regions: Temperature Front (TF), temperature of the dorsum (TD), axillary temperature (AT), temperature of the external face of the thigh (FEC), temperature of the inner thigh (FIC) and temperature of the perineum (TP). We concluded that thermography can be used to analyze the temperatures of sheep with endotoxemia, better results were obtained by the analysis of the regions: (TF) at times M6 and M60, (TD), M6, M12, M60, (TA), M12; (FEC), and M12 (TFIC), M12. While the non-contact thermometry was not effective in observing the temperature rise caused by endotoxin administration.

ABSTRACT FA-20

ARSENIC TOXICITY IN A HERD OF CATTLE. FR Bertin1, LJ Baseler2, SD Lenz2, CR Wilson2, JE Sojka-Kritchavsky3, SD Taylor1. 1Department of Veterinary Clinical Sciences Purdue University, West Lafayette, IN, 2Comparative Pathobiology, Purdue University, West Lafayette, IN

Arsenic toxicity is uncommon in cattle, and successful treatment has not been previously reported. The objective of this study was to describe the clinical signs, clinicopathologic indices, treatment, and survival status of six cows intoxicated with arsenic.

Cows ranged from 1 to 4 years of age. Cattle were exposed to burned wood previously treated with arsenic. The ashes contained more than 2,400ppm of arsenic by a colorimetric qualitative test. The most common clinical signs included ataxia and weakness (5/6; 83%), dehydration (4/6; 67%), respiratory distress (3/6; 50%) and sudden death (1/6; 17%). Clinicopathologic values on presentation revealed hemoconcentration, azotemia, hypocalcemia, hyperbilirubinemia and increased liver enzyme activity in all animals. A diagnosis of arsenic toxicity was made based on detection of elevated arsenic concentrations in whole blood, urine or tissues using inductively coupled plasma mass spectroscopy. The median blood arsenic concentration for presenting cows was 677ppb [276-747ppb] (reference range: < 50ppb). Supportive treatment included intravenous and oral fluids, oral mineral oil and oral activated charcoal. Oral and intravenous sodium thiosulfate was used as a specific antidote. After treatment, the median blood arsenic concentration was 463ppb [48-514ppb].

There was no association between severity of clinical signs, blood arsenic concentration and outcome. Thirty-three percent of cows survived and were healthy for up to two months after discharge. Necropsy of nonsurvivors revealed abomasal erosions and submucosal edema, segmental jejunal mucosal congestion, and urinary bladder mucosal petechiae. Sodium thiosulfate may be of limited use in affected cattle.

ABSTRACT FA-22

ANALYTICAL VALIDATION OF A COMMERCIALLY AVAILABLE IMMUNOASSAY FOR THE MEASUREMENT OF SERUM FOLATE CONCENTRATIONS IN PIGS. N Grützner1, D Knaibe2, BD Lawhorn3, B Dominguez4, J Kaulfuss5, JS Suchodolski1, JM Steiner1. 1Gastrointestinal Laboratory, Texas A&M University, College Station, TX, 2Department of Animal Science, Texas A&M University, College Station, TX, 3Veterinary Large Animal Clinical Sciences, Texas A&M University, College Station, TX, 4New Bolton Center, University of Pennsylvania, School of Veterinary Medicine, Kennett Square, PA

Folate (vitamin B9) plays an important role in amino acid metabolism, and in RNA and DNA synthesis. Based on literature from human and veterinary medicine the majority of folate is absorbed in the proximal small intestine. In humans, cats, and dogs it has been shown that chronic and severe proximal small intestinal disease can cause folate deficiency and that small intestinal dysbiosis can lead to increased serum folate concentrations. An immunoassay labeled for the measurement of serum folate concentration in humans is routinely used in dogs and cats. In pigs, the role of serum folate has not yet been extensively investigated. The aim of this study was to analytically validate said immunoassay, labeled for use in humans, for the measurement of folate concentrations in serum samples from pigs and to determine serum folate concentrations in weaned pigs.

For the analytical validation of the assay (IMMULITE® 2000 folate immunoassay; Siemens, Deerfield, IL), 20 surplus porcine serum samples were used. Validation of the assay consisted of determination of dilutional parallelism, spiking recovery, and intra- and inter-assay variability. Additional surplus serum samples from 21 piglets from four litters owned by and housed at a Texas A&M University farm were obtained. Each piglet had been bled twice, the first time at weaning (21 days of age) and the second time 12 days later. To investigate results in comparison between age groups (time of weaning and post weaning), serum folate concentrations were compared using a Wilcoxon matched pairs test. Significance was set at p<0.05.

Observed to expected ratios (O/E) for serial dilutions ranged from 78.4 to 98.3% (mean ±SD: 85.2 ±6.9%) for five different serum samples for dilutions of 1:4, 1:8, 1:16, and 1:32. O/E for spiking recovery ranged from 84.9 to 115.2% (mean ±SD: 95.4 ±8.6%) for five different serum samples that had been spiked with each other. Intra-assay coefficients of variation (%CV) for five different serum samples were 5.5, 6.5, 7.2, 7.4, and 8.7%, respectively. Inter-assay %CVs for five different serum samples were 10.0, 6.7, 9.6, 10.4, and 12.5%, respectively. Serum folate concentrations were significantly higher in piglets post weaning (median range: 45.0 [21.0–90.5] µg/L) compared to those at the time of weaning (median range: 17.2 [8.5–50.7] µg/L; p<0.0001).

The IMMULITE® 2000 folate immunoassay labeled for use in humans is linear, accurate, precise, and reproducible for measurement of serum folate concentrations in pigs. This study also shows that piglets that differ in age by only 12 days have significantly different serum folate concentrations. Further investigations of the implications of differing serum folate concentrations in pigs at different stages of life are warranted.

SMALL ANIMAL – GASTROENTEROLOGY

GI-4

CONFOCAL ENDOMICROSCOPY ENABLES IN VIVO IDENTIFICATION OF GASTRIC HELICOBACTER-LIKE ORGANISMS IN DOGS. M J Sharman1, B Bacci1, P Sutton1, T Whitten1, P Delaney1, E-S Mandell1, 1School of Veterinary Medicine, The University of Melbourne, VIC, Australia, 3Optiscan, Nottinghill, VIC, Australia

Confocal endomicroscopy (CEM) is an emerging technology allowing for in vivo cellular imaging of the gastrointestinal mucosa and is capable of achieving subcellular resolution. In
people CEM has been successfully used to identify and diagnose clinical Helicobacter pylori infections and associated gastritis. CEM has also been used to characterise various other gastrointestinal conditions including dynamic morphologic changes in the mucosa in response to provocative challenges. The objective of this study was to determine whether CEM could be used to identify Helicobacter-like organisms in dogs.

Six clinically healthy colony dogs underwent standard upper gastrointestinal endoscopy followed by CEM. CEM-guided pinch biopsies were obtained for comparison. Two fluorophores previously evaluated clinically in people, and shown to be effective and safe in dogs in a previous study, were used to provide contrast. Fluorescein (10% solution, 15mg/kg) was first administered intravenously followed by topical acriflavine (0.05% solution) via an endoscopy spray catheter.

CEM provided high quality in vivo cellular and subcellular histologically-equivalent images for evaluation during gastrointestinal endoscopy. Application of topical acriflavine allowed identification of Helicobacter-like organisms in all six dogs. Ovoid clusters were most commonly identified within the gastric mucus layer, but were frequently present deeper within gastric pits. Distribution throughout the stomach was scattered and multi-focal. CEM findings were correlated with standard histopathology, along with polymerase chain reaction (PCR), serum antibody concentration and culture. CEM provided an accurate semi-quantitative assessment of Helicobacter-like organisms.

Confocal endomicroscopy provides in vivo histology images and is capable of aiding identification of Helicobacter-like organisms and interpretation of mucosal morphology by gastroenterologists during the procedure. This has implications for further investigating the relationship between these organisms and inflammatory change in dogs.

ABSTRACT GI-7
SERUM PEPSONIN A AS A PROGNOSTIC MARKER IN CANINE GASTRIC DILATATION AND VOLVULUS. I Arochi1, J Steinert2, 1Israel1, S Yudelovich1, Y Bruchim1, G Segov1, 1Koret School of Veterinary Medicine, Hebrew University of Jerusalem, Rehovot, Israel, 2GI Laboratory, Texas A&M University, College Station, Texas, USA

Pepsinogens arezymogens secreted mainly by gastric chief cells. In humans, their serum concentration reflects gastric mucusal morphology and function. Our aims were to characterise serum canine pepsinogen A (cPG-A) and lactate concentrations at presentation in dogs with gastric dilatation and volvulus (GDV), assess their relationship with surgical findings and mortality, and compare their prognostic usefulness. Sixty-six dogs confirmed with GDV at surgery were included in the study group. Blood samples collected prospectively at presentation were used to measure cPG-A and lactate concentrations. The reference interval (RI) for cPG-A was based on 79 healthy, fasted controls. The gastric wall status was assessed and assigned a score (GWDS) at surgery.

The cPG-A RI was set at 105-802 µg/L. The mortality rate was 22.7%. cPG-A was higher in GDV dogs (median 397µg/L, range 37-5410) compared to controls (median 304µg/L, range 18-848) (P=0.07). In dogs with GDV, cPG-A level was higher in non-survivors compared to survivors (median 746 µg/L, range 128-5409 versus median 346, range 36-1575, respectively; P=0.003). There was a significant (P=0.007) trend for increased cPG-A with an increase in GWDS. Receiver operator characteristics analysis of cPG-A as a predictor of death had an area under the curve (AUC) of 0.756 and performed better compared to lactate concentration (AUC 0.66).

cPG-A is often increased in canine GDV at presentation. Its level is positively associated with GWDS, and is significantly higher in non-survivors compared to survivors. cPG-A performed better as an outcome predictor compared to serum lactate.

ABSTRACT GI-12
FELINE EXOCRINE PANCREATIC INSUFFICIENCY: 150 CASES, PG Xenoulis1, P Wooll1, DL Zoran2, LC Doyal1, K Wooten3, WN Cutrone3, JS Suchodolski4, JM Steiner5. 1Gastrointestinal Laboratory and, 2Department of Small Animal Clinical Sciences, Texas A&M University, College Station, TX

Exocrine pancreatic insufficiency (EPI) is considered to be a rare condition in cats. However, with the introduction of the feline TLI (fTLI) assay, which is considered to be the gold standard test for the diagnosis of feline EPI, this condition is diagnosed with increasing frequency. Due to the small number of reported cases, the clinical presentation and response to therapy of cats with EPI have been poorly described. The purpose of the present study was to describe the presentation, concurrent diseases, and response to treatment of a large number of cats with EPI.

The Gastrointestinal Laboratory’s database was searched over a 15-month period for cats with a serum fTLI concentration ≤ 8 µg/L, which is the currently recommended cut-off value for a diagnosis of feline EPI. The veterinarians who had submitted the samples were contacted and asked to fill out a questionnaire for each affected cat. Information gathered involved signalment, medical history, clinical signs, concurrent conditions, and treatment.

Questionnaires for 150 cats with EPI were completed. Breeds included DSH (94 cats), DLH (15), DMH (11), Maine Coon (7), British shorthair (6), Siamese (6), Ragdoll (3), Abyssinian (1), Balinese (1), Himalayan (1), and Savannah (1), while 4 cats were of mixed breed. The mean age of the cats was 8.1 years (SD: 4 years). Sixty-one cats were female (all neutered) and 89 were male (86 neutered). The median body condition score was 3/9 (range: 1/9 to 7/9). Ninety-two of 119 cats (77%) had hypochobalaminemia (median: 149 ng/L; range: 149-1,001 ng/L), and 83 of those cats (70%) had undetectable serum cobalamin concentrations (<149 ng/L). Fifty-six of 119 cats (47%) had increased and 6 cats (5%) had decreased serum folate concentrations (median: 21.1 µg/L; range: 3.9-121 µg/L). The median serum Spec IPI concentration was 0.9 µg/L (range: 0.2-4.8 µg/L). The most common clinical signs was weight loss (median weight loss: 1.41 kg; range: 40 grams to 6.82 kg), and was reported in 91% of cases. Other clinical signs included loose stools (62%), poor haircoat (50%), anorexia (45%), increased appetite (42%), depression (40%), watery diarrhea (28%), and vomiting (19%). Eighty-seven cats (58%) were reported to have concurrent diseases, the most common of which were inflammatory bowel disease (21%), diabetes mellitus (14%), pancreatitis (11%), and hepatic lipidosis (6%). One hundred and two cats were treated with enzyme replacement therapy using appropriate products and the treatment response was reported to be good in 66%, partial in 24%, and poor in 10% of cases.

In the present study, the most common clinical sign in cats with EPI was weight loss. A relatively large percentage of cats did not have diarrhea. The majority of cats evaluated had hypochobalaminemia. Also, the majority of cats responded well to enzyme replacement therapy.
with concurrent increases in Proteobacteria). The aim of this study was to validate the results of previous sequencing studies by measuring the abundance of selected bacterial groups using quantitative real-time polymerase chain reaction (qPCR) assays in healthy dogs, dogs with chronic enteropathies (CE), and dogs with acute hemorrhagic diarrhea (AHD).

Fecal samples were collected from healthy dogs (n = 180), dogs with CE (n = 87), and dogs with AHD (n = 48). A qPCR panel targeting 11 bacterial groups was used for analysis of fecal microbiota at various phylogenetic levels (i.e., Faecalibacterium spp., Turicibacter spp., Bifidobacterium spp., Lactobacillus spp., Streptococcus spp., Ruminococcaceae, C. perfringens, E. coli, γ-Proteobacteria, Bacteroidetes, and Firmicutes). Differences in bacterial abundance among groups were evaluated using a Kruskal-Wallis test followed by a Dunn’s post-test. Statistical significance was set at p < 0.05.

Significant differences in the abundance of the evaluated bacterial groups were observed for the disease groups when set at p < 0.05. E. coli and C. perfringens were significantly increased in CE (p < 0.05 and p < 0.001, respectively) and AHD (p < 0.001 and p < 0.01, respectively). Bifidobacterium spp. and γ-Proteobacteria were significantly increased in CE (p < 0.05 for both), but not different in dogs with AHD (p > 0.05 for both). Lactobacillus spp. and Streptococcus spp. were significantly increased in dogs with CE (p < 0.01 for both) and decreased in dogs with AHD (p > 0.05 and p > 0.05, respectively). There was no significant difference in the abundance of Firmicutes in dogs with CE or AHD compared to the healthy dogs (p > 0.05).

In conclusion, the here employed qPCR panel revealed a fecal dysbiosis in dogs with CE and AHD when compared to healthy dogs. These results are similar to recently reported findings using molecular sequencing approaches. Quantification of these bacterial groups by qPCR may be a useful adjunct for diagnosis or monitoring of gastrointestinal disease in dogs.

ABSTRACT GI-2

FINDING DIAGNOSES IN 136 DOGS WITH CHRONIC DIARRHEA. M Volkman1, GT Fosgate2, JM Steiner3, B Kohn1.
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Chronic persistent or intermittent diarrhea is common in dogs and many different underlying causes have to be considered. The objective of this study was to evaluate the final diagnoses of a large number of dogs with chronic diarrhea.

Medical records of 209 dogs with chronic diarrhea (with or without vomiting) presented to the Small Animal Clinic of the Berlin University between September 2009 and July 2011 were retrospectively reviewed. Dogs were included if a minimum work-up including a CBC, plasma chemistry profile, and fecal parasitology (flotation and Giardia ELISA) had been performed. Further diagnostic tests included abdominal radiography and/or ultrasonography, serum cTLL, cobalamin, folic acid, cortisol, or cPli concentrations, fecal microbiology, a therapeutic trial with an exclusion diet and/or gastrointestinal enzymes, and colonoscopy.

In 136/209 (65%) cases a final diagnosis was recorded. A primary enteropathy was diagnosed in 123/136 dogs (90%): food responsive enteropathy (64%), idiopathic inflammatory bowel disease (13%), anticholinergic responsive enteropathy (11%; metronidazole, 2 tylosin), steroid responsive enteropathy (4%; corticosteroid-responsive without histopathologic confirmation of intestinal inflammation), gastrointestinal parasites (15%), lymphoma (5%), protein losing enteropathy of unknown etiology (3%), protozoa (2%), and esophagitis, colorectal adenocarcinoma, colonic intussusceptions and systemic vasculitis in one dog each. In 13 dogs a secondary enteropathy was diagnosed (10%): exocrine pancreatic insufficiency (4%), pancreatitis (3), and in one dog each a pancreatitis, hypoadrenocorticism, hypothyroidism, porotic shunt, renal insufficiency, and heart failure. 57/123 dogs (43%) finally diagnosed with a primary enteropathy received antibiotics (other than or in addition to metronidazole, tylosin) without identifying an obligate enteropathogen.

In this study food responsive enteropathies (47%) were the most important differential diagnoses in dogs with chronic diarrhea.

ABSTRACT GI-3

SERUM HOMOCYSTEINE CONCENTRATIONS IN CHINESE SHAR PEIS AND DOGS OF SIX OTHER BREEDS WITH COBALAMIN DEFICIENCY. N Grützner, VR Rangachari, RM Heilmann, K Weber, JS Nachodofski, JM Steiner. Gastrointestinal Laboratory, Texas A&M University, College Station, TX

Cobalamin deficiency in the Chinese Shar Pei (Shar Pei) is suspected to be hereditary. In humans, various defects of intracellular cobalamin metabolism have been reported in several different studies. All these defects result in deficient function of one of the two main cobalamin-dependent enzymes, methylmalonyl-CoA mutase and methionine synthase, which may lead to methylmalonic aciduria and homocysteinuria. In humans, both disorders have been characterized with increased serum methylmalonic acid concentrations and increased serum homocysteine (HCT) concentrations, respectively. In dogs, a previous study showed that cobalamin-deficient Shar Peis have higher serum methylmalonic acid concentrations compared to normocobalaminemic Shar Peis and cobalamin-deficient dogs of 6 other breeds. The aim of this study was to evaluate serum HCT concentrations in Shar Peis and dogs of 6 other breeds with cobalamin deficiency.

Serum samples from 40 Shar Peis with an undetectable serum cobalamin concentration (<150 ng/L), 28 normocobalaminemic Shar Peis, and 279 dogs of 6 other breeds that were tested at the Gastrointestinal Laboratory between 2008–2011 and had an undetectable serum cobalamin concentration were included in this study. Serum cobalamin concentrations (reference interval: 251–908 ng/L) and serum HCT concentrations were measured using an Immulite®2000 assay (Siemens, Deerfield, IL) and a gas chromatography-mass spectrometry method, respectively. A control interval for serum HCT concentrations was established from 35 healthy pet dogs. Serum HCT concentrations were compared among cobalamin-deficient dogs belonging to the 7 different breeds using a Kruskal-Wallis test with a Dunn’s post-test. A Fisher’s exact test was used to evaluate if cobalamin deficiency in Shar Peis is associated with hyperhomocysteinemia (p < 0.0005).

Serum HCT concentrations ranged from 5.2–25.9 µmol/L. Serum HCT concentrations in Shar Peis (median: 25.4 µmol/L) were significantly higher than in cobalamin-deficient German Shepherd dogs (median: 9.4 µmol/L; n = 96), Labrador Retrievers (median: 10.7 µmol/L; n = 83), Yorkshire Terriers (median: 3.8 µmol/L; n = 44), Boxers (median: 11.8 µmol/L; n = 21), Cocker Spaniels (median: 5.0 µmol/L; n = 20), and Beagles (median: 9.0 µmol/L; n = 15; p < 0.0001). Serum HCT concentrations in normocobalaminemic Shar Peis ranged from 8.6–51.9 µmol/L (median: 13.7 µmol/L), and cobalamin deficiency in Shar Peis was significantly associated with hyperhomocysteinemia (p = 0.0009).

In conclusion, cobalamin-deficient Shar Peis had higher serum HCT concentrations compared to cobalamin-deficient dogs of 6 other breeds and a higher frequency of hyperhomocysteinemia than normocobalaminemic Shar Peis. These findings suggest that the function of the cobalamin-dependent enzyme methionine synthase is impaired in cobalamin-deficient Shar Peis.
ABSTRACT GI-14
COMPARISON OF E. COLI ASSOCIATED WITH GRANULOMATOUS COLITIS OF BOXER DOGS AND E. COLI FROM HEALTHY CONTROLS. B Dogan, M Volkmann, J Oh, A Bencze, K Kluessig, KW Simpson. College of Veterinary Medicine, Cornell University, Ithaca, NY

Granulomatous colitis (GC) of Boxer dogs is a breed specific inflammatory bowel disease associated with mucosally invasive E. coli. Three of four E. coli strains isolated from 2 Boxers with GC were similar to adherent and invasive E. coli (AIEC) linked to Crohn’s disease, raising the possibility that AIEC are adapted to exploit an IBD susceptible host. It is unclear if AIEC arise from the resident microbiome or are transmissible bacteria that could pose a zoonotic risk. Our objectives were to determine the prevalence, relatedness and virulence traits of AIEC associated with GC and then to compare GC-associated E. coli with strains from healthy dogs.

E. coli were isolated via colonic biopsies of 20 Boxers with GC and rectal mucosal swabs of 17 clinically healthy dogs. 10 to 15 isolates from each dog were evaluated for differences in genotype by RAPD-PCR with representative strains evaluated for phylogroup (A, B1, B2, D), serotype, multi locus sequence type (MLST-7), virulence genes, invasion of Caco-2 intestinal epithelial cells and survival in J774 macrophage cells. Gentamicin resistant, cnf or stx-positive strains were excluded from cell culture assays (and could therefore not be identified as invasive or persistant).

We isolated 45 different E. coli strains from GC (1-4 / dog, median 2) and 34 from healthy dogs (1-3 dog, median 2). 10/18 (55%) GC dogs harbored AIEC strains; 15/35 (42%) GC strains were AIEC and showed no consistent association with phylogroup or serotype, and were not clonal: 10/15 (68%) belonged to phylogroup B1 or D. GC AIEC strains commonly carried gsp (73%), hcp (75%), virB (40%), lpfA154 (40%) and fyuA (33%) genes.

13/18 (72%) GC dogs harbored non-AIEC strains; 20/35 (58%) strains isolated from GC dogs were non-AIEC strains. 15/20 (75%) belonged to phylogroup A or B1, and no serotype pre-dominated. GC-associated non-AIEC strains also commonly carried gsp (80%), virB (80%), lpfA154 (50%), hcp (45%) and fyuA (35%) genes.

10/17 (59%) healthy dogs harbored invasive strains; 16/18 (89%) gentamicin-susceptible strains were invasive (persistence in J774 was not assessed). 13/16 (81%) invasive strains belonged to phylogroup B1 or D. Invasive strains from healthy dogs commonly carried virB (100%), lpfA154 (63%), gsp (56%), hcp (50%), rata (44%), and kpsMII (38%) genes. The 2 non-invasive strains carried hcp (100%) genes. 8/34 healthy dog strains (all phylogroups B2) harbored O4:K5:H6 serotype.

Our results reveal that mucosal E. coli isolated from GC are not always AIEC. GC dogs do not have a substantially different proportion of invasive E. coli strains than healthy dogs; these E. coli share similar phylogroup compositions, virulence genes, and have no predominant serotype. Non-AIEC E. coli from GC dogs carry virulence genes commonly found in their AIEC counterparts. Therefore, GC-associated AIEC are likely resident flora that, when presented with an opportunity, invade and persist in mucosa of susceptible dogs leading to the clinical syndrome of GC.

ABSTRACT GI-5
FECAL S100A12 CONCENTRATIONS ARE INCREASED IN DOGS WITH INFLAMMATORY BOWEL DISEASE. L Kearney1,2, K Allenspach3, P Lecoindre4, MJ Day5, 1Department of Veterinary Clinical Sciences, Louisiana State University School of Veterinary Medicine, Baton Rouge, LA, 2Department of Pathobiological Sciences, Louisiana State University School of Veterinary Medicine, Baton Rouge, LA

We hypothesized that fecal S100A12 concentrations are associated with more severe clinical disease in canine CE. This study was designed to retrospectively define the significance of small intestinal crypt lesions in dogs with chronic idiopathic enteropathies (CE). Fifty-eight cases with idiopathic CE were found to have histopathological evidence of small intestinal crypt lesions. They were subsequently divided into those with (CL) and without crypt lesions (NC). CE was further differentiated in crypt abscesses (CA) and dilated crypts containing mucus (DC). This study was designed to retrospectively define the significance of small intestinal crypt lesions in dogs with chronic idiopathic enteropathies (CE). We hypothesized that crypt lesions are associated with more severe clinical disease in canine CE.

This study was designed to retrospectively define the significance of small intestinal crypt lesions in dogs with chronic idiopathic enteropathies (CE). We hypothesized that crypt lesions are associated with more severe clinical disease in canine CE.

Fecal S100A12 concentrations were significantly higher in dogs with IBD (median range: 273 [5-11,400] ng/g) compared to healthy controls (median range: 9 [1-1,810] ng/g; p<0.0001) and correlated with the severity of endoscopic disease in the duodenum (r=0.503; p=0.0068) as well as not in the stomach (r=0.406; p=0.069) and had a trend to correlate with the endoscopic disease activity in the colon (p=0.815; p=0.0136). Fecal S100A12 concentrations were not associated with the severity of histological changes in the stomach (p=0.7749), duodenum (p=0.5517), or colon (p=0.0574), but tended to be higher (15,830 [19-110,400] ng/g vs. 187 [5-3,730] ng/g; p=0.0033) if histology revealed a neutrophilic component of the inflammatory infiltrate (n=5). Fecal S100A12 concentrations showed a trend towards correlation with the CCECAI score (p=0.384; p=0.040). This study showed that fecal canine S100A12 concentrations are increased in dogs with IBD compared to healthy dogs and correlate with endoscopic disease severity. Further studies are under way to evaluate the mucosal expression of S100A12 in dogs with IBD and to assess fecal S100A12 concentrations in response to treatment.
likely to have CA than other breeds. Dogs with CA and DC presented more frequently with ascites. When compared to NC and DC, dogs with CA were older (median: 96 ± 33 months old vs. 59 ± 40 and 51 ± 33 months old) and had lower serum albumin (1.9 ± 0.7 g/dL vs. 3.0 ± 0.7 and 2.9 ± 0.5 resp.), globulin (2.2 ± 0.7 g/dL vs. 2.8 ± 0.4 and 2.7 ± 0.6 resp.) and total calcium (8.0 ± 1.8 mg/dL vs. 9.6 ± 0.6 and 9.5 ± 0.8 resp.). Their small intestinal mucosal echogenicity scores and total AUS scores were greater, and they had more secondary AUS changes such as ascites. Additionally, mucosal edema was more frequently observed during duodenoscopy. Finally, histopathologic lactic acid and villous stunting were more frequent and more severe in dogs with CA than in those of other groups. Crypt necrosis and attenuation were more pronounced in dogs with CA than in those with DC. However, the severity and type of the inflammatory lamina propria infiltrates were not different between the three groups. The median survival of dogs with CA was 489 days and was significantly shorter than that of dogs with NC and DC, which could not be calculated.

Overall, the presence of CA is associated with more severe intestinal protein loss, AUS changes, mucosal architectural lesions, clinical course, and shorter survival in dogs with CE.

ABSTRACT GI-16
FELINE ALIMENTARY LYMPHOMA IS ASSOCIATED WITH CHANGES IN THE SPATIAL DISTRIBUTION OF MUCOSAL BACTERIA. S Hoehne, SP McDonough, KW Simpson. College of Veterinary Medicine, Cornell University, Ithaca, NY

Persistent bacterial infections are causally linked to gastric carcinoma and MALT-lymphoma in people, and the concept that mucosa-associated bacteria can promote gastrointestinal carcinogenesis is well established. Perturbation of the intestinal microbiome has been documented in cats with IBD and it seems plausible it could serve as a trigger for the development of intestinal lymphoma. It is against this background that we sought to assess the spatial distribution of mucosal bacteria in intestinal biopsies from cats with histologically normal small intestinal lympho-plasmacytic enteritis (LPE), and alimentary lymphoma. Endoscopic or surgical biopsies of normal (N) small intestine (n=16), LPE (n=25), and alimentary lymphoma (small cell (SC), low grade, n=33; large cell (LC), high grade, n=16) were identified in the histopathology database at Cornell. The spatial distribution of mucosal bacteria (luminal cellular debris, villus-associated mucus, adherence to epithelium and serosa, mural invasion, intravascular presence) was determined by fluorescence in situ hybridization (FISH) with the eubacterial probe EUB338. The results of FISH analysis are shown in the table below:

The spatial distribution of mucosal bacteria was similar in N and LPE. Colonization of luminal cellular debris was more common in both SC and LC lymphoma than N and LPE. Bacterial colonization of adherent mucus was more common in SC lymphoma than LPE. Invasive bacteria were most frequently associated with lymphoma, particularly sections from the LC group. Bacterial invasion was not restricted to areas of eroded or ulcerated mucus, and in some sections bacteria were visualized in vessels and/or the serosa.

Our results reveal that alimentary lymphoma is associated with alterations in the spatial distribution of mucosa-associated bacteria. Bacterial invasion was most frequent in LC lymphoma (69%), with evidence of bacterial translocation in approximately 30% of cases. Our results support the need to speciate lymphoma (69%), with evidence of bacterial translocation in approximately 17 healthy adult dogs. Two operators each obtained four duodenal biopsy specimens from each dog with each forceps. The lightest sample was discarded and the 3 other specimens were blindly evaluated by one pathologist. A total of 612 specimens were evaluated. Results were analyzed by one-way ANOVA of forceps effects with dog as a blocking factor. Post hoc pairwise comparisons were examined with Tukey’s test when indicated.

The operator had no statistically significant effect on any of the variables. Biopsies performed with the 2 Boston Scientific (BoS) Radial Jaw Large Capacity forceps were significantly heavier and their diagnostic adequacy was significantly superior to the Olympus Standard Oval and ‘pediatric’ forceps. However, no statistically significant difference in depth scores was noted. The BoS spike forceps was significantly associated with less crush artifact than the other forceps. The results also showed that the presence of a spike had no effect on crush artifact and diagnostic adequacy.

Overall, the two BoS Radial Jaw Large Capacity forceps were superior to the standard size forceps, demonstrating optimal quality and diagnostic adequacy. Our study provides valuable initial data to guide the choice of endoscopic biopsy forceps for duodenal samples.

ABSTRACT GI-9
SEROLOGIC AND FECAL MARKERS IN PREDICTION OF ACUTE DISEASE COURSE IN CANINE CHRONIC ENTEROPATHIES, CC Otomo, RM Heilmann, M García-Sancho, JS Suchodolski, JM Steiner, AE Jergens. 1College of Veterinary Medicine, Iowa State University, Ames, IA; 2GI Laboratory, Texas A&M University, College Station, TX; 3College of Veterinary Medicine, Complutense University of Madrid, Madrid, Spain

Canine chronic enteropathies (CE) include a group of disorders characterized by persistent or recurrent gastrointestinal signs and histological intestinal inflammation. The search for biologic markers that can detect disease activity and monitor the effect of therapy has become an important focus of human CE research. Little information is available on pathologic markers that assess the disease course in dogs with CE, especially in response to diet and drug interventions. The purpose of this study was to evaluate the relationships between disease activity and serum and fecal biomarkers in dogs with CE.

Fifteen dogs with CE were prospectively enrolled. CE was diagnosed on the basis of chronic GI signs, the exclusion of identifiable underlying disorders, histological inflammation, and response to sequential therapy with an elimination diet, antibiotics, or immunosuppressive drugs. The clinical scores (i.e., CIBDAI), serum concentrations of C-reactive protein (CRP) by
ELISA), perinuclear antineutrophil cytoplasmic antibodies (p-ANCA by IFA), and canine calprotectin (cCP by ELISA) and fecal concentration of cCP were measured in each dog before and after 21 days of medical therapy. The correlation between CIBDAI with serum and fecal markers was estimated using the Spearman rank correlation coefficient. P-values < 0.05 were considered significant.

The final diagnoses for CE dogs included PLE (n=7), idiopathic IBD (n=5), antibiotic-responsive enteropathy (ARE; n=2) and exocrine pancreatic insufficiency (EPI) with lymphoplasmacytic enteritis (n=1). Treatment for CE resulted in full or partial remission in 14/15 dogs. Serum CRP (P < 0.01), fecal cCP (P < 0.01), and CIBDAI scores (P < 0.01) were significantly increased in CE dogs pre-treatment versus post-treatment values. There were no significant associations between the CIBDAI scores and pre- or post-treatment serum concentrations of CRP or p-ANCA. In contrast, there was a significant association (P = 0.02) between post-treatment fecal cCP and CIBDAI scores. There was a trend toward higher pre-treatment serum CRP and fecal cCP concentrations to be found in dogs with moderate-to-severe disease activity (i.e., CIBDAI > 6).

Our data indicate that fecal cCP levels were related to the extent of disease activity at diagnosis in dogs with CE. Serum and fecal cCP concentrations were not associated with clinical disease activity in response to short-term medical treatment. Overall, dogs with severe GI disease more often have abnormal inflammatory markers, compared with dogs having low grade inflammation.

ABSTRACT GI-10
FLOW CYTOMETRICAL ANALYSIS OF PERIPHERAL BLOOD MONONUCLEAR CELLS IN DOGS WITH INFLAMMATORY BOWEL DISEASE. A. Galler1, BC Ruetergen2, A Saalmueller3, RA Hirt4, W. Gerner5, I Schwendennen6, JG Thalhammer1, N Luckschander1. 1Clinic for Internal Medicine, Department for Companion Animals and Horses, 2Central Laboratory and 3Institute of Immunology, Department for Pathobiology, University of Veterinary Medicine, Vienna, Austria

Inflammatory bowel disease (IBD) is a common cause of chronic gastrointestinal signs in dogs. Although the importance of intestinal intraepithelial lymphocytes (IEL) in the pathogenesis of canine IBD is evident, little is known about the role of peripheral blood mononuclear cells (PBMC) in this disease. Thus the purpose of this study was 1) to analyze PBMCs in canine patients suffering from IBD by flow cytometry (FCM) and 2) to compare PBMC sub-populations between patients and healthy controls.

Blood samples of 5 dogs suffering from IBD, which were clinically scored based on the canine IBD activity index (CIBDAI) and the canine chronic enteropathy clinical activity index (CCECAI) were collected. Blood samples of 10 healthy dogs served as controls.

PBMCs were isolated and stained with a panel of anti-canine and cross-reactive monoclonal antibodies against T and B cell differentiation antigens, including CD45, CD3, CD4, CD8a, CD8b, TCRβ, TCRγδ, CD79 and CD21. All analyses were performed with multi-colour FCM.

Data of healthy dogs and dogs with IBD were compared by a Mann-Whitney U test. P values less than 0.05 were accepted as statistically significant.

Diseased dogs were suffering from moderate to severe IBD (CIBDAI: 6-11, median 9; CCECAI: 6-16, median 10). In canine IBD patients PBMCs showed significantly decreased percentages of CD4 and CD8a (P < 0.01), TCRγδ+ bearing T-lymphocytes (P < 0.03), including CD8a+ (P < 0.04) and CD8b+ (P = 0.02) T-cells, as compared to healthy dogs. The percentage of CD4+ TCRβγ+ lymphocytes (P = 0.049) was significantly increased in dogs with IBD.

In summary, preliminary results demonstrate significant differences between PBMC populations in healthy and IBD dogs analyzed by FCM. These data suggest that canine IBD is associated with an altered distribution in PBMC populations, indicating an imbalance of lymphocytes with different immunological functions emphasizing the value of this examination technique in a larger cohort of dogs.

ABSTRACT GI-11
DECREASED IMMUNOGLOBULIN A LEVELS IN FECES, DUODENUM, AND PERIPHERAL BLOOD LYMPHOCYTES OF DOGS WITH INFLAMMATORY BOWEL DISEASE. S. Muela, K Ohno, K Nakashima, K Fukushima, Y Fujino, H Tsujimoto. The University of Tokyo, Tokyo, Japan

Decreased immunoglobulin A (IgA) levels in fecal and duodenal explants were reported in German shepherd dogs (GSDs). This decrease in IgA levels was considered to be significant in the pathogenesis of inflammatory bowel disease (IBD). The aim of this study was to determine IgA levels in dogs of other breeds (non-GSDs) who had IBD.

Twenty healthy dogs and 21 dogs with IBD were used. IgA and IgG concentrations in serum, fecal, and duodenal samples were measured by ELISA. Duodenal lamina propria IgA+ cells and CD21+ IgA+ cells in peripheral blood mononuclear cells (PBMCs) were examined by immunohistochemistry and flow cytometry, respectively.

Compared to the healthy dogs, IgA levels in the fecal (P = 0.0053) and duodenum (P = 0.0233) samples obtained from dogs with IBD were significantly reduced; however, no significant difference was observed in the IgG concentrations between the 2 groups. Furthermore, there was no significant difference in the serum IgA and IgG concentrations between the 2 groups. The number of duodenal IgA+ cells was significantly decreased in dogs with IBD than in the healthy controls (P < 0.0001). Moreover, the proportions of CD21+ IgA+ cells in PBMCs were significantly decreased in dogs with IBD (P < 0.0001), and the proportions were significantly elevated in post-treatment compared to pre-treatment (P = 0.0165). In conclusion, decreased IgA levels in the feces, duodenum, and PBMCs were observed in non-GSDs with IBD, suggesting that the decreased IgA may be involved in the pathogenesis of canine IBD, regardless of the dog’s breed.

ABSTRACT GI-15
GRANULOMATOUS COLITIS IN FRENCH BULLDOGS IS ASSOCIATED WITH INVASIVE E. COLI AND CLINICAL RESPONSE TO FLUOROQUINOLONE ANTIBIOTICS. A. Manchester1, S. Hill2, B. Sabatino3, R. Armentano4, B. Kessler1, M Miller1, B Dogan1, SP McDonough1, KW Simpson1, 1College of Veterinary Medicine, Cornell University, Ithaca, NY, 2Veterinary Specialty Hospital, San Louis, MO, 3College of Veterinary Medicine, University of Tennessee, Knoxville, TN, 4College of Veterinary Medicine, University of Florida, Gainesville, FL

French bulldogs have been reported to develop a form of inflammatory bowel disease that is histopathologically similar to granulomatous colitis of Boxer dogs (GCB). GCB is associated with mucosally invasive E. coli, whose eradication correlates with clinical remission. We sought to determine the clinical features, presence or absence of intramucosal bacteria and E. coli in colonic biopsies, and response to fluoroquinolone antibiotics in French bulldogs with GC.

Five French bulldogs (4M, 1F; median age 10mo, range 5-12mo) with a histological diagnosis of GC were studied. Bacterial colonization was evaluated using eubacterial (EUB-338) and E. coli-specific FISH probes. E. coli were isolated and antimicrobial resistance was determined by broth microdilution MIC from available fresh biopsies. Response to fluoroquinolone antibiotics was determined by monitoring clinical signs.

Dogs were presented with clinical signs of chronic hematicocrits (5/5), large bowel diarrhea (3/5), and tenesmus (1/5) after failed therapeutic trials with metronidazole (5/5), various other antimicrobials (3/5), and anthelmintics. Age at onset of clinical signs was 1-7mo (median 3mo). Clinicopathologic findings and fecal analysis were unremarkable apart from mild anemia (PCV = 39%) in 1/5 dogs. Abdominal ultrasound revealed patchy thickening of the colonic wall and regional lymphadenopathy in 3/4 dogs. Multiple hypochoeic foci within the colonic submucosa were observed in 1/4 dogs. Colonoscopic findings
included hyperemic and irregularly thickened mucosa (5/5), overt bleeding (2/5) and mucosal ulceration (3/5). FISH revealed multi-focal accumulations of intramucosal E. coli in colonic biopsies from 5/5 dogs. E. coli G2a strains isolated from 2/2 dogs were susceptible to enrofloxacin, marbofloxacin and trimethoprim sulfa. Treatment with fluoroquinolones (enrofloxacin 4/5, marbofloxacin 1/5) at 4.4-10 mg/kg (median 10 mg/kg) PO SID for 6-10 weeks was associated with clinical remission. Hematochezia resolved in 3-14 days in 5/5 dogs, and 2 dogs had gained weight within 1 month. All 5 dogs remained free of clinical signs over a 9-23 month follow up period.

We conclude that GC in young French bulldogs is associated with the presence of invasive E. coli and closely parallels GCB. Treatment with fluoroquinolones was associated with lasting clinical remission. Documented treatment failures in GCB caution against empirical antimicrobial therapy in French bulldogs with unconfirmed GC.

ABSTRACT GI-13
EXOGENOUS SIALIC ACID AND CYSTEINE PROTEASE INHIBITION BLOCK ADHERENCE OF TRITRICHOMONAS AS FOETUS TO THE INTESTINAL EPITHELIUM.
K Tolbert, JL Gookin. North Carolina State University College of Veterinary Medicine, Raleigh, NC

Trichomonas foetus (TF) is a flagellated protozoan that parasitizes the feline colon resulting in chronic foul-smelling diarrhea. Up to 30% of young purebred cats are infected and this disease is now recognized as pandemic. Only a single drug, with a narrow margin of safety, is effective for treatment. While the general pathogenicity of bovine TF is attributed to adherence to uterovaginal epithelium, the pathogenesis of diarrhea in feline TF infection is unknown. Aims of this study were to establish an in vitro model of TF adhesion to intestinal epithelium and apply this model towards investigating TF cytopathogenicity and putative pharmacological targets. Confluent monolayers of porcine intestinal epithelial cells (IPEC-J2, TER > 2,000Ohm·cm²) were infected with axenic cultures of feline TF that were labeled with [3H]thymidine (4Ci/ml for 48hrs) or CFSE (30µM for 20min) and harvested at log-phase. The effect on TF cytoasthesion of multiplicity of infection, duration of infection, viability of TF, binding competition, sialic acid (N-acetylneuraminic acid, 2-50µM), cytoskeletal (cytochalasin B, 10.5µM; colchicine, 250µM) and protease inhibitors (E64, 0.3-1.5mM; ethylendiaminetetraacetic acid, 0.5mM, 4-(2-aminoethyl) benzensulfonyl fluoride hydrochloride, 1-4mM, phenylmethanesulfonyl fluoride, 0.3-0.6mM; ethylenediaminetetraacetic acid, 0.5mM, 4-(2-aminoethyl) benzensulfonyl fluoride hydrochloride, 1-4mM, phenylmethanesulfonyl fluoride, 0.3-0.6mM; ethylenediaminetetraacetic acid, 0.5mM, 4-(2-aminoethyl) benzensulfonyl fluoride hydrochloride, 1-4mM, phenylmethanesulfonyl fluoride, 0.3-0.6mM; ethylenediaminetetraacetic acid, 0.5mM, 4-(2-aminoethyl) benzensulfonyl fluoride hydrochloride, 1-4mM, phenylmethanesulfonyl fluoride, 0.3-0.6mM) were quantified by liquid scintillation counting and immunofluorescence of adherent TF. A minimum of four replicates was performed for each experiment. Data were analyzed using commercially available statistical software.

[3H]thymidine and CFSE-labeled TF cytoadhered to IPEC-J2 monolayers in a dose and time-dependent manner with reproducible adhesion achieved by infection with 20×10³ TF for 6hrs. Clinical isolates of feline TF (n=5) demonstrated significantly greater adhesion to intestinal epithelium than feline Pentatrichomonas hominis, the latter of which is a presumably nonpathogenic trichomonad. Adhesion of TF required viable trophozoites but the latter of which is a presumably nonpathogenic

ABSTRACT GI-17
NATURALLY-OCcurring HYPERADRENOCorticism IS ASSOCIATED WITH INCREASED PANCREATIC LIPASE IMMUNOREACTIVITY CONCENTRATIONS IN DOGS.
DL Mawby1, JC Whittemore1, K Fecteau1, A Reed1, JM Steiner2, JS Suchodolski2. 1University of Tennessee, Knoxville, TN, 2Texas A&M Gastroenterology Lab, College Station, TX

Canine pancreatic specific lipase immunoreactivity concentrations (cPLI) are used to diagnose pancreatitis. The effect of naturally-occurring hyperadrenocorticism (HAC) on cPLI concentrations is unknown. The purpose of this study was to determine whether dogs with HAC have different cPLI concentrations by Spec cPL (SpeccPL) or SNAP cPL (SNAPcPL) assay from dogs without HAC.

Healthy dogs based on clinical examination and laboratory work (Group 1, n=20), dogs with signs of HAC but normal ACTH stimulation tests (Group 2, n=12), and dogs with HAC (Group 3, n=20) were enrolled between December 2009 and September 2010. Dogs with signs compatible with pancreatitis were excluded. Samples were batched and SpeccPL and SNAP- cPL assays were performed. SNAPcPL results were categorized as negative, low positive (LP), or high positive (HP). Associations between Group and cPLI were assessed using the Fisher’s exact test (SNAPcPL) or Kruskal-Wallis test (SpeccPL). P < 0.05 was significant.

SNAPcPL results differed significantly between groups (p < 0.005), with more HP results in Group 3 than Group 1. SpeccPL concentrations were significantly higher in Group 3 than Group 1 or 2 (p < 0.0001).

Dogs with HAC had significantly higher SpeccPL concentrations and more HP SNAPcPL results than dogs without HAC. Further study is necessary to determine the clinical relevance of this association.

ABSTRACT GI-18
ALPHA-ENOLASE ANTIBODIES ARE NOT ASSOCIATED WITH FELINE PANCREATIC LIPASE IMMUNOREACTIVITY CONCENTRATIONS IN CLIENT-OWNED CATS.
JC Whittemore1, JM Steiner2, JS Suchodolski2, S Radecki3, MRLappum4. 1Department Small Animal Clinical Sciences, University of Tennessee, Knoxville, TN, 2Gastrointestinal Laboratory, Texas A&M University, College Station, TX, 3Private Statistical Consultant, MI, 4Department of Clinical Sciences, Colorado State University, Ft. Collins, CO

Alpha-enolase antibodies are a biomarker for inflammatory and autoimmune diseases in people. Pancreatitis is increasingly diagnosed in cats based on increased feline pancreatic lipase immunoreactivity (fPLI) concentrations. Histologically, it is characterized by lymphocytic infiltration, suggesting a potential underlying immune-mediated etiology. The purpose of this study was to evaluate for an association between alpha-enolase antibodies and fPLI concentrations in client-owned cats.

Residual sera were collected from 458 privately-owned cats following fPLI concentration measurement. Age was known for all cases. fPLI concentrations were classified as normal (2.0-6.8µg/l), questionable (6.9-12µg/l), or consistent with pancreatitis (>12µg/l). Alpha-enolase antibody %ELISA values were deter-
The prevalence of alpha-enolase antibodies was not associated with IPI concentrations. Prospective evaluation in cats with and without histologically confirmed pancreatitis should be considered to further assess for associations.

**ABSTRACT GI-19**

**MUCOSAL NUCLEOTIDE Oligomerization domain TWO (NOD2) mRNA OVEREXPRESSION AND NF-kappaB ACTIVATION IN DOGS WITH CHRONIC ENTEROPATHY.**

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Nucleotide oligomerization domain two (NOD2) is an intracellular receptor involved in the innate immune response against muramyl dipeptide, a component of the bacterial cell wall. Recently, NOD2 was reported to be overproduced in inflamed mucosa in Crohn’s disease, and to be accompanied with a significant increase in NF-kappaB activity. However, few studies to date have investigated intercellular signal molecules in Chronic enteropathy dogs. The activities of NOD2 and NF-kappaB in mucosal biopsies from CE dogs, as compared to healthy controls, were investigated in the present study.

Endoscopic descending colon biopsies were obtained from 10 dogs referred for evaluation of chronic signs of large bowel disease. Biopsies from 5 healthy dogs were used as controls. Tissue was collected and immersed in liquid nitrogen (RNA) or formalin (histology). Expression of NOD2 mRNA was determined by RT-PCR, and was normalized against GAPDH. Amplified products were subjected to gel electrophoresis, followed by computer-assisted densitometry analysis using Quantity One Software. NF-kappaB binding activity was assessed by electrophoretic mobility shift assay.

The histological diagnosis was lymphocytic-plasmocytic colitis in CE dogs. NOD2 mRNA expression was significantly higher in CE dogs than in healthy controls (p = 0.012). Moreover, NF-kappaB binding activity was significantly upregulated in the inflamed colon mucosa of CE dogs, as compared to healthy controls (p = 0.0047).

In conclusion, NOD2 mRNA is overproduced and NF-kappaB activity is upregulated in the inflamed colon of CE dogs. Our data suggest that NOD2 and NF-kappaB play an important role in the pathogenesis of CE.

**ABSTRACT GI-20**

**Fecal and Urinary N-Methyllhistamine Concentrations in Dogs with Chronic Gastrointestinal Disease.**

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The role of mast cells in dogs with chronic gastrointestinal (GI) disease is not well understood. Mast cells are potentially important in intestinal inflammation due to their ability to release inflammatory mediators, such as histamine. Histamine is rapidly metabolized upon its release, but one of its metabolites, N-methyllhistamine (NMH), can be readily measured in both fecal and urine samples. The purpose of this study was to measure NMH in fecal and urine samples from dogs with chronic GI disease, and to evaluate its utility as a potential inflammatory marker in dogs.

Three consecutive fecal samples and one urine sample were collected from 53 dogs with chronic GI disease. Fecal and urinary NMH concentrations were measured by gas chromatography/mass spectrometry. Fecal NMH concentrations were reported as 3-day means and also as the maximum concentration for the 3 days. Urinary NMH was normalized using urinary creatinine concentrations and results were expressed as ng NMH/mg creatinine. Fecal NMH concentrations were compared to those in a group of 49 control dogs, and urinary NMH concentrations were compared to a previously established control range. A correlation between fecal and urinary NMH concentrations and the clinical IBD activity index (CCECAI) in dogs with GI disease was calculated using Spearman’s rank correlation. Statistical significance was set at p < 0.05.

Mean 3-day fecal NMH concentrations were significantly higher in the dogs with GI disease (median: 97 ng/g, range: 0-4,690 ng/g) than in the control dogs (median: 53 ng/g, range: 9-224 ng/g; p = 0.009). Similarly, 3-day maximum NMH concentrations were significantly higher in the dogs with GI disease (median: 160 ng/g, range: 0-7,059 ng/g) than in the control dogs (median: 83 ng/g, range: 14-666.2 ng/g; p < 0.01). Eleven dogs (19%) had 3-day mean fecal NMH concentrations above the upper limit of the reference interval (>191 ng/g), and 23 dogs (36%) had maximum fecal NMH concentrations above the upper limit of the reference interval (>334 ng/g). Sixteen dogs (30%) had urinary NMH concentrations above the upper limit of the control range (>136 ng/mg creatinine), 8 of which also had simultaneously increased fecal NMH concentrations. There was no correlation between fecal and urinary NMH concentrations, or between these parameters and the clinical activity index.

These data show that fecal and/or urinary NMH concentrations may be increased in a subset of dogs with chronic GI disease. The lack of correlation to the clinical IBD activity index suggests that mast cell related inflammation may not be of clinical importance in all dogs with GI disease. The lack of correlation between fecal and urinary NMH concentrations may be due to a difference in distribution of mast cells within the mucosa, or may be due to potential uptake of NMH along the GI tract, leading to subsequent urinary excretion. Further studies are underway to evaluate the distribution of intramucosal mast cells and the correlation between fecal and urinary NMH concentrations and mucosal mast cell numbers in dogs with chronic GI disease.
Serum cobalamin concentrations were significantly lower in dogs with GI disease (median [range]: 251 [333-835] ng/L) than in control dogs (median [range]: 515 [149-1000] ng/L; p<0.001). Twenty-one dogs with GI disease (36%) had hypocobalaminemia (<251 ng/L), and 8 dogs (14%) had undetectable cobalamin concentrations (<150 ng/L). Serum MMA concentrations were significantly higher in dogs with GI disease (median [range]: 442 [205-399] nmol/L) than in control dogs (median [range]: 649 [228-1253] nmol/L; p<0.046). Five dogs with GI disease (9%) had MMA concentrations above the reference interval (>1192.5 nmol/L). Serum MMA concentrations were significantly higher in dogs with GI disease (median [range]: 741 [334-1556] mg/L) compared to Yorkshire Terriers with a normal serum cobalamin concentration (median [range]: 1665.0 [900.0-2970.0] ng/L; p<0.0001). One fourth of the cobalamin-deficient Yorkshire Terriers had a serum cobalamin concentration below the lower limit of the reference interval (<749.9 mg/L), and cobalamin deficiency was significantly associated with a decreased serum cobalmin concentrations. In this study, serum concentrations of cobalamin were decreased in cobalamin-deficient Yorkshire Terriers compared to normal-cobalaminemic Yorkshire Terriers. The functional and potentially prognostic implications of this decrease in serum cobalamin concentrations warrant further studies.

ABSTRACT GI-23
EFFECTIVITY OF AST-120 IN DOGS WITH CHRONIC INFLAMMATORY ENTEROPATHIES. M. Volkmann1, NC Wirtherle2, GF Beddies3, B. Kohn4. 1Clinic of Small Animals, Faculty of Veterinary Medicine, Freie Universität Berlin, Germany, 2Bayer Animal Health GmbH, D-51368 Leverkusen

Canine chronic inflammatory enteropathies (CIE) are highly complex diseases of unknown origin. Abnormal immunological tolerance towards luminal antigens and the loss of gut-associated lymphoid tissue might play an important role. AST-120 is a spherical carbon adsorbent preparation with a highly adsorption ability for low molecular substances.

The objective of this study was to evaluate the clinical efficacy of supplementary feeding of AST-120 in dogs with CIE.

Sixteen client-owned dogs with chronic diarrhea and no or insufficient response to an elimination diet were included into the explorative, randomized, placebo-controlled, double blinded field study. The dogs received either AST-120 (n=8) or placebo (n=8) for a duration of 21 days. The dogs were evaluated using the Canine Inflammatory Bowel Disease Activity Index (CIBDAI) was used to assess disease severity and clinical outcome. Remission was defined as complete (75% or greater reduction in CIBDAI score) or partial (<75% and >25% reduction).

A significant reduction in CIBDAl score was observed in the AST-120 group (day 1: 4.6, day 21: 1.8; p=0.016, Wilcoxon signed-rank test) but not in the placebo group (day 1: 4.4, day 21: 3.6; p=0.656). After 21 days, 7/8 dogs treated with AST-120 (3 complete, 4 partial) and 3/8 dogs treated with placebo (2 complete, 1 partial) were in remission. An increase of body condition score was observed in 5/8 dogs treated with AST-120 but remained unchanged in the placebo group. No side effects of AST-120 were noted.

The data suggest that AST-120 may represent a safe and effective alternative therapy for dogs with mild to moderate CIE.

ABSTRACT GI-24
INTERLEUKIN-17A GENE EXPRESSION IN THE INTESTINAL MUCOSA IN DOGS WITH LYMPHOCYTIC-PHILOMICCYTIC ENTERITIS AND INFLAMMATORY COLORECTAL POLYP. H. Ohba1, K. Takada1, Y. Tamura1, N. Nakamura2, M. Yamasaki3, M. Takiguchi1. 1Graduate School of Veterinary Medicine, Hokkaido University, Sapporo, Hokkaido, Japan

Interleukin (IL)-17A is a proinflammatory cytokine produced by T helper (Th)17 cells, and an increase in IL-17A expression in the intestinal mucosa has been reported in human inflammatory bowel disease (IBD). Lymphocyctic-plasmacytic enteritis (LPE) is the most common form of canine IBD, and IL-17A messenger RNA (mRNA) expression has not been examined in dogs with LPE. Inflammatory colorectal poly (ICRP) in miniature daschunds is recently recognized in Japan as a major cause of large bowel symptoms in this breed. ICRP is characterized by the formation of multiple small polyps (small polyps) in the large bowel mucosa, accompanied by a large space-occupying polyp (large polyp) formation, and is thought to be a novel form of IBD. The aim of the current study was to evaluate the mRNA expression of IL-17A in the duodenal mucosa from dogs with LPE and colorectal mucosa form dogs with ICRP.

Duodenal mucosa of 20 dogs with LPE were obtained by endoscopic biopsy. Endoscopic or surgical colorectal biopsies from 6 dogs with ICRP were obtained. Duodenal and colorectal mucosa were obtained from 8 control dogs. Total RNA was extracted from intestinal mucosa and cDNA was synthesized. IL-
17A mRNA expression was measured by a quantitative reverse transcriptase polymerase chain reaction technique. In addition, mRNA expression of IFN-gamma (Th1 cytokine), IL-4 (Th2 cytokine) and IL-10 (immunoregulatory cytokine) was measured. Results were normalized using two housekeeper genes (GAPDH and SDHA).

The mRNA expression of all cytokines in the duodenal mucosa from dogs with LPE was not different from those of the control dogs. IL-17A, IFN-gamma, and IL-10 mRNA expression in large polyps, but not in small polyps, was significantly higher than that in colonic mucosa form control dogs. IL-4 mRNA expression was not different among groups. IL-17A mRNA expression in large polyps was negatively-correlated with IL-10 mRNA expression. In addition, IL-17A mRNA expression was strongly-correlated with serum C-reactive protein (CRP) concentration. Meanwhile, IL-10 mRNA expression was negatively-correlated with serum CRP concentration.

These findings indicated that the IL-17A mRNA expression was not increased in the duodenal mucosa in dogs with LPE. On the other hand, IL-17A mRNA expression was increased in large polyps in dogs with ICRP which composed mainly of neutrophils. IL-17A may play an important role in the recruitment of neutrophils and the formation of large polyps in colorectal area in dogs with ICRP, while IL-10 could oppose the proinflammatory effect of IL-17A.

**ABSTRACT GI-25**

**C-REACTIVE PROTEIN CONCENTRATIONS IN DOGS WITH INFLAMMATORY BOWEL DISEASE AND CORRELATION WITH A CLINICAL DISEASE ACTIVITY INDEX AND SERUM ALBUMIN CONCENTRATIONS.** LM Oliveira-Barros1, RM Heilmann2, JM Steiner2, JS Suchodolski2, LFM Barros3, SRR Lucas4, JM Materia5. 1School of Veterinary Medicine, University of São Paulo, São Paulo, Brazil, 2Gastrointestinal Laboratory, Texas A&M University, College Station, TX, USA

C-reactive protein (CRP) is a positive acute-phase protein and has been considered as a useful biological marker in dogs with inflammatory bowel disease, particularly for monitoring the response to treatment. The canine inflammatory bowel disease activity index (CIBDAI) is used to assess clinical disease severity. The purpose of this study was to compare serum CRP concentrations between dogs diagnosed with inflammatory bowel disease (IBD) and healthy dogs, and to correlate serum CRP concentrations with CIBDAI scores and serum albumin concentrations in affected dogs.

Twenty dogs referred to the Small Animal Teaching Hospital at the School of Veterinary Medicine, University of São Paulo, Brazil, with a diagnosis of IBD were included in this prospective study. The severity of clinical disease was assessed using the CIBDAI scoring system. Blood samples were collected from these animals and from healthy control dogs (n = 20). Serum CRP concentrations were measured using a commercial ELISA kit (Tri-Delta Phase CRP Canine kit, Tri-Delta Diagnostic, Boonton Township, NJ). The data were statistically analyzed using GraphPad InStat version 3.10 for Microsoft Windows. Data were expressed as medians and range. The Mann-Whitney U test and Spearman’s rank order correlation test were used. Statistical significance was set at P < 0.05 for all analyses.

Dogs in the IBD group had significantly higher serum CRP concentrations compared to dogs in the control group (medians and range – IBD group: 1.85 mg/L versus control group: 0.10 mg/L; P = 0.0244, Mann-Whitney U test). Serum albumin concentration in the IBD group was 3.20 ± 0.67 g/dL (mean ± standard deviation; reference interval: 2.5 – 4.5 g/dL). Only one animal in IBD group had serum albumin concentration below the reference interval (< 2.5 g/dL) and all other animals had normal serum albumin concentration. No correlation was found between serum CRP and albumin concentrations (r = -0.098, P = 0.7475; Spearman correlation coefficient). The median CIBDAI score in affected dogs was 5 (range 0 to 9). A direct moderate positive correlation was found between serum CRP concentration and CIBDAI score (r = 0.613; P = 0.0040; Spearman correlation coefficient).

Hypoalbuminemia were not frequently observed in dogs with IBD. Elevated serum CRP concentrations of affected dogs suggest that this protein can be useful as a biological disease marker. Also, our findings indicate that CRP can reflect the severity of clinical disease. Only one animal had serum albumin concentration.

**ABSTRACT GI-26**

**THE EFFECT OF A MULTI-STRAIN SYNBIOTIC ON THE MICROBIOTA OF CATS WITH CHRONIC ENTERITIS.** CB Webb1, JF Garcia-Mazcorro2, JM Steiner2, JS Suchodolski2. 1Colorado State University, Fort Collins, CO, 2Gastrointestinal Laboratory, Texas A&M University, College Station, TX

Alteration of the host microbiota is one proposed mechanism for the potentially beneficial effect of pre- and probiotics in patients with diarrhea. The purpose of this study was to test the hypothesis that oral administration of a synbiotic (Proviable800, DC, Nutramax Laboratories) containing a total of 5x109 CFUs of a mixture of multiple probiotic strains and a blend of prebiotics would significantly alter the microbiota of cats with chronic diarrhea.

Adult cats (n = 21) presenting for chronic diarrhea (≥ 3 months) without prior treatment were recruited and screened for systemic disease and parasitism. The cats were then randomly assigned to receive the synbiotic once daily. Owners recorded stool quantity and consistency before and after supplementation. After 21 days cats underwent endoscopy for histopathology and characterization of the mucosa-adherent microbiota. One cat was found to have GI lymphoma and removed from the study. For analysis, cats were grouped into responders (R; n = 13) and non-responders (NR; n = 7) based on the subjective assessment of response to therapy by the owner. Mucosal biopsies (n = 13 and 7 for group R and NR, respectively) and paired pre- and post-synbiotic fecal samples (n = 5 each for groups R and NR) were used for microbiota analysis by 16S rRNA gene 454-pyrosequencing and qPCR assays. Differences in the abundance of bacterial groups and baseline characteristics between R and NR were assessed by Wilcoxon signed rank test or Kruskal-Wallis test. Differences in microbial community structure between R and NR were assessed by permutational multivariate analysis of variance (PERMANOVA) of the distance matrix, followed by Analysis of similarity (ANOSIM) of the distance matrix. Significance was set as p < 0.05.

There were no significant differences in age, body weight, serum cholesterol or folate concentrations, duration of clinical signs, or fecal scores between the 2 groups prior to supplementation (p = 0.10). Histopathology revealed mild (n = 8), moderate (n = 9), or severe (n = 3) enteritis. No significant differences in microbiota composition of the mucosa-adherent microbiota were observed between R and NR after synbiotic use. However, in feces, the community structure at baseline differed significantly between R and NR (p = 0.04). The abundance of probiotic genera in feces at baseline was significantly higher in the NR than in R (p = 0.016). The NR displayed a significantly lower bacterial diversity (median Chao index: 130, range 86-169 vs. 306, range 186-313; p = 0.03) in feces. No differences in fecal microbial community structure were observed between pre- and post-synbiotic use samples.

In this study, synbiotic administration did not significantly alter the microbial community structure of cats regardless of their clinical response. The lower diversity of the microbiota, as well as the higher abundance of probiotic genera in the non-responders at baseline, may help to explain the failure of their diarrhea to improve with synbiotic use.

**ABSTRACT GI-27**

**REGIONAL GRANULOMATOUS ENTERITIS IN 14 DOGS.** P Lecondu1, A Lecondu1, I Cattin1, M Chevalier1. 1Clinique Veterinaire des Cerisiers, Lyon, France, 2Animal Health Trust, Newmarket, UK, 3Laboratoire M. Mérieux, Lyon, France

Regional granulomatous enteritis is a rare form of canine inflammatory bowel disease (IBD) characterized by transmural granulomatous inflammation primarily involving the distal ileum and ileo-colic junction, and resulting in a stenosing, mass-like
thickening of the affected areas. The aim of this retrospective study is to describe the clinical and morphological characteristics of this condition, to describe and characterize the histological lesions observed and to report the treatments used and long-term follow-up.

Clinic data was reviewed to find dogs with a histopathological diagnosis of granulomatous enteritis. Fourteen dogs were included in the study. All dogs were purebred (5 French Bulldog, 4 Yorkshire Terrier, 2 West Highland White Terrier, 2 Cavalier King Charles Spaniel, 1 English Cocker Spaniel), with 7 males and 7 females and a mean age of 6.6 years (range 2.5-13), body condition score was 3 to 4/9. All dogs presented with about 6 months history of chronic small intestinal diarrhea and weight loss. Four dogs had concurrent tenesmus, hematochezia, abdominal pain and vomiting. According to the clinical index CIBDAI score (Jergens), all dogs were scored 10 or more. In all dogs a firm, tubular mass was palpated in the cranial abdomen. Mild to moderate hypoproteinemina was present in 4 cases, and was severe in one case (total protein 3.3g/dL). On abdominal ultrasonography a segmental, parietal thickening of both the distal ileum and ileo-colic junction with loss of layering was seen. In 3 dogs there was an obstructive pattern and in 1 an intestinal intussusception was identified. Gas troendoscopy was performed in 12 dogs and inflammatory lesions of the ascending colon were seen in 6 dogs. Exploratory colectomy performed in 9 dogs revealed: severe thickening of the ileum (n=9), serosal lipogranulomas (n=8), inflammation of the caecum and ileo-colic junction (n=9) and inflammation of the ascending colon (n=5). Histology of intestinal biopsies revealed a transmural granulomatous inflammation with voluminous lipogranulomas in the muscularis and serosa in all cases. In 9 dogs, an enterectomy was performed because of partial or total intestinal obstruction. Medical treatment with antibiotics (enrofloxacin and metronidazole) and immunosuppressive drugs (prednisolone and/or cyclosporine) were used in all dogs. A long-term (>6months) clinical improvement was seen in 7 cases, with a complete remission in 6.

Regional granulomatous enteritis seems to be a specific entity affecting small breed dogs, characterized by profound parietal changes in the intestine with preferential localization to the ileum and the ileo-colic junction. Further evaluation to determine the aetiology of the disease and classify it into the entity of inflammatory bowel disease is needed.

**ABSTRACT GI-28**
EVALUATION OF FECAL SHORT CHAIN FATTY ACID CONCENTRATIONS IN HEALTHY DOGS AND DOGS WITH CHRONIC DIARRHEA
Y Minamoto, N Berghoff, VR Rangachari, JM Steiner, JS Suchodolski. Gastrointestinal Laboratory, Texas A&M University, College Station, TX

Short-chain fatty acids (SCFA) are major end-products of bacterial carbohydrate fermentation in the gastrointestinal (GI) tract. They constitute an important energy source for intestinal epithelial cells and help maintain intestinal mucosal integrity. Several studies have shown decreased fecal SCFA concentrations in humans with inflammatory bowel disease. The role of SCFA in dogs with GI disease has not yet been studied extensively. Therefore, the aim of this study was to evaluate fecal concentrations of SCFA in healthy dogs and dogs with chronic diarrhea.

Fresh fecal samples were collected from 10 healthy pet dogs and 14 dogs with chronic diarrhea (>3 weeks duration). Fecal concentrations of SCFA (acetate, propionate, butyrate, and total SCFA) and branched chain fatty acids (BCFA; isobutyrate, isovalerate, valerate, and total BCFA) were measured using gas chromatography-mass spectrometry. The fecal SCFA concentrations were compared between both groups using a Student’s t-test or Wilcoxon rank-sum test where appropriate. Significance was set at p < 0.05.

Fecal concentrations of acetate, propionate, and total SCFA were significantly decreased in dogs with chronic diarrhea when compared to the healthy dogs (Table 1). There were no significant differences in fecal concentrations of butyrate or any of the BCFA between groups.

In this study, dogs with chronic diarrhea had decreased fecal concentrations of total SCFA, acetate, and propionate. These results warrant further studies with larger populations of dogs and various GI diseases to further evaluate the role of SCFA in gastrointestinal health and disease in dogs.

**Table 1.** Cricoides midges caught in tent traps on 3 farms with 2 horses per farm during 6 tests and in a black light trap.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Cricoides</th>
<th>Total</th>
<th>C. boletus</th>
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<td></td>
<td>Culuiides</td>
<td>blood-fed</td>
<td>blood-fed</td>
<td>blood-fed</td>
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<tr>
<td>Horses with blank</td>
<td>402</td>
<td>(32%)</td>
<td>295</td>
<td>(30%)</td>
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<tr>
<td>Horses without blank</td>
<td>464</td>
<td>(56%)</td>
<td>318</td>
<td>(58%)</td>
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<td>Black light trap</td>
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</table>

**ABSTRACT GI-29**
THE EFFECT OF VARIOUS STORAGE CONDITIONS ON THE ABUNDANCE OF BACTERIAL GROUPS IN CANINE FECES.
BJ Marvel, NM Gossett, WE Geiger, JM Steiner, JS Suchodolski. Gastrointestinal Laboratory, Texas A&M University, College Station, TX

Quantitative polymerase chain reaction (qPCR) assays can be used to quantify specific bacterial groups in fecal samples of healthy dogs and dogs with clinical signs of gastrointestinal disease. The stability of fecal bacterial groups stored at various temperatures and for various time periods is of critical concern, because shifts in the fecal microbiota attributable to storage conditions may influence the interpretation of findings. Limited information is available about optimal storage conditions of fecal samples for evaluation of the microbiota. It is often recommended that samples be immediately frozen after collection. The aim of this study was to evaluate the effect of various storage temperatures and time periods on the abundance of selected fecal bacterial groups in dogs using qPCR.

Ten fresh fecal samples were collected from seven dogs. For each sample, 9 aliquots were prepared. One aliquot of each sample immediately underwent DNA extraction using a modified bead beating protocol (Zymo Fecal DNA extraction kit; Zymo Research, Orange, CA). The remaining aliquots were stored at -80°C, -20°C, 4°C, and room temperature (RT). After 24 hours and after 7 days, one aliquot of each sample was extracted and analyzed. Previously established qPCR assays were utilized for the evaluation of abundance of total bacteria, gram positive bacteria (Firmicutes, Faecalibacterium spp., and Clostridium perfringens), and gram negative bacteria (Bacteroides). The bacterial abundance in all aliquots was compared using a repeated measures 2-Way ANOVA and a Bonferroni post-test with time and temperature as independent variables. A p < 0.05 was considered statistically significant.

Neither storage temperature nor storage time significantly influenced the abundance of total bacteria or gram positive bacteria. However, a lower abundance of Bacteroidetes was observed across all time points and storage conditions as compared to baseline abundance. Statistically significant differences were identified between the baseline samples (median = log 4.96 of DNA, range = log 4.02-5.43) and samples stored at -80°C for 24 hours (median = log 4.40, range = log 3.15-5.45 p < 0.01), those stored at -20°C for 24 hours (median = log 4.41, range = log 3.69-5.12; p < 0.01), those stored at -20°C for 7 days (median = log 4.49, range = log 3.00-5.35; p < 0.05), and those stored at RT for 7 days (median = log 4.46, range = log 3.67-5.43; p < 0.05).

In this study, neither temperature nor time had a significant influence on the abundance of Firmicutes, Faecalibacterium spp., or C. perfringens. However, a significantly lower abundance of
Bacteroidetes was observed within 24 hours of storage at -80°C and -20°C, and after storage at RT for 7 days. Because there was no significant change observed at 4°C for any of the bacterial groups analyzed, refrigeration may be recommended for short term storage of fecal samples. Future studies are needed to establish the influence of storage conditions on other clinically relevant bacterial groups.

ABSTRACT GI-30
DAY-TO-DAY VARIATION OF FECAL MICROBIOTA IN DOGS OF DIFFERENT AGES. JF Garcia-Mazcorro1, JM Steiner2, JS Suchodolski1. Gastrointestinal Laboratory, Texas A&M University, College Station, TX

Despite increasing evidence suggesting age-related differences in the composition and metabolic activity of the intestinal microbiota, the nature of this relationship remains unclear. Especially young dogs appear to be at an increased risk for gastrointestinal disease, which may or may not be related to changes of their intestinal microbiota. Therefore, the aim of this study was to investigate day-to-day variation of fecal microbiota in a population of healthy dogs of different ages.

A total of 22 dogs (median age: 6.2 years; range: 4 months - 12 years) were enrolled into this study. The dogs did not have any clinical signs of gastrointestinal disease and did not receive any medication within at least three months before enrolling into the study. Fecal samples were collected daily from all dogs during a period of five consecutive days. The abundance of total bacteria, Enterococcus, Lactobacillus, and Streptococcus spp. was estimated in feces using quantitative real-time PCR targeting the 16S rRNA gene using published oligonucleotides. The average, as well as day-to-day standard deviation and percentage coefficient of variation (%CV) were calculated using normalized 16S rRNA gene copies (16S rRNA gene copies from the bacterial groups divided by the 16S rRNA gene copies for total bacteria).

The day-to-day standard deviation for total bacteria ranged from 0.1 to 1.7, and from 0.2-0.5 for the three bacterial groups specifically analyzed (i.e., Enterococcus, Lactobacillus, and Streptococcus spp.). The day-to-day %CV for all bacteria ranged from 2.41%, and from 3.32% for the three bacterial groups analyzed separately. The bacterial group with the highest day-to-day variability was Streptococcus (median day-to-day %CV: 57%), followed by Enterococcus (median %CV: 34%), and Lactobacillus (median %CV: 6%). There was no significant linear relationship (R²<0.1, P>0.1) between age and either the average and day-to-day standard deviation or %CV for any of the bacterial groups analyzed, including total bacteria. Additionally, visual analysis of day-to-day variability plots did not reveal any obvious patterns associated with age. Instead, the pattern of day-to-day variability seemed to be unique in each dog and dependent on the specific bacterial group analyzed.

Our results suggest that short-term day-to-day variation of fecal microbiota is not affected by age in healthy dogs. Instead, this variation seems to be unique in each dog and dependent on the particular bacterial group analyzed. However, further studies are warranted to evaluate more intestinal microbial groups in a larger population of dogs to assess the relationship (if any) between aging and over time variability of the intestinal microbiota.

ABSTRACT GI-31
PRESURGICAL EVALUATION OF RETINAL MASSES IN DOGS BY ENDOSCOPY AND ENDOSCOPIC ULTRASOUND: 28 CASES. K Hayashi1, H Okanishi1, Y Sakamoto1, Y Kagawa2, K Asano1, M Sakai1, T Watari1. Nihon University, Kanagawa, Japan, 1North Lab, Hokkaido, Japan

Detailed evaluation of rectal masses is essential in selecting endoscopic treatment and minimal access surgery. However, because colorectal masses in dogs frequently occur in the distal rectum, visualization by abdominal ultrasound is difficult. The purpose of this study was to assess the usefulness of preoperative evaluation of rectal masses by endoscopy and endoscopic ultrasound (EUS).

This study targeted 28 cases in which rectal masses were assessed by endoscopy and EUS, prior to undergoing surgery. Abdominal ultrasound was performed in 10 cases, but was unable to provide detailed evaluation data. Rectal tumors in all cases could be evaluated in detail by EUS, and were classified by T stage (Tis-T2) or as submucosal tumor (SMT). Endoscopic histopathology showed good correlation with surgical histopathology in masses of Tis-T2 and accuracy was 92% (k=0.85). However, endoscopic and surgical pathology results did not correspond in SMT masses. Tis-T1 masses included 23 cases (inflammatory polyp: 15 cases; low-grade adenocarcinoma: 8 cases), T2 masses included 3 cases (high-grade adenocarcinoma: 2 cases; low-grade adenocarcinoma: 1 case) and SMT masses included 2 cases (leiomyoma: 1 case; rectal cyst: 1 case). EUS showed good correlation with surgical histopathology and accuracy was 86% (k=0.72).

Endoscopic histopathology was useful for evaluating of Tis-T2 masses, but was not useful in evaluating SMT masses. Diagnosis of SMT masses requires evaluation by both EUS and surgical histopathology. Although abdominal ultrasound was ineffective for evaluation of rectal masses, EUS was useful. Therefore, EUS may be applicable in the selection of surgical procedure and estimation of prognosis.

SMALL ANIMAL - HEMATOLOGY

ABSTRACT HM-1
THE OVERALL HEMOSTASIS POTENTIAL: A NOVEL, COST EFFECTIVE, GLOBAL COAGULATION ASSAY FOR USE IN CANINE PLASMA. A Dengate1,2, MC Morel-Kopp1, J Braddock2, R Churcher1, J Beaty2, V Barrs2, C Ward1. 1Northern Blood Research Centre, Kolling Institute, University of Sydney, Australia, 2Faculty of Veterinary Science, University of Sydney, Australia, 3North Shore Veterinary Specialist Centre, Crows Nest, Australia

The overall haemostasis potential (OHP) is a novel coagulation assay measuring both speed and extent of coagulation as well as fibrinolysis (Figure 1). Other global haemostasis assays such as thromboelastography (TEG) and the calibrated automated thrombogram (CAT) are gaining popularity in veterinary medicine, though their application is limited by cost and the requirement for specialised equipment. The OHP measures optical density (OD), directly related to fibrinogen, generation, with common absorbance spectrophotometry equipment. The purpose of this study was to optimise the OHP assay for use with canine platelet-poor plasma, and correlate the outputs with those obtained by TEG and CAT.

Citrated plasma was collected from 60 clinically healthy dogs. The OHP assay and standard coagulation assays (prothrombin time [PT], activated partial thromboplastin time [APTT], fibrinogen [Fg], Factor VIII and von Willebrands factor [vWF]) were performed for each sample. CAT was performed on 23 samples, and TEG on seven.

Figure : Outputs generated by the OHP assay. The delay, maximum slope, and maximum optical density (OD Max) are recorded. The overall fibrinolytic potential is calculated by area under OCP – OHP/OCP x 100.

Modifications to the published methodology for the OHP assay were required, with less coagulation activator (thrombin) and more fibrinolysis activator (tPA) utilised in canine plasma. Increasing Factor VIII activity was associated with a shortened delay (P = 0.043). High fibrinogen levels and decreased PT were associated with increased OD Max, OCP, OHP and max slope (P = <0.05). There was a strong correlation between the clot stability (G) and maximum amplitude (MA) using TEG, and the Delay, OCP, OD Max, OHP, and max slope obtained using the OHP assay (P = <0.05). Comparing OHP assay with CAT, there was a positive correlation for Peak with the OHP curve (P = 0.019).
These results support the use of the OHP assay as an accessible, cost-effective alternative to TEG.

ABSTRACT HM-2
MEASUREMENT OF THROMBIN GENERATION IN DOGS WITH DIFFERENT DISEASES. R Mischke1, C Witten1, A Tiede2. 1Small Animal Clinic, University of Veterinary Medicine Hannover, Hannover, Germany, 2Department of Haematology, Haemostasis, Oncology and Stem Cell Transplantation, Hannover Medical School, Hannover, Germany

The aim of the present study was to establish reference values for the in vitro thrombin generation (TG) assay and to assess possible changes in dogs suffering from different diseases which may be associated with hypo- and/or hypercoagulability.

Dogs with hemophilia A (5), hemophilia B (3), hyperadrenocorticism (11), inflammatory diseases (11) and neoplastic diseases (lymphoma [7], systemic histiocytic sarcoma [6], acute lymphoblastic leukaemia [5]) were included. 62 healthy dogs served as a control. TG was measured by use of the Calibrated automated Thrombinography (CAT) method which revealed the following parameters: lag time, peak, endogenous thrombin potential (ETP), time to peak and reaction time. Measurements were carried out with three different TF concentrations (1, 5 and 20 pM) using frozen platelet poor citrated plasma as sample material.

Dogs with hemophilia showed a significantly lower peak and prolonged lag time, time to peak and reaction time at low TF concentrations when compared to healthy dogs. Dogs with hemophilia B showed evidence of a lower mean peak and ETP at a TF concentration of 1 pM. There was a trend towards more severe changes with decreasing residual factor activity. Dogs with hyperadrenocorticism and inflammatory processes had significantly higher ETPs at all TF concentrations in comparison to healthy dogs, whereas ETP in neoplastic diseases was mainly unchanged. Dogs with histiocytic sarcoma had increased ETP values at 1 pM TF.

TG, particularly when performed with 1 pM TF, seems to be a valuable additional tool to verify hypo- and hypercoagulability in dogs and may be a helpful indicator of severity of thrombophilia in hypercoagulable conditions and a predictor of the severity of hemorrhagic diathesis in dogs with hemophilia.

ABSTRACT HM-3
IN VITRO EVALUATION OF THE EFFECT OF RIVAROXABAN ON COAGULATION PARAMETERS IN HEALTHY DOGS. B Conversy, M-C Blais, C Gara-Boivin, JRE del Castillo, L Carriólo, M Dunn. Faculté de Médecine Vétérinaire, Université de Montréal, Montréal, Canada

Rivaroxaban is a novel, direct factor Xa inhibitor used in people for the prevention and treatment of thromboembolic disorders at a fixed-dose regimen, without the need for laboratory monitoring. Its per os administration makes it an attractive anticoagulant for dogs. The purpose of this study was to evaluate the in vitro effects of rivaroxaban on canine coagulation parameters.

Aliquots of pooled citrated platelet poor plasma obtained from 20 healthy adult beagles were fortified in vitro with DMSO solutions of rivaroxaban (98% purity) to obtain 19 final concentrations ranging from 0 (solvent) to 1000 mg/L of drug. Samples were immediately submitted for the following coagulation assays: prothrombin time (PT), partial thromboplastin time (PTT), tissue factor induced thrombin generation and anti-Xa activity. Concentration-effect data were analyzed with ADAPT v.5, using sigmoid stimulatory or inhibitory Emax regression models.

Rivaroxaban caused a concentration-dependent prolongation of all coagulation parameters. The half maximal inhibitory concentration (IC50) for the propagation phase (rate index) of thrombin generation was 0.03 mg/L. The anti-Xa activity recommended for thromboprophylaxis (0.5-1 U/mL) was reached at rivaroxaban concentrations between 0.04 and 0.11 mg/L. At these concentrations, PT and PTT remained within the reference range. Two-fold prolongation from baseline of PT and PTT were achieved with concentrations of 1.24 and 1.45 mg/L, respectively. Thrombin generation was completely suppressed with concentrations ≥ 0.8 mg/L.

In vitro concentration-effect relationships of rivaroxaban on canine plasma coagulation parameters were documented. Thrombin generation and anti-Xa activity appear more sensitive in detecting rivaroxaban’s anticoagulant effect than PT and PTT.

ABSTRACT HM-4
ASSESSMENT OF HYPERCOAGULABILITY IN CANINE PITUITARY-DEPENDENT HYPERADRENOCORTICISM. F Park, A Abrams-Ogg, D Wood, D Allen, S Blois. Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

Dogs with pituitary-dependent hyperadrenocorticism (PDH) are at increased risk of thromboembolic disease. Thromboelastography (TEG®) provides a global assessment of coagulation, and is more sensitive than conventional coagulation tests for detecting hypercoagulability. TEG® with Platelet Mapping™ allows assessment of maximal amplitude (MA) in response to the agonists arachidonic acid (MAAα) and adenosine diphosphate (MAADP).

The purpose of this prospective clinical study was to evaluate for, and quantify, hypercoagulability in dogs with PDH. Citrated kaolin TEG® with Platelet Mapping™ was performed in 19 dogs with PDH pre-treatment, in 16 of these dogs during treatment with trilostane, and in 40 healthy control dogs. For citrated kaolin TEG®, dogs with PDH had decreased k-time (p=0.002), increased angle (p=0.007) and increased MA (MAAα and MAADP) compared to controls. The MAAα of dogs treated with trilostane decreased significantly after 3 months (p=0.02) and 6 months (p=0.04), but was still significantly higher than controls. MAAADP was significantly higher in dogs with PDH (p=0.02) but did not change significantly following treatment. MAADP was not significantly different between PDH dogs and controls.

In conclusion, dogs with PDH have evidence of increased clot strength and rate of clot formation. Clot strength decreases significantly during trilostane treatment, but does not normalize. Results also suggest that dogs with PDH may have higher platelet reactivity to arachidonic acid.

ABSTRACT HM-5
DELAYED FIBRINOLYSIS IN DOGS WITH NATURALLY OCCURRING PITUITARY DEPENDANT HYPERADRENOCORTICISM. A Dengate1,2,3, MC Morel-Kopp1, J Braddock1, R Churcher1, J Beatty2, V Barra2, C Ward1. 1Northern Blood Research Centre, Kolling Institute, University of Sydney, Australia, 2Faculty of Veterinary Science, University of Sydney,
Canine hyperadrenocorticism has been associated with hypercoagulability due to increases in circulating procoagulant factors II, V, VII, IX, X, XII, and fibrinogen, and decreased anticoagulant antithrombin (AT). In human hyperadrenocorticism, increased plasminogen activator inhibitor (PAI-1) also contributes to impaired fibrinolysis. The purpose of this study was to identify hypercoagulability in dogs with pituitary-dependent hyperadrenocorticism (PDH), using a novel global coagulation assay, the overall haemostasis potential (OHP).

Citrated plasma samples were collected from 11 client owned dogs with PDH, and 11 age-matched, clinically healthy dogs. The OHP assay was run on each sample, recording optical density (related to fibrin generation and lysis) over 1 hour (Figure 1). The mean area under the OHP curve was significantly increased in the PDH group (8.9) compared with the normal group (2.2), P = 0.038 (student’s t-test). The fibrinolytic potential (area under OCP – OHP,OCP x 100) was significantly reduced in PDH group (51.4%) compared with the normal group (84.6%), P = 0.017. These results support the presence of a hypercoagulable state associated with PDH, and that delayed fibrinolysis contributes to this state.

**Figure**: Overall haemostasis potential (OHP) and overall coagulation potential (OCP) curves for canine PDH and pooled normal canine plasma (PNP). The OHP curve shows both coagulation and fibrinolysis, the OCP coagulation only.

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**ABSTRACT HM-6**

**SYRINGE AND AGGREGATE FILTER ADMINISTRATION DOES NOT AFFECT SURVIVAL OF TRANSFUSED AUTOLOGOUS FELINE RED BLOOD CELLS.**

The use of mechanical administration systems, such as fluid pumps and syringe+aggregate filters, are reportedly associated with a risk of early loss of transfused autologous red blood cells (RBC’s) in the dog. Of these two techniques, syringe+aggregate filter is more commonly used in the cat. As cat RBC’s have differing flexibility and size than canine RBC’s, the aim of this study was to determine the effect of syringe+aggregate filter administration on RBC’s from domestic cats. Our hypotheses were that administration of autologous feline RBC’s through a syringe+aggregate filter would decrease the probability of short-term survival of the transfused cells, and reduce the circulating half-life of transfused cells, when compared to control RBC’s administered via gravity flow.

This was a prospective, blinded study. Six apparently healthy cats (minimum 4.5 kg bodyweight) belonging to staff and students of the Oregon State College of Veterinary Medicine were enrolled. Whole blood (40 ml/cat) was collected into 2×25 ml syringes containing CPDA-1 anticoagulant. Each aliquot of blood was centrifuged, plasma was harvested and stored, and then RBC’s were washed twice in PBS before suspension in 40ml of PBS+1% Dextrose. Washed cells were biotinylated at one of two biotin densities. After biotinylation, cells were washed twice in PBS, packed by centrifugation, and then suspended in autologous plasma before transfer to a labeled sterile syringe or 50ml blood bag. Each cat was then transfused with both aliquots of autologous labeled blood, delivered at a rate of 2 ml/kg/hr using either syringe pump+aggregate filter (AS-50 Syringe Pump, Baxter & Hemo-Nate® Filter, Utah Medical Products) or gravity flow via a standard blood-giving set. After transfusion, 1ml blood samples were collected into EDTA at 2-hour intervals for 12 hours. Subsequent 1 ml samples were obtained weekly for 7 weeks. Five µL aliquots of each whole blood sample were washed in PBS, incubated with streptavidin-phycocerythin, and then analyzed by flow cytometry. The proportion of transfused cells remaining in each of the two populations was measured. Quantitative changes in the two populations over time were assessed by two-way repeated measures ANOVA.

Biotinylated RBC’s were readily detected in all samples from all cats over the 7-week sampling period. One cat showed early loss of RBC’s delivered via gravity flow. There was a significant decrease in both populations of labeled cells over the 7-week period (p = 0.01), as expected. There was no significant difference in probability that the RBC’s would survive 12 hours immediately following transfusion, and no significant difference in survival between the two groups over 7 weeks. The average half-life of all labeled cells was approximately 42 days.

We conclude that the use of a syringe+aggregate filter method to transfuse cats with autologous RBC’s is not associated with decreased short-term RBC survival or decreased RBC half-life.

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**ABSTRACT HM-7**

**LEUKOREDUCTION OF FELINE WHOLE BLOOD USING A NEONATAL LEUKOCYTE REDUCTION FILTER: A PILOT EVALUATION.**

Leukocytes (WBC) present in stored blood are associated with a variety of potentially detrimental pro-inflammatory and immunosuppressive responses. Pre-storage leukocyte reduction (LR) has been advised to reduce the WBCs in stored blood. While LR has been described in human and canine transfusion medicine, due to sizing of available filters, LR has not been previously evaluated in cats. The purpose of this pilot study was to evaluate the efficacy of a human neonatal LR filter in leukoreducing feline fresh whole blood (FWB) using different techniques.

Sixty milliliters of FWB was obtained from 8 healthy donor cats using standard techniques. LR was achieved using an in-line LR filter: 3 different techniques were assessed. Group 1) Warm (room temperature) FWB filtered immediately via slow active push (n=2), Group 2) Warm FWB filtered immediately via gravity (n=3), and Group 3) FWB, chilled at 4°C for 60 min, filtered via gravity. Efficacy of filtration was assessed by the percentage post-filtration decrease in leukocytes (WBC) using a Cell-Dyn Hematology Analyzer, with a level of detection of 500 cell/µL. LR of chilled blood filtered by gravity was significantly more effective (100% LR, p = 0.001) than warm FWB filtered actively (35%) or by gravity (59%).

Inadequate LR was achieved in room temperature blood with active or gravity filtration.

We conclude that chilled FWB can be successfully LR pre-storage with gravity flow through this in-line neonatal filter. The main limitation of the technique is loss of blood volume, since the residual filter volume is 8mL. Investigation of the potential therapeutic benefit of using LR blood in cats is warranted.

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**ABSTRACT HM-8**

**UTILITY OF SERIAL ANTI-XA MONITORING IN DOGS RECEIVING DALTEPARIN.**

Dalteparin is commonly employed as an anticoagulant in critically ill dogs. The aim of this study was to describe the clinical course of hospitalized dogs receiving dalteparin serially monitored with a chromogenic anti-Xa assay.
The medical records of 24 dogs were retrospectively reviewed. Underlying diseases included immune mediated hemolytic anemia, sepsis, neoplasia and protein losing diseases. Five dogs had confirmed thromboembolism prior to anticoagulation. Nineteen dogs were hypercoagulable based on thromboelastography. The median dalteparin starting dose was 150 IU/kg SQ. Twice daily dosing was chosen for 14/24 dogs, three times daily for 9/24 dogs and four times daily for the remaining dog. Anti-Xa assays were performed 4 hours post-administration of dalteparin in 20 dogs and at trough for 4 dogs. From the initial dalteparin dose 7 dogs achieved target anti-Xa levels (0.5–1.0 units/mL), 10 dogs achieved levels above the target range and 6 dogs were below range. Individual dose adjustment was made in 19 dogs. Ultimately 20/24 dogs either achieved or exceeded the target anti-Xa range. Minor bleeding complications (subcutaneous hemorrhage at the injection site) were noted in 2 dogs. Nineteen dogs survived to discharge; 5 were euthanized due to clinical deterioration. Three dogs had confirmed thromboemboli at necropsy.

Serial anti-Xa assays were useful to guide individual dose adjustment of dalteparin in dogs in this study. Further studies are warranted to understand the impact of individual dose adjustment on outcome and cost effectiveness of dalteparin treatment in critically ill dogs at risk of thromboembolism.

ABSTRACT HM-9
PLATELET FUNCTION IN DOGS WITH INFLAMMATORY DISEASES, R Mischke, M Abid, K Kalbantner. Small Animal Clinic, University of Veterinary Medicine Hannover, Germany

The aim of this study was to examine the influence of inflammatory diseases on primary hemostasis in dogs.

Six different parameters were used for testing platelet function in 25 dogs with bacterial or protozoal infections: capillary bleeding time, automatic platelet function analysis (PFA 100, collagen/adenosine diphosphate [COL/ADP] and collagen/epinephrine cartridges), turbidimetric platelet aggregation, impedance aggregometry using a multiple electrode aggregometer, platelet count and hematocrit. Results of the 25 dogs with inflammatory diseases were compared to the control group and additionally classified into two subgroups based on criteria of systemic inflammatory response syndrome (SIRS) (groups “SIRS” and “Non-SIRS”).

The following findings were observed in dogs with inflammatory diseases when compared to the control group: a significantly prolonged closure time of the automatic platelet function analyzer measured with both cartridges (e.g. COL/ADP: 83 s [55–301 s] vs. 65 s [47–99 s]; median [minimum–maximum]; P < 0.0001), a significant decrease in maximal aggregation of the ADP-induced turbidimetric aggregometry (e.g. 40 µmol/L: 45.2 ± 26.8 % vs. 67.3 ± 21.8 %; mean ± SD; P = 0.003) and collagen, a significant increase of impedance aggregometry induced with 5 µg/mL collagen, and significant suppression of arachidonic acid-induced impedance aggregometry. A higher collagen-induced impedance aggregation which was detected in dogs suffering from “SIRS” was the only significant differences between subgroups “SIRS” and “Non-SIRS”.

Although individual tests indicate enhanced platelet aggregation, results of in vitro tests in the present study mainly reveal a normal or minimally to moderately reduced functionality of platelets. The reduced response to aggregation agonists in vitro may partly attributed to the fact that platelets are already activated under inflammatory conditions.

ABSTRACT HM-10
15-GAUGE CORE BONE MARROW BIOPSY IN SMALL DOGS AND CATS WITH HEMATOLOGIC DISORDERS – 16 CASES. A Abrams-Ogg, A Defarge, D Bienzle. Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

The diameter of 11-13ga Jamshidi-type needles makes bone marrow (BM) core biopsy difficult in small dogs and cats. We previously reported the feasibility of 15ga BM biopsy in normal small dogs (Vet Clin Pathol, in press) and cats (J Vet Intern Med 2011;25:703) using EZ-IO® (Vidacare) needles. In this study, 15-25 mm EZ-IO needles were used by 5 operators with variable procedural experience to obtain humeral head BM biopsies from anesthetized small dogs and cats diagnosed with non-regenerative anemia, neutropenia or pancytopenia between June 2009 and October 2011. The EZ-IO cannulae were advanced and retracted manually without a power driver. Specimens were placed into Davidson’s fixative for 20 min of rapid fixation, and then transferred to formalin. Sternal or humeral BM aspirates were also obtained. Animals were treated post-biopsy with opioid or NSAID analgesics and assessed for pain and lameness. The tips of the cannulae, which are crown-shaped, were inspected for damage. Biopsies were reviewed by a pathologist. Biopsy length on the slide was measured, and biopsy quality was scored from 0 (no hematopoietic tissue) to 5 (>5 intertrabeicular spaces free of artifact). Results [Mean ± SD (range)] were:

Quality and length were not different between dogs and cats (P = 0.3–0.4). Biopsy quality and length were significantly correlated (rho = 0.74, P = 0.002). There were no correlations between animal weight and biopsy quality or length. Six biopsies had quality scores of 4-5; of these, 5 were obtained on the first attempt. For 4 biopsies, the cannulae tip were pinched closed; these biopsies were of higher quality (4 – 5) and length (9 mm). Although quality scores of 1-2 were given for 10 biopsies, even these encompassed sufficient hematopoietic tissue to support a diagnosis in conjunction with hemograms and BM cytology. Diagnoses in dogs included myelofibrosis (1), erythroid hypopcellularity (2), myeloid hypopcellularity (1), trilineage hypopcellularity (1), myeloid hyperplasia (1), myeloid leukemia (1) and myelodysplasia (1). Diagnoses in cats included myelofibrosis (1), erythroid hypopcellularity (3), bi- or trilineage hypopcellularity (2), erythroleukemia (1), and lymphoid leukemia (1). For 5 dogs and 5 cats, BM core biopsy was needed for diagnosis; for 3 dogs and 5 cats, biopsy confirmed the cytology diagnosis. In conclusion, 15ga core BM biopsy is a well-tolerated procedure that may facilitate diagnosis of hematopoietic disorders in small dogs and cats. Intentional damage (pinching) of the cannula tip on the first pass through the BM may serve to facilitate specimen retention and maximize quality.

ABSTRACT HM-11
SERUM BIOMARKERS INDICATE HEMOLYSIS AND AN INFLAMMATORY RESPONSE TO TRANSFUSION OF AUTOLOGOUS STORED ERYTHROCYTE CONCENTRATES, SA Smith1, M McMichael1, JM Herring1, A Galligan2, R Corsi1, T Ngwenyama3, AN Beloshapka1, P Deng3, KS Swanson2, 2College of Medicine, 3College of Veterinary Medicine, or 3Department of Animal Sciences, University of Illinois, Urbana, IL

We previously reported that transfusion to normal dogs of stored (21 days) autologous erythrocyte concentrates (pRBCs) caused an inflammatory response as indicated by leucocytosis and elevations in the acute phase reactants. Furthermore, pRBCs

<table>
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<th>Patients (n)</th>
<th>Age (yr)</th>
<th>Weight (kg)</th>
<th>24h pain or lameness</th>
<th>Biopsies (n)</th>
<th>Quality (1–5)</th>
<th>Length (mm)</th>
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<tbody>
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<td>8</td>
<td>7.9 ± 1.8 (5.8 – 11.0)</td>
<td>(2.0 – 9.4)</td>
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<td>(0 – 5)</td>
</tr>
<tr>
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<td>5.1 ± 4.4 (0.8 – 12.2)</td>
<td>(2.6 – 5.9)</td>
<td>None</td>
<td>9</td>
<td>(0 – 4)</td>
</tr>
</tbody>
</table>
stored for 35 days elicited a degenerative left shift followed by a regenerative left shift. We hypothesized that transfusion of fresh pRBCs would elicit less profound increases in serum biomarkers of inflammation than would stored pRBCs.

A whole blood unit was collected from healthy dogs (n=10) for pRBCs on day 0, then again on day 32. On day 35 dogs received an autologous transfusion of pRBCs stored for either 35 days (S, n=5) or 3 days (F, n=5). Serum free hemoglobin (Hgb), CRP, interleukin-8 (IL-8), tumor necrosis factor-α (TNF-α) were evaluated on serum samples collected at 0 (pre) and 5, 9, 24, 48, and 72 hours after transfusion.

Fresh pRBCs did not elicit any change in serum Hgb, or CRP. IL-8 and TNF-α both increased significantly approximately 2 fold, with peaks at 5 hours and 24 hours respectively. Stored pRBCs elicited a 60 fold increase in free serum Hgb (mean 0.21, SD 0.06 g/dL) with a peak at 9 hours. CRP also profoundly increased up to 90 fold with a peak at 24 hours (mean 91, SD 33 μg/mL). IL-8 and TNF-α both increased approximately 2 fold, with peaks at 5 hours and 9 hours respectively.

More significant hemolysis occurs with transfusion of stored erythrocytes. Transfusion of autologous stored pRBCs elicits a markedly greater inflammatory response than fresh pRBCs.

ABSTRACT HM-12 ASSESSMENT OF PLATELET ACTIVATION IN DOGS ADMITTED TO THE INTENSIVE CARE UNIT (ICU) BY USE OF FLOW CYTOMETRY AND THROMBOELASTOGRAPHY. SB Majety, AM de Lorgeril1, M Barnard2. 1Cummings School of Veterinary Medicine at Tufts University, North Grafton, MA, 2University of Massachusetts Medical School, Worcester, MA

Thrombocytopenic disease is a potentially life-threatening complication in critically ill dogs and may be related to excessive platelet activation. We hypothesized that dogs admitted to the ICU would exhibit increased platelet activation as measured by flow cytometry and thromboelastography compared to normal dogs and that there would be a correlation between the degree of platelet activation and severity of illness.

81 dogs hospitalized in the ICU and 24 normal control dogs were enrolled. Blood was collected into 3.2% sodium citrate tubes by jugular venipuncture and rested 30 minutes prior to analysis. Platelet activation was determined by flow cytometry using monoclonal mouse anti-human CD61 and CD62 antibodies in resting and ADP-activated samples. Thromboelastography was performed using kaolin as an activator. SPI2 and APPLE scoring systems were used to estimate severity of illness.

The degree of platelet activation at rest was not significantly different between control dogs and sick dogs as measured by percent positive platelets (%P; 1.34 vs 0.79, p = 0.23) or mean fluorescence intensity (MFI; 2314 vs 798, p = 0.72). Compared to control dogs, sick dogs had significantly increased platelet activation in response to 2 μM ADP (23.5 vs 12.35 μM FMI), 6 μM ADP (36.6 vs 13.3 μM FMI), 10 μM ADP (3562 vs 1306 μM FMI; p < 0.05). Sick dogs had a significantly increased MA (61.9 vs 54.5), alpha (62.5 vs 56.2), and G (59.6 vs 56.5) compared to MSB; 4) CB compared to no bleeding. There was a statistically significant association of the TEG value MA for groups 1, 3, and 4. No significant association was found for any other analyzed variable. In conclusion, MA was the only coagulation parameter that was associated with signs of clinical bleeding.

ABSTRACT HM-14 IMMUNE-MEDIATED HEMOLYTIC ANEMIA IN CATS WITH PANCREATITIS. A Zona, “San Marco” Veterinary Clinic, Padua, Italy

Pancreatitis has been demonstrated in humans and experimentally in rats as a complication of acute hemolysis. Following the identification of a cat with acute hemolysis due to IMHA and concurrent pancreatitis, the aim of this study was to retrospectively investigate if these two diseases are associated in cats.

For this retrospective, case-control study, the author’s residency case log of all cases seen at Glasgow University Small Animal Hospital between July 2004 and December 2007 (consisting of 157 client owned feline patients and 674 canine patients), was searched for cats diagnosed with pancreatitis. These cats were included in group 1. A clinical diagnosis of pancreatitis was made on a combination of: clinical signs, measurement of serum feline pancreatic lipase (fPLI) and trypsin-like immunoreactivity (fTLI), and abdominal ultrasonography. A control population sick cats without pancreatitis (group 2) was created from the same database. For each cat in group 1, three sick cats were included in group 2. These cats were randomly selected after age-, sex- (including neutered status) and breed-matching to the cats with pancreatitis. IMHA was diagnosed as a hemocrit < 15% and the presence of a positive Coombs’ test. The prevalence of IMHA between the two groups of cats was calculated and the difference in prevalence was statistically evaluated with the Fisher exact test. The level of significance was set as p < 0.05.

Of the 157 cats included in the database, 9 were diagnosed at presentation with pancreatitis and three of these cats (33%) had a concurrent diagnosis of IMHA. Only 1 (3.4%) of the 27 cats in group 2 (sick cats without pancreatitis) was diagnosed with IMHA. The prevalence of IMHA was significantly higher in group 1 compared with groups 2 (p = 0.04).

Cats with pancreatitis have an higher prevalence of IMHA compared to other sick cats. The hemolysis occurring during IMHA may therefore be the etiological cause of this disorder in these cats, as previously reported in humans and rats.

ABSTRACT HM-15 OSMOTIC FRAGILITY AND FLOW CYTOMETRIC DETECTION OF LIPID PEROXIDATION IN FELINE ERYTHROCYTES. R Timmons, BF Goodrich, M Gillette, CB Webb. Colorado State University, Fort Collins, CO

Vitamin E (vit E) antioxidant properties include reducing lipid peroxidation. Antioxidant capacity in units of vit E is significantly decreased in cats with chronic kidney disease (CKD) com-
pared to controls (56 ± 21 vs. 81 ± 13, p < 0.005). With the goal of allowing further assessment of the role of oxidative stress and vit E in the anemia of CKD, we developed functional assays of feline RBC health.

Osmotic fragility was measured in cats with a range of packed cell volumes (PCV) using a standardized protocol. The variance, effect of sample dilution, and effect of storage time was determined. An r-squared of 0.45 described the fit between PCV and the NaCl concentration that produced 50% hemolysis (n = 15).

A protocol for the flow cytometric determination of lipid peroxidation in feline RBCs was developed using the fluorescence attenuation of the DHPE fluorophore, which is inversely proportional to membrane lipid peroxidation. DHPE treated samples (n = 8) run in triplicate gave a mean fluorescence of 1.29 units, with a mean standard deviation of 4.10 units (4%). DHPE treated samples (n = 10) run before and after incubation with cumene hydroperoxide to stimulate lipid peroxidation showed an average decrease in fluorescence of 18% (+/- 12%) after stimulation. An r-squared of 0.75 described the fit between PCV and DHPE fluorescence (n = 10).

These assays can be used to determine the correlation between RBC membrane health and vit E antioxidant capacity, as well as the effect of vit E supplementation, in anemic cats with CKD.

### Abstract HM-16 Table

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<th>Length (cm)</th>
<th>Quality (0-5)</th>
<th>Histologic diagnosis</th>
<th>Aspirate diagnosis</th>
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<td>Myelofibrosis</td>
<td>Non-diagnostic</td>
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<td>3</td>
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</table>

### ABSTRACT HM-16

**POWER-DRIVER ASSISTED 11-GAUGE HUMERAL CORE BONE MARROW BIOPSY IN LARGE BREED DOGS WITH HEMATOLOGIC DISORDERS – 6 CASES.** A Abrams-Ogg, A Defarges, D Bienzle. Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

Bone marrow (BM) core biopsy is often performed using 11.13ga Jamshidi-type tapered needles and manual power. Anecdotally, some operators noted poor specimen retention. A newer biopsy system (OnControl, Vidacare) consists of a trocar-tipped stylet; a trochar with an internal marrow capture thread; and a power driver. In this study, the OnControl system was used by 6 different operators with variable procedural experience to obtain humeral head BM biopsies from 6 anesthetized large-breed dogs with hematologic disorders diagnosed between Nov 2010 and 2011. Specimens were placed in formalin, and concurrent sternal or humeral BM aspirates were obtained. Biopsy length on the slide was measured, and biopsies were reviewed and quality scored from 0 (no hematopoietic tissue) to 5 (>= 5 intertrabecular spaces free of artifact) by a pathologist. Dogs were treated with opioid or NSAID analgesics post-biopsy. Chronologic results were:

For cases 2 and 5 there was difficulty orienting the biopsy needle and advancing through the cortex, and there was evidence of mild necrosis in the proximal end of these biopsies. Once the cortex was penetrated and the stylet removed, all operators reported that the biopsy was very easy to advance and retract, and this phase of the biopsy was completed in <1 min. All biopsies captured specimens on the first attempt. In the last dog the biopsy was repeated as the specimen was grossly of lower quality than in the previous dogs. One biopsy had a quality score of 1; this was due to fragmentation, but the specimen was nevertheless adequate for diagnosis. No dog showed signs of lameness attributable to the procedure. In conclusion, the OnControl system reliably captured humeral BM biopsies from large dogs with various hematologic disorders. In 3 cases BM core biopsy was needed for diagnosis; in 3 cases results were confirmatory.

### ABSTRACT HM-17

**EVALUATION OF A HUMAN ELISA KIT FOR THE MEASUREMENT OF PLASMA ADAMTS13 ACTIVITY IN DOGS.** H Maruyama, T Ohtake, M Kaneko, R Kano, Y Yamaya, T Watari, H Kamata. Nihon University, School of Veterinary Medicine, Kanagawa, Japan

A disintegrin-like and metalloprotease with thrombospondin type 1 repeat motifs 13 (ADAMTS13) is a von Willebrand factor (VWF)-cleaving protease. Deficiency in ADAMTS13 activity is known to cause thrombotic diseases in humans. The minimal substrate for ADAMTS13 in humans is VWF73, which contains 73 amino acid residues in the A2 domain of VWF. The aims of this study were to clarify whether canine ADAMTS13 has the ability to cleave human VWF73, and to test a human ADAMTS13 ELISA kit containing human VWF73 for the measurement of plasma ADAMTS13 activity in dogs.

Human VWF73 fused with a GST-tag and a His-tag was expressed in *Escherichia coli* and was purified (GST-VWF73-His). The recombinant canine ADAMTS13 (rcADAMTS13) was expressed in Hela cells, and the concentrated supernatant was used. The GST-VWF73-His was incubated with serially diluted rcADAMTS13, canine pooled plasma, or human pooled plasma. The cleaved products were detected by Western blotting with anti-GST antibody. In all samples, the signals of the cleaved products increased with increasing ADAMTS13 activity.

An ADAMTS13 ELISA kit with human VWF73 (KAINOS Lab., Tokyo) was used to measure canine plasma ADAMTS13 activity. Thirteen citrated plasma samples were obtained from 7 healthy dogs and 6 dogs with bacteremia. The ADAMTS13 activity was significantly lower in dogs with bacteremia than in healthy dogs (p = 0.019).

These results revealed that human VWF73 is cleaved efficiently by canine ADAMTS13 and the ELISA kit with human VWF73 can be useful for measuring plasma ADAMTS13 activity in dogs for the study of thrombotic disorders.

### SMALL ANIMAL – HEPATOLOGY

### ABSTRACT HP-1

**LIVER HISTOLOGICAL LESIONS IN 43 SCOTTISH TERRIERS (ST) WITH HYPERACTIVITY OF ALKALINE PHOSPHATES (AP).** M Chevallier, S Guerret, A Pagnon, P Lecoindre, C Peyron, France

ST increased AP level was associated with development of a vascular hepatopathy (VH) as shown in previous study on 13 dogs (Lecoindre 2009). To assess liver histological lesions in a 43ST with increased AP level (mean: 10N), 55 liver samples obtained from 43 ST (16 wedge biopsies, 39 guided fine-needle biopsies), were analyzed including histological techniques: HES, Trichrome, Picrosirius/PERLS stains, semi-quantitative assessment of vascular hepatocytes using Center grading (G1 to G4)
(JAVMA 2006) necrotic-inflammatory activity (A0 to A3) and fibrosis (F0 to F4) according to METAVIR Score (1996). Cancer or architectural changes were recorded. Ultrastructural study (TEM) for two representative animals and tr-smooth muscle actin antibody (αSMA) immunohistochemistry (HIC) analysis for cells involved in fibrogenesis were undertaken.

Mean age was 8 years (2-13) and ratio M/F (21/22). Lesions distribution was: vascular changes (G1 = 10, G2 = 15, G3 = 9, G4 = 5), fibrosis (F0 = 12, slight periportal F1-F2 = 17, extensive periportal F3 = 8, cirrhotic stage F4 = 6); activity was absent or weak (A0-A1) in 80% of cases. Advanced fibrosis F3-F4 (14 cases) was correlated with vascular change G3 (27%) and G4 (50%). Liver carcinoma was present in 9 biopsies: 4 with extensive fibrosis (F3 or F4) and 5 without significant fibrosis (F0 = 2, F1 = 2, F2 = 1). The 3 cases had nodular regenerative hyperplasia (NRH). TEM observation showed mitochondrial lesions and absence of glycogen overload. IHC with αSMA revealed increased number of stellate cells in perisinusoidal and perivascular hepatic areas.

Liver vascular change observed in 90% of ST with AP hyperactivity correlated with fibrosis stage (p = 0.051) and increased stellate cells activation suggested cellular dysfunction probably related to glucocorticoids metabolism. Cancer pathology remained undetermined.

Bibliography: Lecoinde P. et al. ECVIM Abstract, 2009; Center et al. JAVMA, 2006; METAVIR 1996.

ABSTRACT HP-2


J. Lidbury1, R. Ivanek2, J.M. Steiner1, 1Gastrointestinal Laboratory and, 2Veterinary Integrative Biosciences, Texas A&M University, College Station, TX

Hepatic encephalopathy (HE) is common in dogs, but few studies have specifically described this syndrome and the role of potential predisposing factors. The objectives of this study were to describe the clinical features of dogs with HE, to determine if there is any relationship between plasma ammonia concentrations and the severity of HE, and to determine what proportion of dogs with HE have any of the predisposing factors recognized in humans with HE, such as gastrointestinal hemorrhage, dehydration, or systemic inflammatory response syndrome (SIRS).

Clinical data were obtained from all dogs with a recorded diagnosis of HE between 1/10/91 and 1/10/11 (20 years) were reviewed. The history, physical examination findings, results of diagnostic testing, and diagnoses from each case were recorded. The severity of HE was graded using a previously described system: grade I: apathy, decreased alertness, staring, and/or unawareness of surroundings; grade II: ataxia, circling, head pressing, blindness, and/or salivation; grade III: stupor, severe salivation, and/or completely inactive but arousable; and grade IV: coma and totally unresponsive. Plasma ammonia concentrations were compared amongst the groups of dogs with different grades of HE using a Kruskal-Wallis test. Significance was set at p ≤ 0.05.

Eighty dogs met the inclusion criteria for the study. The most common historical findings were: obtundation in 26 dogs (33%), abnormal behavior in 25 (31%), and apparent seizures in 19 (24%). On neurological examination 46 dogs (58%) had abnormalities recorded. These included obtundation in 25 dogs (31%), ataxia in 16 (20%), weakness in 8 (10%), decreased conscious proprioception in 7 (9%), and seizures in 6 (8%). Twelve of 76 dogs (16%) for which it was possible to grade HE had grade I, 60 (79%) had grade II, 4 (5%) had grade III, and none had grade IV. Dogs with HE grades I, II, and III had median (range) plasma ammonia concentrations of 143 (50-356), 203 (15-617), and 361 (106-1350) µg/dL, respectively (p = 0.091). Forty-one of 65 dogs (63%) for which a cause of HE had been recorded had congenital portosystemic vascular anomalies, 16 (25%) had acquired portosystemic collaterals (APSC), 4 (6%) had hepatic parenchymal disease but no APSC could be detected, and 3 (5%) had hepatic parenchymal disease but were not evaluated for APSC. Forty-three of 80 dogs (54%) had no potential predisposing factors recorded, 9 (11%) had hypoglycemia, 7 (9%) had hypokalemia, 6 (8%) had SIRS, 5 (6%) had a clinically important coagulopathy or DIC, 5 (6%) had hypotension, 4 (5%) had concurrent intracranial disease, and 4 (5%) had azotemia.

Potential predisposing factors to HE include congenital portosystemic vascular anomalies or APSC, the cause of HE in at least 88% of dogs evaluated. There was a non-significant trend for the group of dogs with HE severe enough to cause stupor to have higher plasma ammonia concentrations than those with less severe HE. Potential predisposing factors, such as hypoglycemia, hypokalemia, or SIRS were present in 14% of patients and thus should be considered in dogs with HE.

ABSTRACT HP-3

LONG-TERM SURVIVAL OF DOGS (N = 979) WITH CONGENITAL OR ACQUIRED PORTOSYSTEMIC SHUNTING: 1980-2010.

SA Center, JF Randolph, KL Warner, JC Sapa, WE Hornbuckle, AT Yeager, NL Dykes, HJ Harvey, JA Flanders, College of Veterinary Medicine, Cornell University, Ithaca, NY

Surgical attenuation is preferred treatment for canine congenital portosystemic vascular anomalies (PSVA). However, success of long-term medical management of large canine PSVA cohorts and dogs with anicteric acquired portosystemic shunts (APSS) is undetermined.

A retrospective survival study of dogs with PSVA (extrahepatic [EPSVA, n = 378], intrahepatic [IPSVA, n = 105]) and anicteric APSS (n = 114) over 31 contiguous years at Cornell University is described. Follow-up (91.5% cases) was derived from medical records and contact with managing veterinarians and clients. Medical management consisted of dietary protein restriction/modification, lactulose, or metronidazole. Surgical PSVA attenuation was by surgery ligation (n = 225/239) to tolerance. Age at diagnosis, survival of EPSVA and IPSVA treated surgically (n = 189 and 50, respectively) and medically (n = 166 and 46, respectively), and APSS survival were compared using Wilcoxon rank sum test, Kaplan-Meier survival curves, and two-sample survival tests (Gehan-Wilcoxon and Log Rank Tests), respectively with alpha < 0.05. Dogs dying without treatment were censored. Survivals (Years) at 50th (range: 75th-25th) percentiles are shown.

Median age (years) at diagnosis was significantly younger for PSVA (11.1 vs EPSVA (40.12-12)] and IPSVA (0.5-1.5) vs EPSVA (1.5-12-12)); P < 0.00001. EPSVA survival (all dogs: n = 334, 10.6-13; Yorkshire Terriers: n = 91; 12-13) was significantly longer than IPSVA: n = 104, 4.5(2-9); all P < 0.0001. There was no survival difference between surgically- or medically-treated EPSVA (all dogs: Wisconsin Terriers [n = 41 and n = 43, respectively], and surgically- or medically-treated IPSVA. Of surgically treated dogs, 63% EPSVA and 58% IPSVA also received medical treatment. APSS survival (9.04-6-11]) was significantly shorter than medically-treated EPSVA (all dogs: 10 [6-13]; Yorkshire Terriers:12.0 [6-13]), all P < 0.04.

ABSTRACT HP-4

SERUM BRANCHED-CHAIN AMINO ACID/TYROSINE RATIO (BTR) IN DOGS WITH LIVER DISEASES.

M Sakai, Y Ohori, M Nagamune, Y Sakamoto, T Watari, M Uechi, Nihon University, Department of Veterinary Medicine, Kanagawa, Japan

Branched-chain amino acids (BCAA; valine, leucine, isoleucine) are decreased and aromatic amino acids (AAA; tyrosine, phenylalanine) are increased in the blood of dogs with hepatic disorders and hepatic encephalopathy. The degree of hepatic parenchymal damage can be evaluated by calculating the Fischer ratio, the molar ratio of BCAA to AAA by HPLC. The molar ratio of BCAA to tyrosine ratio (BTR) can also be determined using enzymatically quantified values in humans with chronic liver disease.

We determined serum BTR for 92 dogs with chronic hepatitis (CH; n = 27), primary biliary cirrhosis of the portal vein (PBC; n = 15), congenital portosystemic shunts (CPSS, n = 41), and...
hepatocellular carcinoma (HCC, n = 9) using the Diacolor-BTR kit. Acquired portosystemic collaterals (APSCs) were confirmed in 14 dogs with CH and in all dogs with PHPV. Plasma amino acid (AA) concentrations analyzed by HPLC in 24 healthy dogs included as controls. The BTR closely correlated with the Fischer ratio in controls (r = 0.89, p < 0.001). The BTR was significantly lower in dogs with PHPV (median, 3.28) and CPSS (2.95) than in controls (10.62; p < 0.001). In contrast, BTR was not significantly decreased in CH dogs with APSCs (3.65) compared with controls (p > 0.001). In dogs without APSCs (6.17) and HCC dogs (8.71) as compared to controls.

The BTR is quite simple to determine by enzymatic methods in dogs and is considered a useful indicator of liver parenchymal injury and for monitoring responses to nutritional therapy in dogs with CPSS and APSCs.

**ABSTRACT HP-5**

**PLASMA AND HEPATIC ENDOTHELIN-1 IN DOGS WITH CHRONIC LIVER DISEASES**

Y Sakamoto, M Sakai, T Watari. Nihon University, Department of Veterinary Medicine, Kanagawa, Japan

Elevated plasma endothelin-1 (ET-1) has been reported in human chronic liver diseases, particularly cirrhosis accompanied by esophageal varices. ET-1, which is a potent vasoactive, 21-amino acid peptide, has been evaluated for associations with respiratory and cardiac disorders, but not hepatic disorders, in dogs.

In this study, blood samples were collected from 12 dogs with chronic hepatitis/cirrhosis (CH). Liver biopsy samples were obtained laparoscopically using 5-mm biopsy forceps from 12 dogs with CH and visually inspected for acquired portosystemic collaterals (APSCs). Plasma and hepatic ET-1 concentrations were determined using an ELISA kit, and hepatic ET-1 mRNA expression was evaluated using real-time PCR. Plasma (n = 14) and liver (n = 3) samples were obtained from healthy dogs as controls.

Plasma ET-1 concentration was higher in dogs with CH (median, 1.30 pg/mL; range, 0.68-2.65) than controls (median, 0.86 pg/mL; range, 0.41-1.41; p < 0.05), and hepatic ET-1 concentration was higher in dogs with CH (median, 11.78 pg/mL; range, 3.55-23.90) than controls (median, 2.72 pg/mL; range, 1.70-3.34; p < 0.05). In dogs with CH, confirmation of APSCs (n = 8) was associated with higher plasma ET-1 concentration. Hepatic ET-1 mRNA expression was significantly greater in dogs with CH than controls (p < 0.05).

ET-1 system was shown to be an important factor in canine chronic liver disease. ET-1 may function as a potent vasoconstrictor agonist in intrahepatic blood flow regulation in CH and play a role in the pathogenesis of portal hypertension.

**SMALL ANIMAL - IMMUNOLOGY**

**ABSTRACT IM-1**


A Wang, JR Smith.

University of Georgia College of Veterinary Medicine, Athens, GA

This retrospective case series evaluated the clinical use and adverse effects of mycophenolate mofetil (MMF) for treating canine primary immune-mediated hemolytic anemia (IMHA).

Medical records (2007-2011) were searched for the diagnosis of IMHA (n = 93). Exclusion criteria included PCV < 0.35, with either a positive slide agglutination test, spherocytosis, evidence of hemolysis or positive Coombs' test. Exclusion criteria included IMHA secondary to infectious causes, drug toxicity, or neoplasia (n = 29). Data collected included presenting complaints, signalment, vital parameters, body condition score, clinicopathologic data, diagnostic imaging results, medications administered, duration of hospitalization, survival time, and adverse effects.

Of 64 primary IMHA cases, 57 received steroids and a secondarily immunosuppressive drug: 31 mycophenolate, 15 cyclosporine, 6 azathioprine, 1 human immunoglobulin. Seven dogs received three immunosuppressives; 2 received only steroids; 2 were immediately euthanized.

Data are presented as mean ± SD for dogs receiving mycophenolate mofetil. Initial PCV was 17 ± 5.2%. Initial MMF dose was 20.5 ± 5.8 mg/kg PO or IV divided twice daily. Diarrhea was the only adverse effect noted (n = 5), although one of these dogs presented with diarrhea. Number of transfusions received was 1.9 ± 1.6; hospitalization duration was 5.7 ± 4.5 days. Twenty-four dogs (77.4%) survived to discharge, 2 were lost to follow-up, and 18 were alive at study conclusion. Mean survival time was 13 days in non-survivors.

In conclusion, oral and IV administration of mycophenolate mofetil is a safe additional immunosuppressive for treating primary canine IMHA.

**ABSTRACT IM-2**

**EX VIVO IMMUNOSUPPRESSION OF CANINE T LYMPHOCYTE-SPECIFIC PROLIFERATION USING DEXAMETHASONE, CYCLOSPORINE, AND THE ACTIVE METABOLITES OF AZATHIOPRINE AND LEFLUNOMIDE IN A FLOW CYTOMETRIC ASSAY.**

LA Naie, JR Dodam, CR Reiner, University of Missouri College of Veterinary Medicine, Columbia, MO

A high rate of mortality, expense and complications of immunosuppressive therapy in dogs underscores the need for optimization of drug dosing. While pharmacokinetics helps target therapeutic blood concentrations, pharmacodynamics measures the actual effects of the drug on the immune system. To date, no study has compared a panel of immunosuppressant drugs on T lymphocyte proliferation using a flow cytometric assay in the dog. The purpose of this study was to determine the 50% T cell inhibitory concentration (IC50) in dexamethasone, cyclosporine, and the active metabolites of azathioprine (6-Mercaptopurine) and leflunomide in concaavalin A-stimulated canine lymphocytes. Whole blood was collected from 7 privately owned, healthy dogs of various ages for density gradient separation of peripheral blood mononuclear cells (PBMCs). PBMCs were cultured for 72 hours with concaavalin A, a fluorochrome-marked cell proliferation dye and various concentrations of dexamethasone (-4, -5, -6 and -7 M), cyclosporine (10, 20, 30 and 40 ng/mL), 6-mercaptopurine (50, 100, 250 and 500 nM) and A77 1726 (5, 10, 25 and 50 nM). Following incubation, lymphocytes were labeled with propidium iodide and an anti-CD5 antibody. Flow cytometry determined the % live proliferating T lymphocytes with and without immunosuppressants. Mean (SEM) IC50 were: dexamethasone, 4.6 ± 0.5 ng/mL; cyclosporine 16 ± 2ng/mL; 6-mercaptopurine 64 ± 31nM; and A77 1726, 24 ± 1.0 nM. Inhibition of T cell proliferation for four immunosuppressants was demonstrated in a concentration-dependent manner with marked variability between dogs. These results represent the first steps to tailor this assay for individual immunosuppressant protocols for dogs with immune-mediated disease.

**SMALL ANIMAL - INFECTIOUS DISEASE**

**ABSTRACT ID-1**

**CYTOTAUXZOOON FELIS CYTOCHROME B GENOTYPE IS ASSOCIATED WITH SURVIVAL IN DOMESTIC CATS WITH CYTAUXZOOONOSIS.**

M Downey, HS Marr, J Targo, LA Cohn, MG Levy, AJ Birkenheuer. North Carolina State University College of Veterinary Medicine, Raleigh, NC, University of Missouri College of Veterinary Medicine, Columbia, MO

*Cytotauxzoon felis* is a virulent tick-transmitted protozoan parasite that infects felines. Without treatment, only 3% of infected cats survive. Treatment combining atovaquone and azithromycin (A&A) increased the survival rate to 60%. In related parasites, resistance to atovaquone has been attributed to mutations in its
Leptospirosis is an important zoonotic bacterial disease affecting many mammalian species worldwide, including livestock, horses, dogs, and people. No studies have clearly documented naturally occurring clinical leptospirosis in cats, but experimental feline infections have been shown to result in leptospirosis. The purpose of this study was to use a quantitative real-time PCR (qPCR) assay to determine if pathogenic leptospires are shed in the urine of shelter cats.

Stray and feral shelter cats in Colorado having spent time outdoors were included in the study. Relinquished cats, indoor cats, and cats receiving antibiotics were excluded. At least 5 mL of voided urine was collected from each cat and DNA was isolated using the QIAamp Viral RNA Mini Kit®. For the qPCR, primers were used to amplify an 87 base pair product from a region of the Leptospira spp. 16S ribosomal DNA sequence. This assay is specific for pathogenic leptospires and has been validated in canine urine. To validate the qPCR for this study the assay was used in normal feline urine to which live pathogenic leptospirosis serovars were added in serial 10-fold dilutions. The assay showed linearity over a range of dilutions and the threshold (Ct) was set at 36 cycles.

Urine samples were obtained from a total of 85 shelter cats; 10 cats were positive for leptospires in the urine based on the qPCR assay (Ct < 36). Outdoor cats in Colorado can shed pathogenic leptospires in the urine and may potentially be reservoir or incidental hosts in the transmission of leptospirosis.
The objective of the study was to investigate in dogs with CL the iron status and its relation with c-re reactive protein (CRP), as sensitive marker of inflammation.

Bolle UB, TIBC. % of saturation, ferritin and CRP were measured in 86 dogs (group 0) presented to the San Marco Veterinary Clinic (November 2008-December 2011) and in which CL was diagnosed based on presence of clinical signs, high-titer anti-Leishmania antibodies and positive real-time PCR on bone marrow sample. All dogs were classified as stages C or D, according to the Canine Leishmaniasis Working Group guidelines. Control groups consisted of age, sex and breed-matched dogs from the same database. Group 1 (n=86) were healthy patients and Group 2 (n=86) were non-CL sick patients.

Dogs affected by CL showed significant lower (p < 0.0001) iron and TIBC and significant higher (p < 0.0001) CRP and ferritin concentrations respect to both control groups. UIBC and % of saturation of group 0 were significantly lower (p = 0.02 and p = 0.95, respectively) only compared to group 1. Within group 0 serum CRP was significantly higher than survival (p = 0.03)

To assess whether ferritin concentrations in dogs with CL was affected only by the degree of inflammation, the three groups were stratified based on different CRP concentrations. Plasma ferritin was found still significantly higher (p < 0.001) in group 0 compared to control groups.

Inflammation contributes to decrease plasma iron concentrations. Degree of inflammation is a risk factor for outcome. Increased ferritin is not only due to inflammation, but may reflect other specific mechanisms implicated in intracellular infections as demonstrated in human beings.

ABSTRACT ID-6
PREVALENCE OF BLASTOCYSTIS SPP AND GIARDIA SPP IN DOGS AND CATS RESIDENT IN A PACIFIC NORTHWEST SHELTER. B Stang, C Ruaux. Oregon State University College of Veterinary Medicine, Corvallis, OR

Blastocystis spp and Giardia spp are protozoan parasites of the gastrointestinal tracts of many mammalian species. Giardia spp are well-recognized enteric pathogens in dogs, cats, and humans, while there is limited data regarding the prevalence of Blastocystis spp in companion animals. Blastocystis spp are, however, the most commonly recognized enteric protozoan parasite in human patients with gastrointestinal disease within the Pacific Northwest region of the USA. The aim of this study was to estimate the prevalence of these two organisms within a population of shelter-resident dogs and cats in the Pacific Northwest.

Freshly voided stool samples were collected from 40 dogs and 40 cats resident at the Oregon Humane Society facility in Portland, Oregon. Giardia carriage was assessed using a commercially available immunofluorescence assay kit (Merifluor® Cryptosporidium/Giardia), while Blastocystis spp were detected using a novel nested PCR methodology, following extraction of DNA from feces using routine methods. Amplified material from all samples testing positive for Blastocystis spp in companion animals. Blastocystis spp are, however, the most commonly recognized enteric protozoan parasite in human patients with gastrointestinal disease within the Pacific Northwest region of the USA. The aim of this study was to estimate the prevalence of these two organisms within a population of shelter-resident dogs and cats in the Pacific Northwest.

FRESHLY voided stool samples were collected from 40 dogs and 40 cats resident at the Oregon Humane Society facility in Portland, Oregon. Giardia carriage was assessed using a commercially available immunofluorescence assay kit (Merifluor® Cryptosporidium/Giardia), while Blastocystis spp were detected using a novel nested PCR methodology, following extraction of DNA from feces using routine methods. Amplified material from all samples testing positive for Blastocystis spp in companion animals. Blastocystis spp are, however, the most commonly recognized enteric protozoan parasite in human patients with gastrointestinal disease within the Pacific Northwest region of the USA. The aim of this study was to estimate the prevalence of these two organisms within a population of shelter-resident dogs and cats in the Pacific Northwest.

Giardia spp were detected in stool samples from 6/40 dogs and 0/40 cats. Dogs were significantly more likely to test positive for Giardia than cats (p < 0.05, Fischer’s Exact Test). Blastocystis spp were detected in stool samples from 9/40 dogs and 19/40 cats, with cats being significantly more likely to test positive for Blastocystis than dogs (p < 0.05, Fischer’s Exact Test). Coinfection with both protozoa was noted in 2/40 dogs. Shelter resident animals overall were significantly more likely to test positive for Blastocystis spp than Giardia spp. (p < 0.01, Fischer’s Exact Test).

We conclude that both Giardia spp and Blastocystis spp are common in shelter-resident animals in the Pacific Northwest region. Cats apparently have a higher carriage rate of Blastocystis than dogs, however, in this population of cats at least, Giardia spp were uncommon.

ABSTRACT ID-7
TREATMENT OF CHRONIC RHINITIS IN SHELTER CATS WITH PARENTERAL ALPHA-INTERFERON OR AN INTRANASAL FELINE HERPESVIRUS 1 AND FELINE CALICIVIRUS VACCINE. A Fenimore, J Fankhauser, K Carter, JR Hawley, MR Lappin. Department of Clinical Sciences, Colorado State University, Ft. Collins, Colorado

Feline upper respiratory tract disease is a leading cause for euthanasia in shelter cats and can be frustrating to treat. The purpose of this study was to evaluate novel treatments for cats from shelters with suspected chronic viral rhinitis that have failed conventional therapy.

Cats from shelters that failed traditional therapy (lysozyme; antibiotics) for ≥2 weeks were transported to CSU and randomly assigned to one of two treatment groups. Group A was administered human interferon alpha (10,000 Units/kg SQ) once daily for 14 days. Group B was administered an intranasal FHV-1/FCV vaccine (HESKA Corporation, Loveland, CO) on Day 1 as immunotherapy followed by 1 mL of saline SQ once daily for 14 days. A clinical score for each cat was determined daily by a trained, blinded individual. Cats who improved (clinical score < 3) by day 14 were eligible for adoption. Cats with a score of ≥ 3 on Day 14 were entered into the crossover group. Cats that failed both therapies and/or had severe ocular ulcers were administered famciclovir as a rescue drug for FHV-1. Total DNA and RNA was extracted from nasal or pharyngeal swabs collected prior to the first treatment and evaluated for the presence of FHV-1 DNA and FCV RNA using previously reported molecular assays.

A total of 47 cats were transferred from the shelters to the research facility to enter the treatment study. Of these cats, 16 had clinical signs resolve spontaneously during the final equilibration period before treatment; three cats required famciclovir treatment immediately due to ocular ulcers, one cat had to be euthanized prior to treatment because of severe stomatitis, and one cat was euthanized early during the first treatment period because of severe stomatitis. One cat had a clinical score > 3 after both treatments and famciclovir rescue therapy and was found on workup to have a severe proliferative rhinitis. All other cats (n = 25) had a clinical score of < 3 during the first treatment period or soon after crossover. Response rates to primary treatment with interferon alpha or intranasal vaccine administration were 66.7% (8 of 12 cats) and 100% (13 of 13 cats), respectively (p = 0.03). All four cats with clinical scores > 3 after alpha interferon therapy had clinical scores < 3 two to seven days after the crossover to intranasal vaccine administration. Mean time to response for those cats developing clinical scores < 3 during the first treatment was not significantly different between groups. All six cats positive for nucleic acids of FHV-1, FCV, or both responded to the primary treatment (2 cats-interferon alpha; 4 cats-intranasal vaccine).

Administration of human interferon alpha or a topical FHV-1/FCV vaccine as immunotherapy may be beneficial in alleviating chronic clinical signs of suspected feline viral URTD in some cats.

ABSTRACT ID-8
INTRANASAL ADMINISTRATION OF A MODIFIED LIVE FELINE HERPESVIRUS 1 AND FELINE CALICIVIRUS VACCINE INDUCES CROSS PROTECTION AGAINST BORDETELLA BRONCHISEPTICA. A Bradley1, J Kinyon2, T Frana3, D Bolte3, DR Hyatt3, M Rappin1. 1Department of Clinical Sciences, Colorado State University, Fort Collins, CO, 2Veterinary Diagnostic Laboratory, Iowa State University, Ames, IA, 3Veterinary Diagnostic Laboratory, Colorado State University, Fort Collins, CO

Vaccination against all feline upper respiratory pathogens is not possible. Results of previous studies suggest that intranasal vaccination may stimulate nonspecific immunity against agents not contained within the vaccine, but no study has directly examined this in cats. The authors hypothesized that cats administered a modified live feline herpesvirus-1 (FHV-1) and feline calicivirus (FCV) intranasal vaccine would have fewer clinical signs after challenge inoculation with Bordetella bronchiseptica than unvaccinated controls.
Twenty specific pathogen free 12 week-old kittens were randomly assigned into two groups of 10 cats each. The vaccinated group was administered a single intranasal dose of a commercially available vaccine containing modified live strains of FHV-1 and FCV, and the control group remained unvaccinated. All 20 cats were administered *B. bronchiseptica* by nasal inoculation seven days later and were observed daily for clinical signs of illness for 20 days.

In the first 10 days after *B. bronchiseptica* challenge, vaccinated cats were less likely to be clinically ill (indicated by lower cumulative clinical scores) than control cats (*p* = 0.01). The most commonly observed clinical sign was sneezing. Overall, 9 of 10 control cats and 2 of 10 vaccinated cats were noted to sneeze at least once during days 1-10 after inoculation with *B. bronchiseptica* (*p* = 0.006). These differences were no longer apparent during days 11-20. Finally, the percentage of observation points with sneezing recorded was significantly greater in control cats than in vaccinated cats over days 1-10 (*p* < 0.0001) and days 1-20 (*p* = 0.02).

Intranasal vaccination against FHV-1 and FCV decreased signs of illness due to an infectious agent not contained in the vaccine. This nonspecific immunity could be beneficial for protection against organisms for which vaccines are not available and as early protection while specific adaptive immunity is developing.

**ABSTRACT ID-9**

**FELINE HERPESVIRUS 1 VIRAL LOAD AS A TOOL TO DIFFERENTIATE LYTIC FROM LATENT INFECTION.**

CM Leutenegger1, PA Pesavento2. 1IDEXX Laboratories, Inc., Sacramento CA 2School of Veterinary Medicine, University of California, Davis

Feline Herpesvirus 1 (FHV-1) detection by real-time polymerase chain reaction (PCR) is considered the most sensitive diagnostic tool in feline upper respiratory infections (URI). It has long been criticized that PCR overestimates FHV-1 prevalence because of detecting latent virus not involved in causing respiratory disease manifestation. In this report we review three studies that established protocols to use FHV-1 DNA viral load to differentiate acute, lytic from latent infections.

In the first study, FHV-1 experimentally infected cats were monitored with clinical examination, quantitative virus isolation and quantitative real-time PCR. Viral load by PCR correlated with quantitative virus isolation during the clinical phase but remained detectable at a lower level for a period of 8 weeks while cats were free of clinical signs. A PCR cutoff value was established to differentiate virus loads associated with clinical signs and positive virus isolation indicating lytic virus from later stages in infection with negative virus isolation, absence of clinical signs characterizing the chronic or latent stage of FHV-1 infection. In a second study, immune induction and FHV-1 replication was studied in shelter cats naturally infected with FHV-1. Cats with confirmed FHV-1 infection by virus isolation had a specific type of cellular induction, detectable FHV-1 replication and high DNA viral loads measured by real-time PCR. In a third study, a link was established between lytic FHV-1 infection in naturally infected shelter cats, herpes specific inclusions, histological scores in biopsies, and FHV-1 DNA load measured by real-time PCR. This study was able to establish causality between the presence of FHV-1 and disease manifestation and confirmed that FHV-1 DNA viral load correlated with lytic FHV-1 infection.

In conclusion, these studies strongly indicate a link between FHV-1 DNA viral load and clinical parameters, viral replication, induction in culture, immune reaction, pathomorphologic inclusions, and histological grades for tissue damage. Real-time PCR therefore could be a key tool to differentiate between lytic and latent FHV-1 infection in cats and could be used to determine if FHV-1 is the cause of URI in individual cats.

**ABSTRACT ID-10**

**SERIAL FIV SEROLOGICAL RESULTS IN COHABITING FIV-POSITIVE AND FIV-NEGATIVE CATS.**

A. Lister, Purdue University College of Veterinary Medicine, West Lafayette, IN

Horizontal transmission of feline immunodeficiency virus (FIV) most commonly occurs via the inoculation of infected saliva into bite wounds during territorial fights. Conflicting accounts have been published in the veterinary literature regarding transmission between cohabiting cats in stable closed households and the mechanics of possible casual transmission, if it occurs, are poorly understood. The aim of this study was to document the FIV serological status of cats living long-term in a stable multi-cat household containing FIV-positive and FIV-negative cats.

Serological testing (IDEXX SNAP FIV/FeLV Combo) was performed on 138 cats living in a stable multi-cat household. All cats had unrestricted access to each other. Eight of the 138 cats were FIV-positive (6 MN, 2 FS; median age 28 months; range 5-129 months) and 130/138 cats were FIV-negative (71 MN, 59 FS; median age 4 months; range 2-155 months). Some inter-cat fighting took place, mainly involving 2 cats known to be FIV-positive, but only scratches were observed rather than bite wounds. All cats were kept indoors only, except for 1 FIV-positive cat, which was housed indoor/outdoor. No cats were FeLV-positive on the first test.

Testing was repeated in 50/138 and the FIV/FeLV serological status of each cat was unchanged. (FIV-positive n = 5; FIV-negative n = 45; median 28 months after the first test; range 1-106 months), except for one of the FIV-negative cats, which was FeLV-positive on the second test. That cat was transferred to another household 6 days after the test and subsequently died 2 weeks later. A third test was performed on 5/138 cats (median 3 months after the second test; range 1-45 months) and FIV and FeLV serological status remained unchanged (FIV-positive n = 1; FIV-negative n = 4). Total cumulative exposure to FIV-positive cats was calculated for each FIV-negative cat that had at least 2 test results and was exposed to FIV-positive cats (months of exposure to each FIV-positive cat was calculated and the result for the FIV-negative group were added; FIV-positive n = 5; FIV-negative n = 44; median cumulative exposure duration of FIV-negative cats to FIV-positive cats = 140 months; range 14-167 months).

It is concluded that despite occasional minor fighting between FIV-positive and FIV-negative cats kept in a stable multi-cat household, FIV transmission did not occur over years of cumulative exposure to FIV-positive cats.

**ABSTRACT ID-11**

**U. S. PREVALENCE OF CANINE INFECTIOUS RESPIRATORY DISEASE PATHOGENS: A 3-YEAR STUDY.**

R Lavine1, O Knesl1, S Podlany1, S Shields1, B Dronson1, CM Leutenegger2. 1Pfizer Animal Health, Madison, NJ, 2IDEXX Laboratories, West Sacramento, CA

The diagnosis of canine infectious respiratory disease (CIRD) is complicated by the emergence of at least four canine respiratory pathogens since 2000: canine influenza virus (CIV), canine respiratory coronavirus (CRCoV), *Mycoplasma cynos*, and *Streptococcus equi subsp. zooepidemicus*.

Pfizer established an Immunization Support Guarantee (ISG) program to diagnostically evaluate samples from dogs vaccinated with a Pfizer Animal Health vaccine that subsequently developed clinical signs of CIRD. Resulting data were combined with CIRD diagnostic data from Idexx Laboratories to determine the prevalence of nine common CIRD pathogens, including the four newly emerging agents. The combined databases included diagnostic results from 2008-2011 for >13,000 dogs from all 50 states.

The three most frequently identified pathogens in the Idexx database were *M. cynos* (36.5%, 682/1,867), *Bordetella bronchiseptica* (24.2%, 524/2,149), and canine distemper virus (19.2%, 2,578/13,429). In the ISG database, the three most frequent diagnoses were *M. cynos* (59.6%, 65/109), CRCoV (15.3%, 50/327), and *Bb* (14.4%, 47/327). Divergence in prevalences between the two databases can be partly explained by a high percentage of unvaccinated, at-risk shelter dogs in the Idexx database.

Results indicated that newly emerging CIRD pathogens may be the cause of CIRD in dogs that were vaccinated for conventional agents, and that *M. cynos* should be a prime suspect in clinical CIRD, especially in dogs that do not respond to antimicrobial therapy that targets other pathogens.
ABSTRACT ID-12
ARTHROPOD-BORNE DISEASE IN SICK SOUTHERN CALIFORNIA DOGS. L Kidd 1, M Barr 1, M Lappin 2, EAC Davenport, PE Mascarelli, M Burns, CR Sharp, N Etedali, J Morlock. Tufts Cummings School of Veterinary Medicine, North Grafton, MA

The distribution of arthropod borne disease (ABD) is expanding. Dogs are sentinels for ABD in people. Rocky Mountain spotted fever is rare in southern California due to a lack of Dermacentor ticks, the primary vector for Rickettsia rickettsii in North America. Amblyomma and Ixodes species are prevalent in Arizona and Mexicali, Mexico. This ubiquitous tick is also a known or suspected vector for Ehrlichia, Babesia, and Bartonella species. Ixodes pacificus, which transmits Anaplasma phagocytophilum and Borrelia burgdorferi, is also present in southern California. Studies investigating the prevalence of ABD in dogs in the southernmost regions of California are very limited. The objective of this study was to determine the prevalence of exposure to, or active infection with, ABD agents in ill dogs presenting to specialty hospitals in San Diego County.

Thirty-one dogs were enrolled, 19 dogs had blood samples tested for Anaplasma phagocytophilum and Babesia, 10 dogs tested for Ehrlichia canis and E. chaffeensis, 9 dogs for Borrelia burgdorferi and 2 dogs tested for Bartonella species. Ixodes pacificus, which transmits A. phagocytophilum and B. burgdorferi, is also present in southern California. Studies investigating the prevalence of ABD in dogs in the southernmost regions of California are very limited. The objective of this study was to determine the prevalence of exposure to, or active infection with, ABD agents in ill dogs presenting to specialty hospitals in San Diego County.

Blood samples were collected from 201 dogs with septic peritonitis. Serial blood samples were collected from dogs with septic peritonitis in this study. Further work is needed to improve the diagnostic utility of NT-pCNP, notably to improve specificity, across a broad population of dogs. This may involve reassessment of the cut-off value and/or combination with other biomarkers.

ABSTRACT ID-14
SERIAL NT-PCNP IN HOSPITALIZED DOGS WITH SEPSIS. M Burns, CR Sharp, N Etedali, J Morlock. Tufts Cummings School of Veterinary Medicine, North Grafton, MA

N-terminal pro-CNP (NT-pCNP) has been shown to have high sensitivity and specificity (using a cut-off value of 10.1pmol/L) for the diagnosis of sepsis and its differentiation from noninfectious causes of the systemic inflammatory response syndrome, when excluding dogs with septic peritonitis. The purpose of this prospective pilot study was to evaluate the utility of serial measurement of NT-pCNP in assessing response to treatment and assigning prognosis to hospitalized dogs with sepsis. A secondary objective of the study was to further assess NT-pCNP in dogs with septic peritonitis. Serial blood samples were collected from dogs with sepsis at hospital admission, and then at 24-hour intervals until hospital discharge for measurement of NT-pCNP.

Fourteen dogs with sepsis were enrolled. The origin of sepsis was intra-abdominal (n = 5), pneumonia (3), urosepsis (3), cutaneous (2), and chemotherapy induced (1). Thirteen dogs had community acquired (CA) sepsis, while two dogs had hospital acquired (HA) sepsis. Thirteen dogs survived to discharge, and two were euthanized. All but one dog had an NT-pCNP concentration above the cut-off value. The two dogs with HA-sepsis had low NT-pCNP concentrations initially, that subsequently increased with the onset of sepsis. There was no predictable change in NT-pCNP over time in dogs with CA-sepsis. Despite a clinical response to treatment, NT-pCNP concentrations did not reliably decrease. NT-pCNP may not be a useful standalone biomarker to assess response to treatment in dogs with sepsis. Contrary to previous findings, NT-pCNP was a useful diagnostic biomarker for septic peritonitis in this study.

ABSTRACT ID-15
PHYLGENETIC DIVERSITY OF BACTERIA ISOLATED FROM SICK DOGS USING THE BAPGM ENRICHMENT CULTURE PLATFORM. AC Davenport, PE Mascarelli, RG Maggi, EB Breitschwerdt. North Carolina State University, Raleigh, NC

It is estimated that fewer than 5% of bacterial organisms have been isolated using contemporary bacteriologic methods; however, isolation remains the gold standard for the diagnosis of bacterial infections. During the last decade, our laboratory developed and optimized a liquid growth medium, Bartonella alpha-Proteobacteria growth medium (BAPGM), in an attempt to more successfully isolate Bartonella spp. As BAPGM is not a selective medium, non-Bartonella spp. isolated from canine blood, pathologic effusions, and tissue samples were phylogenetically characterized by 16S rDNA sequencing. The purpose of this study is to describe the phylogenetic bacterial diversity and disease manifestations in dogs infected with these isolates.

Non-Bartonella BAPGM subculture isolates were obtained from 70 of 513 dogs (14%) tested using the BAPGM platform. All isolates (n = 98) were members of 4 Phyla: 55 Proteobacteria, 26 Firmicutes, 14 Actinobacteria, and 3 Bacteroidetes. Members of the class alpha-Proteobacteria were more frequently isolated (n = 36) than any other bacterial class. Fourteen dogs were co-infected with a Bartonella spp. Retrospective review of the 26 dogs with NCSU-
VTH medical records identified *Sphingomonas* spp. (n = 7) and *Staphylococcus* (n = 5) as the most common isolates. These twenty-six dogs had variable clinical presentations, including 7 dogs with suspected immune-mediated disease, 4 with pathological effusions, and 4 with endocarditis. Direct comparison of conventional and BAPGM blood culture was not performed in this population; however, review of blood cultures performed for NCSU-VTH patients revealed the distribution of organisms isolated differed substantially: 58% *Firmicutes*, 24% *Proteobacteria*, 12% *Actinobacteria*, and 6% fungi using conventional culture techniques versus 63% *Proteobacteria*, 22% *Firmicutes*, 11% *Actinobacteria*, and 4% *Bacteroidetes* using BAPGM.

BAPGM preferentially facilitates growth of alpha-Proteobacteria. Future studies are needed to elucidate the diagnostic utility of BAPGM and other “non-conventional” growth media for the isolation of fastidious organisms from patients with immune-mediated, effusive and other “sterile” diseases and to determine if these organisms play a causal role in disease development.

**ABSTRACT ID-16**

**PREVALENCE OF BARTONELLA SPP. AND HEMOPLASMAS IN THE BLOOD OF DOGS AND THEIR FLEAS IN FLORIDA.** K. Yore1, BA DiGangi2, M. Brewer1, M. Lappin1, LA. Cohn1, KM Lewis1, JR. Dodam1, H. Marr2, A. J. Birkenheuer2

1Department of Clinical Sciences, Colorado State University, Ft. Collins, Colorado; 2Department of Small Animal Clinical Sciences, University of Florida, Gainesville, FL.

Fleas are known to be the vector for a number of *Bartonella* spp. and are believed to be associated with the transmission of some hemoplasmas. While a number of studies have evaluated dogs for these potential pathogens, little is known about prevalence rates in fleas. The objective of this study was to define the prevalence of these organisms in healthy shelter dogs and their fleas in Florida.

Blood (EDTA), serum, and fleas of unknown genus and species were collected from 37 healthy dogs on admittance to a shelter in Florida as part of routine screening for *Dirofilaria immitis* and tick borne diseases. The samples were stored at -20°C until shipped to Colorado State University. Upon arrival, total DNA was extracted from the blood and the fleas and assayed in previously reported genus-specific, conventional PCR assays that amplify the DNA of *Bartonella* spp. and hemoplasmas. An average of 4.8 fleas were collected from each dog; for the 4 dogs with > 5 fleas, the fleas were assayed in groups of 3 to 6. Positive amplicons were sequenced to confirm the species.

*Bartonella* spp. or hemoplasma DNA was amplified from 6 of 37 dogs (16.2%) and from at least one flea group from 5 of the dogs (13.5%) giving a total of 8 positive (dog, fleas, or both) sample pairs (Table 1). *Bartonella vinsonii* subsp. *berkhoffii* DNA was amplified most frequently.

While *B. vinsonii* subsp. *berkhoffii* DNA has been amplified from fleas (predominately *Pulex simulans*) collected on gray foxes, to our knowledge, this is the first study to amplify DNA of the organism from fleas collected from domestic dogs. In Florida, *C. felis* is the most prevalent flea feeding on dogs. The genus and species of the fleas are being determined for all new cases in this ongoing, prospective study. Results of this study document that flea-associated, potentially zoonotic, infectious agents are common in dogs and fleas in Florida and support the recommendation that stringent flea control be maintained on dogs.

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NEG = negative; MH = *Mycoplasma haemocanis*; MHP = ‘Candidatus *M. haemotaparvum*’; BV = *B. vinsonii*; BC = *B. claridgeiae*.

**ABSTRACT ID-17**

**CLINICOPATHOLOGIC FEATURES AND ATYPICAL PRESENTATIONS OF NATURALLY OCCURRING CANINE LEPTOSPIROSIS: 51 CASES (2000-2010).** L. Tangeman, A. M. Gittman, University of Pennsylvania, School of Veterinary Medicine, Philadelphia, PA.

The purposes of this study was to retrospectively review the clinicopathologic presentations of dogs infected with leptospriosis, identify antibodies against *Leptospira* serovars based on acute and convalescent microscopic agglutination test (MAT), identify and describe the percentage of atypical abnormalities, and evaluate the importance of convalescent MAT titers.

Medical records of 138 dogs with leptospirosis presented to the Matthew J. Ryan Veterinary Hospital of the University of Pennsylvania between January 1, 2000 and January 1, 2010 were retrospectively reviewed. The MAT titers were considered positive when ≥1:1600 in vaccinated dogs, ≥1:800 in non-vaccinated dogs, or when demonstrating a ≥4-fold increase in convalescent titer.

Fifty-one dogs met the criteria for inclusion. Clinical presentation, temporal distribution and signalment were similar to previous studies. Convalescent MAT titers were necessary for diagnosis in 45% of cases. *L.icterohaemorrhagiae* and *L. grippo* were the most commonly identified infectious serovars on MAT. Atypical abnormalities included hepatic dysfunction alone (22%), coagulopathy (29%), radiographic evidence of pulmonary disease (43%), proteinuria (82%), glucosuria (18%), and hypobuminemia (27%). Significant associations were found between *L. grippotyphosa* and renal involvement (p = 0.02), and *L. icterohaemorrhagiae* and hepatic involvement (p = 0.01).

Atypical presentations were common. Awareness of atypical presentations may decrease misdiagnosis of leptospirosis for other disease entities (e.g. Lyme nephritis, protein-losing disease, tick-borne disease, pulmonary disease). Convalescent titers are necessary to identify infection when acute titers are negative. Further research is needed to determine the true association between infecting serovars and clinical presentation.

**ABSTRACT ID-18**

**PARASITE BURDEN DOES NOT FLUCTUATE WITH TIME OF DAY IN CATS WITH CHRONIC CYTAUXZOOM FELIS INFECTION.** LA. Cohn1, KM Lewis1, JR. Dodam1, H. Marr2, AJ. Birkenheuer2, 1University of Missouri – College of Veterinary Medicine, Columbia, MO; 2North Carolina State University College of Veterinary Medicine, Raleigh, NC.

*Cytauxzoon felis* is a hematoprotozoan parasite of cats that causes substantial morbidity and mortality, but cats that survive acute infection may remain persistently parasitemic and may serve as a pathogen source for vector ticks. For many hematologic infections, parasite numbers in circulation vary markedly over periods of time as brief as hours, and often parasite numbers vary with time of day. If this were true for *C. felis*, it could impact a veterinarian’s ability to identify chronically infected carrier cats.

Parasite burden was estimated in the peripheral blood of five apparently healthy cats with naturally acquired chronic *C. felis* infections. Peripheral blood was obtained twice in a 24 hour period, 12 hours apart, from each cat via jugular venipuncture on 4 separate occasions. In total, 20 samples were obtained at approximately 9 am and 20 samples obtained at approximately 9 pm into EDTA containing Vacutainer tubes. Blood smears were prepared immediately, and the remainder of the blood was used to perform CBC in routine fashion and for real time PCR for *C. felis*. Each slide was stained with Wright-Giemsa and examined thoroughly for piroplasms, and the number of piroplasms per 1500 RBC was noted. Cycle threshold (Ct) was also used as a semi-quantitative measure of parasite burden in peripheral blood. Ct was compared between times of day using a two way repeated measures ANOVA (two factors: repetition).

Piroplasms were observed at low numbers on all blood smears at all time points, and all blood samples were PCR positive for *C. felis*. While at least a single RBC containing piroplasm was seen on every slide, the number of piroplasm infected RBCs per 1500 RBC ranged from 0 to 4, with no difference between samples obtained in the morning versus the evening. The mean Ct for all cats on samples obtained in the morning was 24.1 ± 1.2.
and the mean in the evening was 24.7 ± 2.0. No significant difference was detected in the Ct between samples obtained in morning versus the evening (p = 0.107). However, parasite burden was observed to vary from day to day in a given cat (p = 0.041). This suggests that timing of blood collection to detect the carrier state is unimportant despite some variability in parasite burden from day to day. PCR is a more sensitive method for detection of the carrier state, but if blood smear analysis is used, the entire smear must be carefully evaluated as piroplasms often occur in extremely low numbers.

**ABSTRACT ID-19**

MITOCHONDRIAL GENOME SEQUENCES RESULT IN IMPROVED UNDERSTANDING OF THE PHYLOGENETIC RELATIONSHIPS OF PIROPLASMA THAT INFECT COMPANION ANIMALS. M Downey1, HS Marr1, J Tarigo1, LA Cohn2, DM Bird3, EH Scholl4, MG Levy5, AJ Birkenheuer1.

1North Carolina State University College of Veterinary Medicine, Raleigh, NC, 2University of Missouri College of Veterinary Medicine, Columbia, MO, 3North Carolina State University College of Agriculture and Life Sciences, Raleigh, NC

Based on phylogenetic analyses using 18s ribosomal ribonucleic acid (rRNA) gene sequences, parasites in the order Piroplasmida have been sub-categorized into at least five distinct groups. Piroplasma from these groups infect common companion animal species—dogs and cats. In this study, we characterized the mitochondrial genome sequence and structure from these piroplasms. We hypothesized that use of mitochondrial gene sequences would improve upon previous phylogenetic analyses that used 18S rRNA genes alone. Blood was collected from dogs or cats infected with species representing the proposed sub-groups: Babesia microti-like sp. (AKA, Thelileria annae), B. conradae, B. canis, B. rossi, B. canis vogelli, an un-named Babesia sp. (“Coco”), and Cyttauxzoon felis. DNA was isolated and the entire mitochondrial genome (5.6-5.9 kb) was PCR-amplified in overlapping fragments. Amplicons were sequenced bi-directionally, and contigs were assembled using a commercially available software package. Mitochondrial genomes were annotated for cox1, cox3, cyt b and ribosomal subunit genes. Phylogenetic trees were constructed using both mitochondrial genes and 18S rRNA gene (Neighbor-joining, 1000 bootstrap replicates). Utilization of mitochondrial genes improved bootstrap support and resolved uncertainties concerning the relationship between Cyttauxzoon species and Thelileria species compared to trees based on 18S gene sequence alone. Additionally, one sub-group characterized by its tropism for ungulid hosts was shown to include a species (Babesia sp. “Coco”) that parasitizes dogs. In conclusion, we demonstrated the utility of the mitochondrial genome structure and sequence for phylogenetic analyses, and propose that future studies include mitochondrial genes to further define evolutionary relationships between Piroplasma species.

**ABSTRACT ID-20**

PREVALENCE OF BARTONELLA SPP. ASSOCIATED CANINE INFECTIONOUS ENDOCARDITIS IN BANGKOK, THAILAND, S Surachetpong1, S Assarasakorn1, AV Scorzà2, MM Brewer2, KW Simpson3, MR Lappin3. 1Department of Veterinary Medicine, Faculty of Veterinary Science, Chulalongkorn University, Bangkok, Thailand, 2Department of Clinical Sciences, Colorado State University, Fort Collins, CO, 3Department of Clinical Sciences, College of Veterinary Medicine, Cornell University, Ithaca, NY

Infectious endocarditis (IE) is a heart valve or endocardial disease caused by bacterial infection. Bartonella spp. is considered one of the major causes of IE. Stray dogs in Thailand were found seropositive to Bartonella spp. The prevalence of Bartonella spp. associated canine IE in Thailand has not been investigated. The prevalence of IE was studied by the necropsy reports of dogs, from January 1999 to December 2009. The cardiac paraffin embedded tissue blocks were used to study the presence of Bartonella spp. by fluorescence in situ hybridization (FISH) and conventional polymerase chain reaction (PCR).

A review of 3545 dogs demonstrated 23 cases of IF, yielding a prevalence rate of 0.65%. Paraffin blocks from 11 dogs were retrieved. Two of 11 dogs were positive to eubacteria by FISH. None of these dogs was positive for Bartonella spp. by FISH and conventional PCR.

The prevalence of canine IF is low. Bartonella spp. was not detected in the dogs tested in this study. Other types of bacteria should be considered as the cause of IF in Thailand.

**ABSTRACT ID-21**

PREVALENCE OF SELECTED INFECTIOUS DISEASES IN SAMOAN DOGS. RJ Cardlake1, KE Hill1, K Sjölander2, D Prattley1, E Acke3. 1Institute of Veterinary and Biomedical Sciences, Massey University, Palmerston North, New Zealand, 2Faculty of Veterinary and Animal Sciences, Swedish University of Agricultural Sciences, Uppsala, Sweden

Samoa has a tropical island climate ideally suited to many infectious diseases, and vectors for some infectious diseases are known to be present. Dogs are very common pets in Samoa with 88% of households owning an average of two dogs, which live in direct contact with their owners and the wider village community. These dogs also come into close proximity to a substantial tourist population visiting this holiday destination. Many canine infectious diseases are zoonotic and there is limited preventative medicine available for dogs in Samoa. There are very few studies into the presence of zoonotic pathogens in Samoa or other South Pacific islands, and the role of dogs as a reservoir for zoonotic diseases is unknown.

The prevalence of selected infectious diseases was evaluated in 242 dogs undergoing surgical sterilisation in Samoa in July 2010 and August 2011. Dogs were selected from both main Samoan islands, in rural and urban areas. Data were obtained from dogs' owners by interview, including age, environment and any previous preventative medication. Serum and faecal samples were collected, and the skin examined for external parasites. Seroprevalence of five vector-borne diseases were assessed in 237 dogs using point of care qualitative ELISA assays (SNAP Leishmania and SNAP 4Dx, IDEXX, Westbrook, ME) to detect antibodies against Leishmania infantum, Anaplasma phagocytophilum, Ehrlichia canis and Borrelia burgdorferi, and Dirofilaria immitis antigens. Fecal analysis was performed by flotation testing on fresh fecal samples from 204 dogs to screen for intestinal parasites. Forty-eight fecal samples were tested for Giardia and Cryptosporidium spp.

The median age of dogs was one year old, with a range of four months to eight years and 73.3% (176/240) were male. The vast majority of dogs, 95% (230/242), were owned, the remaining were stray animals. The seroprevalence of D. immitis was 46.8% (111/237) and A. phagocytophilum prevalence was 8.4% (20/237). All serum samples tested negative for E. canis, B. burgdorferi and L. infantum. Prevalence of hookworm was 92.6% (185/204), Trichuris vulpis 6.9% (14/204), Dipylidium caninum 4.4% (9/204), Toxocara canis 3.4% (7/204) and Capillaria spp. 2.0% (4/204). Prevalence of Giardia spp. was 14.6% (7/48) while no Cryptosporidium was detected. Examination for external parasites was completed in 221 dogs. Fleas were found on 83.7% of the dogs (185/221), ticks on 42.1% (93/221) and lice on 8.1% (18/221). Identified ticks were Rhipicephalus sanguineus, with no Exodes spp. found.

The results indicate a very high prevalence of hookworm, D. immitis, and external parasites in dogs in Samoa. This study provides valuable information on canine health and suggests dogs could play a role in the spread of some zoonoses in Samoa. Further studies are required to review the public health implications of this study.

**ABSTRACT ID-22**

MOLECULAR EPIDEMIOLOGY AND ANTIFUNGAL SUSCEPTIBILITY OF FUNGAL ISOLATES FROM NORTH AMERICAN DOGS AND CATS, LM Singer1, W Meyer2, GR Thompson3, E Samit4, JE Sykes5. 1Small Animal Clinical Sciences, Michigan State University College of Veterinary Medicine, East Lansing, MI, 2Molecular Mycology Research Laboratory, The University of Sydney at Westmead Hospital, Westmead, NSW, Australia, 3Department of Medical Microbiology, University of California, Davis, 4Veterinary...
Cryptococcosis is caused by Cryptococcus neoformans and Cryptococcus gattii. Eight molecular types have been described (VNI-VNIV for C. neoformans and VGI-VGIV for C. gattii). The objective of this study was to examine correlations between species, molecular type and antifungal drug susceptibility among canine and feline isolates from North America.

Cryptococcal isolates from dogs and cats from 2004 to 2011 were typed using restriction fragment polymorphism analysis and/or multilocus sequence typing. Susceptibilities to amphotericin B, fluconazole, itraconazole, 5-fluorocytosine, posaconazole, and voriconazole were determined using the Sensititre YeastOne® microdilution susceptibility test. The unpaired t-test and F-test were used to compare minimum inhibitory concentrations (MICs) between groups.

Fifteen canine and 27 feline isolates were examined. Most were from Colorado (34); 3 were from Washington and Oregon. Molecular types were VGI (3), VGII (3), VGIII (1), VGIc (2), VGII (16), VGIV (2), VNI (14) and VNII (1). All VGIII isolates were from cats in CA, AZ, and NV. The most common type in dogs was VNIV (9 dogs). Fluconazole and voriconazole MICs were lower among C. gattii than C. neoformans isolates. For all drugs except itraconazole, C. gattii exhibited wider variation in MICs than C. neoformans isolates. VGII MICs were not different to non-VGII MICs. VGII isolates exhibited wider variation in fluconazole and voriconazole MICs than non-VGII isolates.

In conclusion, differences in drug susceptibility exist between C. gattii and C. neoformans isolates and molecular types from dogs and cats in North America. The clinical significance of these findings requires further investigation.

**ABSTRACT ID-23**

**DEVELOPMENT OF AN INDIRECT ENZYME-LINKED IMMUNOSORBENT ASSAY FOR THE DETECTION OF FELINE ANTIBODIES AGAINST MYCOPLASMA FELIS.**

KT Wiggins, JR Hawley, MR Lappin. Department of Clinical Sciences, Colorado State University, Fort Collins, CO

Mycoplasma spp. are normal commensal organisms of the feline conjunctiva, genital tract and upper respiratory tract but also have been implicated in upper respiratory tract disease (URTD), lower respiratory tract disease, conjunctivitis and arthritis. Current detection methods for Mycoplasma include culture and polymerase chain reaction (PCR), both of which require specialized staff and facilities. Serology can be performed with minimal equipment and may be adapted for use at the point-of-care. The purpose of this study was to develop an indirect enzyme-linked immunosorbent assay (ELISA) for detection of antibodies against M. felis.

A checkerboard titration was performed to determine the optimal IgG ELISA conditions using M. felis antigen produced from an isolate grown from a shelter cat with URTD. Serum from specific pathogen-free (SPF) cats (n = 6) prior to and after (10 days, 6 months and 12 months) exposure to M. felis and shelter cats (n = 52) with and without signs of URTD were tested in the ELISA. PCR assay for M. felis DNA was performed on conjunctival cells collected on swabs from the shelter cats. Potential for M. felis antibody cross-reactivity was tested by creating an IgG ELISA using Ureaplasma sp. antigen produced from an isolate grown from a shelter cat with URTD and used under the same ELISA conditions as the M. felis assay.

The precision of the optimized M. felis ELISA was estimated at approximately 5% by calculating the coefficients of variation for negative and positive absorbance values on 3 plates run on 3 separate days. When the same M. felis positive and negative sera were evaluated in parallel in the M. felis and Ureaplasma sp. IgG ELISAs, the percentage agreement was 92.3% suggesting a high degree of cross-reactivity between the antigen preparations. In the SPF cats, M. felis IgG absorbance values were significantly greater than pre-exposure absorbance values 10 days (P < 0.001) and 6 months (P = 0.008) post-exposure, but not 12 months (P > 0.05) suggesting that M. felis antibody titers may wane over time. Shelter cats with signs of URTD had significantly higher (P < 0.001) M. felis IgG absorbance values than healthy cats, but the percent agreement with PCR results was only 36.5%. Using the PCR assay results as the gold standard for infection, the specificity, sensitivity, positive predictive value and negative predictive value of the M. felis ELISA were 19.5%, 100%, 25% and 100%, respectively.

Cats experience a rapid and prolonged elevation in M. felis IgG antibodies following exposure to M. felis. Detection of M. felis IgG may prove to be a useful epidemiological tool for study of cats with URTD but appear to cross-react with other Molluscum species. While negative test results in cats with URTD can be used to exclude the diagnosis, positive test results do not accurately predict current infection.

**ABSTRACT ID-24**

**DETECTION OF FELINE ANTIBODIES AGAINST A NOVEL ANAPLASMA PHAGOCYTOPHILUM PEPTIDE (AP-4) AFTER EXPOSURE TO WILD-CAUGHT ADULT IXODES SCAPULARIS.**

MR Lappin1, R Chandrashekar2, B Stillman3, J Liu4. Department of Clinical Sciences, Colorado State University, Ft. Collins, CO, 1IDEXX Laboratories, Portland ME

Cats that are exposed to Anaplasma phagocytophilum (AP) infected Ixodes scapularis ticks develop serum antibody responses to an immunodominant peptide (P44) used in a commercially available assay that is licensed for use with canine serum. The purpose of this study was to evaluate feline antibody responses to a novel AP peptide (AP-4) as a method for evaluating for early evidence of AP infection in cats.

Young, adult, mixed sex research cats (n = 4) were used in this pilot study with 1ACUC approval. Each of the cats was shown to be negative for antibodies against AP using a commercially available kit (SNAP® 4Dx®, IDEXX Laboratories) and negative for AP DNA in blood by use of a commercially available conventional PCR assay (Veterinary Diagnostic Laboratory, Colorado State University). Using the pre-inoculation samples, an ELISA for detection of antibodies against the AP-4 was optimized. Cats were infected with AP by exposure to wild-caught Ixodes scapularis. Blood for AP PCR assay and for serum separation for assessment for AP antibodies by SNAP® 4Dx® and AP-4 ELISA were collected prior to tick attachment and then on weeks 1 - 10 after tick attachment.

Each cat had AP DNA amplified from blood and each cat developed detectable AP antibodies in serum by both assays. Antibodies against AP were detected prior to those detected by the commercially available kit for 3 of 4 cats.

<table>
<thead>
<tr>
<th>Cat</th>
<th>A. phagocytophilum DNA</th>
<th>SNAP® 4Dx®</th>
<th>AP-4 ELISA</th>
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<tr>
<td>1</td>
<td>Weeks 2 - 5, 8 - 10</td>
<td>Weeks 6 - 13</td>
<td>Weeks 6 - 10</td>
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<td>Weeks 5 - 13</td>
<td>Weeks 3 - 10</td>
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<tr>
<td>4</td>
<td>Weeks 2, 3, 6</td>
<td>Weeks 5 - 13</td>
<td>Weeks 3 - 10</td>
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The results suggest that antibodies against the AP-4 peptide may be useful for the early detection of AP exposure in cats and that further studies from samples collected from naturally exposed cats should be performed.

**ABSTRACT ID-25**

**DETECTION OF CANINE SERUM ANTIBODIES AGAINST A NOVEL MUTANT PEPTIDE OF ANAPLASMA PHAGOCYTOPHILUM.**

S Moroff1, I Sokolchik1, T Wooddri2, C Woodriff1, B Atkins2, M Lappin2. Antech Diagnostics, Lake Success, NY, 1Department of Clinical Sciences, Colorado State University, Ft. Collins, Colorado

Anaplasma phagocytophilum (AP) is the cause of granulocytic anaplasmosis in a variety of species including dogs. The purpose of this study was to validate a new automated system to detect...
antibodies against AP using a novel mutant peptide of the organism.

Mixed sex beagles were inoculated with culture derived AP IV with serum and blood collected prior to inoculation, twice weekly for 4 weeks, and then weekly for an additional 4 weeks to provide samples for assay development. To test the optimized assay using field-like conditions, adult Ixodes scapularis (average AP PCR positive rate = 15%) wild-caught in Rhode Island were allowed to feed on 18 mixed sex beagles for 7 days (13 female and 12 male per dog). Serum and blood in EDTA were collected prior to tick attachment and then weekly for 16 weeks. The AP mutant peptide was used as the capture reagent in a proprietary automated fluorescence system that is based on a silicon wafer. Titrations were performed to determine the optimal concentrations of the peptide, buffers, serum dilutions, and secondary antibody concentrations using samples from IV inoculated dogs. After the assay was optimized, sera from the dogs exposed to wild caught I. scapularis were assayed. The sera were also assayed for AP antibodies by IFA (Prototek Reference Laboratory, Chandler AZ) and a commercially available kit (SNAP® 4DX; IDEXX Laboratories, Portland ME). In addition, a proprietary PCR assay (Antech Diagnostics, Lake Success, NY) was used to attempt to amplify AP DNA from blood of the tick exposed dogs.

The precision of the AP mutant peptide based assay based on the coefficient of variation of 20 positive samples varied between healthy (H) and cats with kidney disease.

Results of the 3 AP antibody tests were similar. Performance of AP PCR assays is indicated in dogs with suspected acute anaplasmosis if antibody assays are negative.

ABSTRACT ID-26
VACCINE-ASSOCIATED LEPTOSPIRA ANTIBODY RESPONSES IN CLIENT-OWNED DOGS, KT Wiggans1, LER Martin1, K Curtis2, R Chandrashekar2, MR Lappin3, Colorado State University, Fort Collins, CO; 2IDEXX Laboratories, Portland ME.

Antibody testing by microscopic agglutination test (MAT) is commonly used to aid in the diagnosis of canine leptospirosis. Leptospira vaccines are commonly administered to lessen illness associated with infection but induce antibodies that cannot be distinguished from those induced by natural infection. In addition, while multiple 4 serovar vaccines are now available in the United States, MAT responses after vaccination of client-owned dogs have not been widely reported. The purpose of this study was to determine the antibody responses of client-owned dogs vaccinated with 1 of 4 commercially available 4-serovar Leptospira vaccines.

Healthy, client-owned dogs (n = 32) with no history of Leptospira vaccination for at least 1 year were enrolled. Dogs were randomly assigned to be administered 1 of 4 vaccines containing the Canicola, Grippotyphosa, Icterohemorragiae, and Pomona serovars with a booster vaccine 3 weeks later. Sera were collected prior to vaccination, week 3, and week 7. MAT titers against serovars Bratislava (B), Canicola (C), Grippotyphosa (G), Hardjo (H), Icterohemorrhagiae (I), and Pomona (P) were determined at Colorado State University.

One dog was positive for one serovar (1:200; I) prior to vaccination. Percentages of dogs developing a MAT titer of 1:100 varied between the weeks and amongst the vaccines (Table 1). MAT titers > 1:800 were detected for at least one serovar for 19 dogs (59.4%) on Week 3 and 20 dogs (62.5%) on Week 7. MAT titers as high as 1:6,400 were detected and 28 of 32 dogs developed at least one MAT titer > 1:1,600. The most common serovars with MAT titers > 1:800 after vaccination (Weeks 3 and 7 combined) varied amongst the vaccines, but were most commonly associated with C (31 samples), G (14 samples), P (13 samples), and I (10 samples).

Leptospire MAT titers after vaccination vary amongst client-owned dogs, the weeks after vaccination, and the vaccine product. MAT titers > 1:800 will not always correlate to the presence of clinical leptospirosis if vaccines were recently administered.

ABSTRACT ID-27
FELINE LEPTOSPIROSIS: A SEROLOGIC AND URINARY PCR SURVEY IN HEALTHY CATS AND IN CATS WITH KIDNEY DISEASE, J Rodriguez, M-C Blais, C Lapointe, L Carioto, J Harel. Faculte de medecine vétérinaire, Université de Montréal, St-Hyacinthe, Québec, Canada.

Leptospirosis is a globally widespread zoonosis, with prevalence in cats varying from 8.8% to 35% depending on geographical localization. Although serologic evidence of feline exposure exists, clinical disease is rarely reported.

This study aimed to compare seropositivity and urinary PCR status for Leptospira spp. between healthy (H) and cats with kid-
ney disease (KD; acute and chronic KD IRIS stages II, III and IV).

Cats (n=240) enrolled from January 2010 to December 2011 were age- and sex-matched into two groups: HD (n=121) and KD (n=119). A complete blood count, biochemistry profile, urinalysis, and Leptospira spp. serology (titers ≥ 1:100 considered positive) and PCR were performed in all cats.

Seropositivity for Leptospira spp. was not statistically different between age (p=0.75) and sex (p=0.17) groups. Antibody titers were submitted to microagglutination test (MAT) for anti-leptospiral antibodies. The definitive identification was made by cross-reaction with standard strain L. interrogans (samples B, C, titer 3,200). Sample A was identified as serogroup icterohaemorrhagiae, and share the same molecular characteristics, as did the hemoplasmas. The hemoplasmas were further subdivided into two distinct groups, both of which contained the hemoplasmas with members of the genus Mycoplasma species, including M. haemolamae, M. haemohominis, and 'Ca. M. kahanei'. The samples were obtained by clustering analysis of the phylogeny. The phylogeny showed that all hemoplasma species resided within a single group, and that the hemoplasmas were further subdivided into two subgroups, the haemofelis and haemominutus groups, as found previously with 16S rDNA-based phylogeny. The hemoplasmas were present within a single clade on 16S rDNA-based phylogeny, were in separate clades on both gapA- and dnaK-based phylogeny, confirming the previously reported phylogeny. Additionally, the gapA-based phylogeny did not cluster the hemoplasmas with members of the pneumococci group of Mycoplasma species, including M. fastidiosum, which agrees with the previously reported phylogeny. For the first time, and compare this to previously reported phylogeny.
their fleas in the United States, a PCR assay utilizing primers target-}


ging a portion of the 16S-23S rRNA intergenic region that results in a different amplicon size for each Bartonella spp. has been used. Recently, it has been shown that in this PCR assay, *B. koehlerae* and *B. henselae* DNA have the same amplicon size which may lead to misidentification of the species if genetic sequencing is not performed.

Total DNA previously extracted from cats (n = 48 cats) and their *C. felis* (n = 47 flea groups [1 – 12 fleas per group]) that were positive for DNA of *B. henselae*, *B. clarridgeiae*, or both in the 16S-23S intergenic region *Bartonella* spp. PCR assay were selected. The DNA had been stored at -80°C until used in this study. A conventional PCR assay with primers designed to amplify only the DNA of *B. koehlerae* was optimized (sensitivity = 1-5 bacteria/μl DNA) and applied to the DNA extracts which was used to confirm the presence of *B. koehlerae* DNA in the uninfected cats.

ABSTRACT ID-31

A FLEA AND TICK COLLAR CONTAINING 10% IMIDACLOPRID AND 4.5% FLUMETHRIN PREVENTS FLEA TRANSMISSION OF *BARTONELLA HENSELAE* IN CATS FOR 8 MONTHS. MR Lappin1, D Stanneck2. 1Antech Diagnostics, Lake Success, NY, 2Department of Clinical Sciences, Colorado State University, Ft. Collins, Colorado

The purpose of this study was to validate a proprietary automated fluorescent system (Accuplex4™) that allows for simultaneous detection of 5 distinct serum antibodies against Bb in canine serum and differentiation of natural infection from vaccination and acute to chronic infection.

The Bb markers used in the Accuplex4™ included OsPA, OsPc, OsPF, P39 and OspC. Multiple titrations with sera from naturally exposed or vaccinated dogs were performed to determine the optimal concentrations of the markers, buffers, serum dilutions, and secondary antibody concentrations. After the assay was optimized, sera from 36 mixed sex, young adult beagles that were exposed to wild caught *I. scapularis* (average Bb PCR positive rate = 56%) before (18 dogs) or after vaccination (18 dogs; 6 dogs per vaccine group) with three vaccines (Merck Novibac Lyme; Pfizer LymeVax; Merial Reombicte Lyme) were assayed. Sera were collected from vaccinated dogs on Weeks 0, 1, 2, 3, 4, 5, 6, 7, 8, 11, 17 and 24 (Accuplex4™) and sera from weeks 24 through week 46. Results of Bb western blot immunoassays were also used in the development of proprietary computer algorithms to classify Bb infections based on antibody responses to the 5 targets.

LymeVax induced positive Osp A, Osp C, and SLP responses. LymeVax induced positive OsPA and SLP responses, and Reombicte Lyme induced only OsPA responses. Vaccine induced antibody responses could generally be detected 2 to 3 weeks after the first vaccination. Of 18 dogs exposed to *I. scapularis* prior to vaccination, 14 developed evidence of infection with first positive antibody assay results detected from 14 to 70 days after tick attachment. Antibodies against OsP F were only detected in unvaccinated dogs with chronic infections (>7 weeks). When compared to western blot immunoassay, the Accu-plex4™ detected antibodies for the first time on the same sample date (9 dogs), 1 week earlier (4 dogs) and 1 week later (1 dog).

Computer algorithm based evaluation of antibody response to multiple targets provides classifications that can differentiate vaccinated dogs, those with acute infections, and those with chronic infections and correlates closely with results of Western blot immunoassay. However, antibody test results must be interpreted in concert with clinical findings to diagnose clinical canine borreliosis.

ABSTRACT ID-32

CLASSIFICATION OF *BORRELIA BURGDORFERI* INFECTION USING RESULTS OF 5 ANTIBODY TARGETS IN AN AUTOMATED SYSTEM. S. Moroff1, T Sokolich1, T Woodring1, C Woodruff1, B Atkinson1, M Lappin2. 1Antech Diagnostics, Lake Success, NY, 2Department of Clinical Sciences, Colorado State University, Ft. Collins, Colorado

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Computer algorithm based evaluation of antibody response to multiple targets provides classifications that can differentiate vaccinated dogs, those with acute infections, and those with chronic infections and correlates closely with results of Western blot immunoassay. However, antibody test results must be interpreted in concert with clinical findings to diagnose clinical canine borreliosis.

Feline histoplasmosis is a systemic fungal infection traditionally treated with itraconazole, which can be cost prohibitive for some clients. Additionally, although the clinical disease in cats has been thoroughly documented, risk factors have yet to be explored. The objectives of this study were to compare the outcomes of cats with histoplasmosis treated with fluconazole to those treated with itraconazole and evaluate possible environmental risk factors for affected cats. Medical records from feline patients with confirmed histoplasmosis (n = 32) at Kansas State University were systematically reviewed, and follow-up was performed by owner telephone interview.

One cat treated with fluconazole (n = 17) required a treatment change as compared with five cats treated with itraconazole (n = 13). Two cats were not treated. Overall mortality rates of cats treated with fluconazole (29%) and itraconazole (38%) were not significantly different (p = 0.27). Rates of recrudescence were also not significantly different (p = 0.29) when comparing cats treated with fluconazole to those treated with itraconazole (40% vs 31%). At the authors’ institution, a one month supply of itraco-
nazole for a 5-kg cat would cost $212.85 compared to $18.60 for fluconazole. Fluconazole is a viable, cost-effective alternative therapy for the treatment of feline histoplasmosis.

Forty-one percent of cats (12/29) represented in the follow-up survey were housed strictly indoors. Commonly reported environmental risk factors included exposure to indoor potted plants (13/29) and unfinished basements (12/29). These findings differ from the traditionally held view that histoplasmosis is strictly a disease of outdoor cats. Thus, other environmental risk factors warrant critical investigation.

**ABSTRACT ID-34**

**EVALUATION OF ENTEROCoccus FaeCIum SF68 SUPPLEMENTATION WITH METRONIDAZOLE IN THE TREATMENT OF NON-SPECIFIC DIARRHEA IN DOGS HOUSED IN ANIMAL SHELTERS.** A Fenimore, L Groshong, V Scorza, MR Lappin. Department of Clinical Sciences, Colorado State University, Fort Collins, Colorado

*Enterococcus faecium* strain SF68 (FortiFlora, Nestle Purina PetCare) supplementation was shown in a recent study of shelter cats to lessen the incidence of non-specific diarrhea of > 2 days duration when compared to placebo treated controls. SF68 is known to be resistant to metronidazole which is commonly used to treat shelter dogs with diarrhea. The purpose of this study was to determine whether dogs with non-specific diarrhea administered SF68 with metronidazole would have better clinical outcomes than dogs administered metronidazole alone.

A physical examination and a standardized fecal score system (7 = watery puddles; 6 = texture but no shape; 5 = moist piles; 4 = moist log shape; 3 = normal) was applied to all samples daily by a person masked to the treatment groups. Stray dogs with diarrhea without vomiting, a fecal score of > 4, interest in food, and no clinical findings suggesting a foreign body were included. All dogs were fed a standardized diet and were administered metronidazole USP at 25 mg/kg, PO, twice daily for 7 days. The treated dogs were randomized to be administered SF68 (treatment) or a placebo mixed with their food daily for 7 days. Feces collected prior to treatment were analyzed by fecal flotation as well as fluorescent antibody assay for *Giardia* cysts and *Cryptosporidium* spp. oocysts. Speed to improvement was defined as the first day the score dropped 2 points from Day 0 or a fecal score of 4 was reached and sustained for 2 days in a row.

A total of 48 dogs were entered into the study by the time of abstract submission. Of these dogs, 33 dogs (16 treatment; 17 placebo) completed the study. Overall, 50% of the treatment group and 29.4% of the placebo group had fecal scores < 3 by Day 7 (p > 0.05). However, speed to improvement was faster (p = 0.04) in the treatment group than in the placebo group. Twenty-nine percent of the treatment group and 29.4% of the placebo group had fecal scores < 3 by Day 7 (p > 0.05). However, speed to improvement was faster (p = 0.002). Multiple *Mycoplasma* spp. were grown but none were *M. cynos*. Coinfections with multiple agents were detected more frequently in shelter-sick dogs than community-sick dogs (p = 0.03).

Currently available diagnostic assay results for dogs with suspected CIRDS do not always correlate with clinical signs at the time of testing. *Mycoplasma* spp. appear to be associated with CIRDS in some dogs, but can be grown or amplified from healthy and sick dogs and it is currently unclear which *Mycoplasma* spp. are most likely to be pathogenic.

<table>
<thead>
<tr>
<th>Table 1. Prevalence rates (%)</th>
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<tr>
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<td>Community Sick (n = 60)</td>
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<td>Shelter Sick (n = 20)</td>
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<td>Shelter Healthy (n = 10)</td>
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**ABSTRACT ID-35**

**PREVALENCE OF AGENTS ASSOCIATED WITH CANINE INFECTIOUS RESPIRATORY DISEASE SYNDROME IN CLIENT-OWNED DOGS AND DOGS HOUSED IN SHELTERS.** C Karsten1, JR Hawley1, C Luttenegger2, MR Lappin1. 1Department of Clinical Sciences, Colorado State University, Ft. Collins, Colorado; 2IDEXX Laboratories, Sacramento CA

Canine infectious respiratory disease syndrome (CIRDS) is a common in dogs housed in high density housing such as boarding facilities, day care, and animal shelters. The primary agents associated with this syndrome are *Mycoplasma* spp. (Myco), *Bordetella bronchiseptica* (Bb), *Streptococcus equi* var. *zooepidemicus* (SZ), adenovirus 2 (A-2), canine distemper virus (CDV), canine herpesvirus (CHV), parainfluenza (Para), canine influenza virus (CIV), and respiratory coronavirus (RCV). The purpose of this study was to use commercially available diagnostics to evaluate the prevalence of these agents in three groups of dogs.

In the community-sick dogs were animals presented to their veterinarians or boarding facility with clinical signs consistent with CIRDS; shelter-sick dogs were animals that developed clinical signs of CIRDS while in a large open admission animal shelter; and shelter-healthy dogs were animals without clinical signs in the same shelter. Nasal discharges or materials from the caudal pharynx were collected onto 2 swabs with the swab containing Amies media transported to Colorado State University for *Mycoplasma* spp. culture and species determination. The other swab was transported to IDEXX Laboratories for performance of a proprietary PCR panel that amplifies the DNA or RNA of the primary agents associated with CIRDS.

CIV RNA (all dogs), SZ DNA (21 dogs), and H1N1 RNA (human influenza; 42 dogs) were not amplified from any dog. The distribution of results for other agents is listed in Table 1.

Shelter-sick dogs were more likely than community-sick dogs to be positive for a *Mycoplasma* spp. (p = 0.002). Multiple *Mycoplasma* spp. were grown but none were *M. cynos*. Coinfections with multiple agents were detected more frequently in shelter-sick dogs than community-sick dogs (p = 0.03).

Currently available diagnostic assay results for dogs with suspected CIRDS do not always correlate with clinical signs at the time of testing. *Mycoplasma* spp. appear to be associated with CIRDS in some dogs, but can be grown or amplified from healthy and sick dogs and it is currently unclear which *Mycoplasma* spp. are most likely to be pathogenic.

**ABSTRACT ID-36**

**COMPARISON OF ELISA, CONVENTIONAL PCR, AND QUANTITATIVE PCR FOR DETECTION OF CANINE PARVOVIRUS.** Y Nakayama, MR Lappin, JK Vizcayr. Colorado State University College of Veterinary Medicine and Biomedical Sciences, Fort Collins, CO

A point-of-care antigen ELISA is currently the most commonly used diagnostic test for canine parvovirus (CPV-2). However, it has low sensitivity compared to PCR based assays. This study compares the results of ELISA, conventional PCR (cPCR) and quantitative real time PCR (qPCR) in detecting CPV-2 in whole blood and feces of dogs suspected of being infected with CPV-2.

A biased group of samples was obtained from 49 dogs exhibiting clinical signs consistent with CPV-2 infection. DNA was extracted from both fecal and EDTA blood samples for cPCR and qPCR analyses. CPV-2 virus in the feces was also detected by a commercially available antigen ELISA. For all samples, a segment of the viral DNA was amplified and sequenced for genotyping.

Of the 49 fecal samples, 26 tested positive with ELISA. All of these samples were determined by a previously published qPCR assay to have a viral load of >10³ viral particles/mg feces. The limit of detection for this ELISA. Real time PCR of the matching blood for these ELISA positive fecal samples showed that a viral load of >10³ virus/ul blood could be detected in most but
not all cases (23/26). Conventional PCR detected CPV in the blood and feces from all dogs with positive ELISA results. Seventeen of the 23 fecal samples that tested negative with ELISA were determined to have a viral load as determined by qPCR less than the limit of detection of the ELISA assay. However, there were 6 ELISA negative fecal samples with viral loads as determined by qPCR to be well above the limit of detection for ELISA. When all samples were genotyped, and 2% of the samples were CPV-2a, 50% CPV-2b, and 48% CPV-2c and differences in genotypes did not account for the discrepancy between qPCR and ELISA results seen above. Also, there were 6 samples that had positive results with both ELISA and qPCR, that initially were not detected by qPCR. However, using different primers and probes targeting a more conserved region of the CPV genome resulted in a high viral load as expected.

Overall, this study confirms that qPCR and qPCR of fecal samples are the most sensitive of the modalities presented. These results also suggest that because CPV-2 is a rapidly evolving virus, compatibility of existing diagnostic tests with current clinical strains should be tested periodically.

**ABSTRACT ID-37**

**PARVOVIRUS DNA COPY NUMBERS IN THE BLOOD OF CATS WITH AND WITHOUT HISTOLOGICALLY CONFIRMED PANLEUKOPENIA.** KP Polak, MR Lappin, CM Leutenegger, SL Marks, J Robertson. 1

Use of real time polymerase chain reaction (qPCR) for quantitative detection of FPV and CPV2 DNA in samples from cats (qPCR-PV) has been shown to be both sensitive and specific over a wide range of viral titers in cats with naturally occurring FPV. Parvoviruses induce a viremia and so can be amplified from the blood. The purpose of this study was to determine the range of Parvovirus copy numbers in blood of kittens suspected of having parvoviral disease.

Blood, jejunum and ileum samples were collected from 25 shelter cats with clinical signs consistent with FPV or CPV from humane euthanasia. The majority of cats were vaccinated with a parenteral modified live FPV, FHV-1, and FCV containing vaccine upon intake to the shelter, prior to development of clinical signs. Blood in EDTA was evaluated in a previously validated qPCR-PV. Tissues were evaluated histopathologically after being stained with hematoxylin and eosin. The tissues were examined by an individual blinded to clinical history and qPCR-PV results. A diagnosis of FPV was given if characteristic lesions were present such as lymphoid depletion, intranuclear inclusions, villus blunting and fusion, or crypt necrosis, loss and abscessation.

In the 5 cats with histologically confirmed FPV infection, 4 cats were positive in blood by qPCR-PV with the PV copies/µl ranging from 0 – 89,333 (mean = 22,929; SD = 33,078). In the 20 cats with no histological evidence of FPV infection, PV copies/µl were < 3,000 in all cats with a range of 0 – 2,947 (mean = 319; SD = 790). PV copies/µl were < 100 in 17 of 20 cats.

The use of qPCR-PV performed on blood of kittens suspected to have FPV should be evaluated further for clinical utility by comparing to other currently available assays.

**ABSTRACT ID-38**

**TOXIN QUANTIFICATION OF CLOSTRIDIUM PERFRINGENS IS A PREDICTOR FOR DIARRHEA IN DOGS AND CATS.** CM Leutenegger, SL Marks, J Robertson. 2

Toxigenic Clostridium perfringens strains are believed to be important contributors to gastrointestinal disease, and acute hemorrhagic diarrhea has been well documented in association with infection. Two toxins, the C. perfringens α-toxin and C. perfringens enterotoxin (CPE) are most frequently detected in dogs and cats, although questions have been raised regarding their toxigenic potential when detected in healthy animals. The objective of this work was to evaluate the relationship of toxin quantification with disease severity in diarrheic and apparently healthy dogs.

A total of 181 healthy and diarrheic dogs and cats were selected based on fecal scoring and analysis of clinical history. Toxin DNA and RNA quantification and toxin production were measured with commercial real-time PCR tests (IDEXX Laboratories, Inc.) and a commercially available enterotoxin ELISA (TechLab, Inc.).

181 fecal specimens were evaluated, including 48 from healthy dogs, 39 from healthy cats and 46 from diarrheic and 48 from diarrheic cats, respectively. When using a cutoff value determined by real-time PCR for toxin gene DNA quantification, the α-toxin gene was found to be significantly associated with diarrhea: the α-toxin gene was detected in 47.8% of diarrheic dogs vs. 4.2% of healthy dogs (OR = 25.2, p < 0.0001), whereas the α-toxin gene was detected in 37.5% of diarrheic cats vs. 12.8% of healthy cats (OR 4.7, p = 0.01). CPE was detected via ELISA in 19.6% of diarrheic dogs vs. 2.1% of healthy dogs (OR = 11.43, p = 0.007), whereas CPE was detected in 8.3% of diarrheic cats vs. 0% of healthy cats (OR = 7.99, p = 0.1). Quantification of DNA from both toxins in diarrheic and healthy animals was significantly different in dogs and cats: α-toxin DNA: p < 0.001; α-toxin cats: p = 0.0098; CPE dogs: p = 0.02; CPE cats: p < 0.0001. All fecal specimens positive for toxin DNA were also positive for toxin gene mRNA indicating active transcription of the gene. This indicates that both the α-toxin gene and cpe are actively transcribing and synthesizing toxin proteins in toxigenic C. perfringens strains. The Pearson correlation between PCR and ELISA indicated a weak positive r value of 0.59.

In conclusion, we found that quantitative toxin gene analysis by real-time PCR for the α-toxin and CPE correlates with presence of diarrhea and has the potential to be used as a diagnostic marker.

**ABSTRACT ID-39**

**CANINE INFLUENZA VIRUS H3N8: A 4 YEAR REVIEW OF SEASONAL PATTERNS, GEOGRAPHICAL FREQUENCY DIFFERENCES AND AGE DISTRIBUTION.** CM Leutenegger, M Estrada, RD Armstrong. 3

Canine influenza virus (CIV) H3N8 has been circulating in the canine population of the United States since early 2000. Using results from samples submitted by veterinarians, we analyzed epidemiological aspects of CIV occurrence between 2008 and 2011 including patterns in seasonal distribution, geographic occurrence and age classes of positive dogs.

A total of 17,331 swab samples (conjunctival and pharyngeal) submitted by veterinarians were analyzed over the 4 year period using a panel of real-time PCR tests specific for nine respiratory pathogens including CIV. A total of 311 CIV positive results were recorded. The yearly CIV PCR test positive proportion was 2008 - 3.7%; 2009 - 1.2%; 2010 - 1.7%; 2011 - 1.4%. In general, there was a seasonal distribution of positive results with peak numbers during either the winter months (January through March), or during summer to early fall (July - October). In 2008, outbreaks occurred both during winter (14 cases from 1 state) and summer (58 cases from 7 states). In 2009, a large outbreak occurred between January and March (40 cases from 7 states) and a second one between August and October (19 cases in 8 states). In 2010 two outbreaks were detected: one between April and June (25 cases in 6 states) and September (6 cases in 1 state). In 2011 three separate outbreaks were observed with a total of 28 cases in 6 states.

The main geographic locations with elevated case numbers were: 2008 - Illinois and Colorado; 2009 - Colorado; 2010 - North Eastern states; 2011- North Eastern states, Texas and California. CIV positive cases were grouped into 4 age classes: < 6 months, 7-18 months, 19-84 months, and > 84 months. The average age for H3N8 positive dogs was 40 months. Positive tests were detected in all age classes, with the 19-84 month group infected most frequently (36%). In contrast, canine distemper virus PCR positive tests in our laboratory show an average age...
of 13 months with the youngest age class (< 6 months) most likely to test positive.

These results highlight the dynamic situation of canine influenza virus H3N8 infections in the US dog population. Canine influenza has a seasonal pattern, tends to occur as outbreaks within a geographical area, and adult dogs (19 – 84 months) are the main age class affected.

ABSTRACT ID-40
THE EFFECTS OF MAROPITANT VERSUS ONDANSETRON ON THE CLINICAL RECOVERY OF DOGS WITH PARVOVIRAL GASTROENTERITIS. J Lenberg, L Sullivan, P Boscan, T Hackett, D Twedt. Department of Clinical Sciences, Colorado State University, Fort Collins, CO

Dogs affected with parvoviral gastroenteritis often require parenteral antiemetic therapy to control vomiting, avoid dehydration and enhance return of voluntary appetite. Maropitant acts centrally at the neurokinin-1 receptor to inhibit vomiting and may also provide visceral analgesia. The efficacy of maropitant has not been tested in dogs with parvovirus, but given its strong antiemetic properties, maropitant may be superior in controlling clinical signs when compared to traditional antiemetics. We hypothesized that hospitalized dogs treated with maropitant would demonstrate an improved clinical recovery and shorter duration of hospitalization compared to dogs treated with ondansetron.

Twenty-two naturally infected dogs, not previously treated for their disease, were included in the study following a positive snap ELISA parvoviral test. All dogs were treated with intravenous fluids, cefoxitin, and enteral nutrition. Dogs were randomized to receive either maropitant (1 mg/kg IV q24h, n=11) or ondansetron (0.5 mg/kg IV q8h, n=11) as a primary antiemetic. Frequency of vomiting and visceral pain/nausea scoring were evaluated twice daily. Rescue analgesics and antiemetics were administered as dictated by specific pain and nausea criteria. Clinical severity scoring, body weight, and caloric intake were monitored daily.

When comparing maropitant and ondansetron groups, there was no statistical difference in: duration of hospitalization (3.36 ± 0.56 vs. 2.73 ± 0.38 days, p=0.36), frequency of rescue antiemetic use (3/11 vs. 5/11 dogs, p=0.66), duration of vomiting (5 vs. 4 days, p=0.65), days to voluntary appetite (2 vs. 1.5 days, p=1.0), mean nausea score (27.9 ± 6.3 vs. 22.7 ± 5.9, p=0.56), or mean CSU pain score (1.25± 0.18 vs. 1.10 ±0.16, p=0.87). Dogs treated with maropitant gained significantly more weight during hospitalization (0.10 ± 0.10 kg), whereas dogs treated with ondansetron lost weight (-0.13± 0.16 kg). Maropitant was administered intravenously in dogs ≥ 9 weeks of age, consecutively for up to 6 days, without any noted adverse effects.

In dogs with parvoviral gastroenteritis, maropitant appears to be equally as effective in controlling clinical signs when compared to ondansetron. Dogs treated with maropitant demonstrated improved ability to maintain body weight during hospitalization.

ABSTRACT ID-42
IDENTIFICATION OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS OF ANIMAL ORIGIN USING BACTERIOPHAGE AMPLIFICATION AND A LATERAL-FLOW IMMUNOASSAY. PS Morley1, D Bolte1, JD Rousseau1, D Manna1, B Dreiling1, JS Weese1. Colorado State University, Fort Collins, CO, 2University of Guelph, Guelph, ON, 3MicroPhage Inc., Longmont, CO

Methicillin-resistant S. aureus (MRSA) has emerged as an important health hazard for animals. Rapid laboratory confirmation is essential for appropriate clinical management and to allow appropriate control measures for minimizing nosocomial and zoonotic transmission risks. Recently, bacteriophage amplification technology has been used as the basis for a commercial test designed to rapidly identify MRSA in human clinical specimens. The purpose of this study was to evaluate the ability of a similar prototype test to identify animal-source MRSA and methicillin-susceptible (MS) Staphylococcus aureus (SA) and to evaluate the test’s reactivity with relevant non-SA staphylococcal isolates.

Bacteriophage specific for SA were included in 2 broth media solutions, 1 that also contained cefoxitin to select for methicillin-resistant (MR) bacterial strains. A variety of genetically characterized staphylococcal isolates of animal origin were selected from an archival bank, and standardized concentrations were inoculated into the broth solutions. A lateral-flow immunosensor was used to detect phage that were amplified in overnight cultures of broth solutions.

Thirty-six MRSA isolates belonging to 7 major genetic types (USA 100, USA 200, USA 300, USA 400, USA 500, USA 600, USA 700, and CC398) were evaluated. Thirty-two MRSA were correctly classified; 4/15 CC398 isolates were misclassified. Eleven of 15 MSSA isolates were correctly classified, as were 25 of 25 other non-SA staphylococcal isolates (including MR S. pseudintermedius, SA S. pseudintermedius, MR S. schleiferi, and coagulase-negative Staphylococcus spp.).

This prototype rapid assay correctly classified a high proportion of widely diverse MRSA, MSSA, and other non-SA staphylococcal strains of animal-origin. However the failure to detect some CC398 isolates might be problematic for some regions and animal species. Modification of the bacteriophage mixture may help overcome this misidentification and requires further study. This inexpensive, rapid method has promise for practical applications requiring identification of RSA colonization and infection in animals.
Abstract ID-43: Table

<table>
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<tr>
<th>Comparison Test</th>
<th>Sample Size</th>
<th>SNAP 4DX Plus / Reference Test</th>
<th>Total</th>
<th>Sample Type</th>
<th>Relative Sensitivity and Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTWM¹ ²</td>
<td>94</td>
<td>1 / 2 / 269</td>
<td>366</td>
<td>Serum/Plasma</td>
<td>Sen., 98.9% (95% CL 94.3%-99.8%)</td>
</tr>
<tr>
<td>A. phagocytophilum¹</td>
<td>123</td>
<td>13 / 15 / 235</td>
<td>386</td>
<td>Serum/Plasma</td>
<td>Spec., 99.3% (95% CL 97.3%-99.8%)</td>
</tr>
<tr>
<td>A. platys⁴</td>
<td>102</td>
<td>21 / 15 / 235</td>
<td>373</td>
<td>Serum/Plasma</td>
<td>Sen., 90.4% (95% CL 84.3%-94.3%)</td>
</tr>
<tr>
<td>B. burgdorferi⁶</td>
<td>112</td>
<td>7 / 10 / 246</td>
<td>375</td>
<td>Serum/Plasma</td>
<td>Spec., 94.0% (95% CL 90.3%-96.3%)</td>
</tr>
<tr>
<td>E. canis³</td>
<td>131</td>
<td>3 / 18 / 217</td>
<td>369</td>
<td>Serum/Plasma</td>
<td>Sen., 94.1% (95% CL 88.4%-97.1%)</td>
</tr>
<tr>
<td>E. ewingii⁸</td>
<td>109</td>
<td>4 / 10 / 154</td>
<td>277</td>
<td>Serum/Plasma</td>
<td>Spec., 96.3% (95% CL 89.0%-96.8%)</td>
</tr>
</tbody>
</table>

Reference ¹Necropsy and ²petechia ³A. phagocytophilum IFA ⁴B. burgdorferi IFA ⁵E. canis ⁶E. ewingii ELISA

ABSTRACT ID-44

PREVALENCE OF SELECT VECTOR BORNE DISEASE AGENTS IN OWNED DOGS OF GHANA. L. Clarke¹, L R Ballweber², K Allen², S Little², MRLappin¹. ¹Colorado State University, Fort Collins, CO and, ²Oklahoma State University, Stillwater, OK

While many dogs in West Africa are seen in clinics for evaluation of clinical syndromes related to vector-borne diseases, such as anemia, weakness, and lethargy, the resources for definitive diagnosis are not available. The purpose of this study was to evaluate for evidence of vector borne infections in pet dogs in Ghana.

Ticks (n = 8), sera (n = 17), and blood samples in EDTA (n = 17) were collected from dogs evaluated in the Amakom Veterinary Clinic in Kumasi, Ghana between Dec 2010 and Jan 2011. The ticks were identified to the genus level by microscopy. Sera were assayed in an EC IFA (Prototek Reference Laboratory, Chandler AZ) and a commercially available kit (SNAP®4DX; IDEXX Laboratories, Portland ME). Conventional polymerase chain reaction assays designed to amplify the DNA of Ehrlichia spp./Anaplasma spp./Neorickettsia spp./Wolbachia spp., Babesia spp., Rickettsia spp., Hepatozoon spp., Bartonella spp. and the hemoplasmas were performed on DNA extracted from EDTA blood. Positive amplicons were sequenced.

All of the ticks were Rhipicephalus spp. Overall, 8 of 17 dogs (47%) were confirmed by PCR and genetic sequence to harbor a vector borne agent (4 Hepatozoon canis; 2 E. canis; 1 A. platys; 1 Wolbachia). In addition, 3 samples were positive for A. phagocytophilum antibodies, 2 samples were positive for E. canis antibodies and 1 sample was positive for E. canis antibodies and D. immitis antigen. Of the 3 dogs positive for E. canis antibodies, 2 were PCR positive and confirmed by sequencing to be E. canis and Wolbachia. One of the dogs that was PCR positive for E. canis and the A. platys PCR positive dog were negative for antibodies in the SNAP®4DX. The Wolbachia PCR positive dog was also positive for D. immitis antigen in serum. Bartonella henselae DNA was amplified from 2 ticks and Hepatozoon canis DNA was amplified from 1 tick.

Vector borne diseases are common in this part of Ghana and include H. canis, E. canis, D. immitis, and A. platys. Bartonella henselae is generally considered to be vectored by Ctenocephalides felis but has been amplified from both Eosodes and Rhipicephalus ticks. Hepatozoon canis is known to be carried by Rhipicephalus ticks and were the likely vectors in these dogs.

ABSTRACT ID-45

USE OF AN AUTOMATED SYSTEM FOR DETECTION OF CANINE SERUM ANTIBODIES AGAINST GLYCOPROTEIN GP36. S Moroff¹, 1 Sokolohik¹, 1 Woodring¹, C Woodruff¹, B Atkinson, M Lappin¹. ¹Antech Diagnostics, Lake Success, NY, ²Department of Clinical Sciences, Colorado State University, Ft. Collins, Colorado

Ehrlichia canis (EC) is the most common cause of monocytopenic ehrlichiosis in dogs around the world. The purpose of this study was to validate a new automated fluorescence system (Accuplex4™) to detect antibodies against the EC immunodominant glycoprotein gp36.

Young adult, mixed sex beagles (n = 8) were inoculated with culture derived EC IV. Serum and blood samples (EDTA) were collected on Days 0, 3, 7, 10, 14, 17, 21, 28, 35, 42, 49, 63, 70, 77, and 84. Doxycycline was administered daily at 10 mg/kg, PO on Days 56 - 77. An assay to measure canine antibodies against gp36 in the Accuplex4™ was titrated with positive and negative control sera to determine the optimal concentrations of gp36, buffers, serum dilutions, and secondary antibody concentrations. After optimization, the sample set from the EC inoculated dogs was assayed. Sera were also assayed in an EC IFA (Prototek Reference Laboratory, Chandler AZ) and a commercially available kit (SNAP®4DX; IDEXX Laboratories, Portland ME). A complete blood cell count and a proprietary EC PCR assay (Antech Diagnostics, Lake Success, NY) were performed on each blood sample.

Results from the EC inoculated dogs varied by the assay with some statistical differences detected (Table 1). Onset of thrombocytopenia (<170/mm³) occurred on Day 14 (4 dogs), Day 17 (1 dog) or Day 21 (3 dogs). On the day thrombocytopenia was first detected, PCR assay results (8 dogs) were positive more commonly than SNAP (1 dog) and IFA (2 dogs) but not more commonly than gp36 (4 dogs). Serum antibodies (all assays) but not EC DNA were detected after starting doxycycline.

Abstract ID-45:

Table 1. % positive results for 8 EC infected dogs.

<table>
<thead>
<tr>
<th>Assay</th>
<th>Day</th>
<th>0</th>
<th>3</th>
<th>7</th>
<th>10</th>
<th>14</th>
<th>17</th>
<th>21</th>
<th>28</th>
<th>35</th>
<th>42</th>
<th>49</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>75¹</td>
<td>87.5³</td>
<td>100³</td>
<td>100³</td>
<td>100</td>
<td>87.5</td>
<td>87.5</td>
<td>87.5</td>
</tr>
<tr>
<td>Low plat.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>62.5</td>
<td>100</td>
<td>100</td>
<td>87.5</td>
<td>87.5</td>
<td>87.5</td>
<td>87.5</td>
</tr>
<tr>
<td>gp 36</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12.5²</td>
<td>87.5³</td>
<td>100³</td>
<td>100³</td>
<td>100</td>
<td>100</td>
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<td>100</td>
</tr>
<tr>
<td>IFA</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>75³</td>
<td>100³</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>SNAP</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12.5³</td>
<td>12.5³</td>
<td>37.5³</td>
<td>87.5</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

¹is statistically different than ²plat – platelet.
EC DNA was amplified before serum conversion in any assay and compared with serum of thrombocytopenia. Antibodies against gp36 were detected within 3 days of PCR positive test results. Detection of EC antibodies in the Accuplex™ assay occurs 3 to 21 days sooner than by SNAP and 7 to 14 days sooner than IFA which likely reflects the cutoff value chosen for each assay.

SMALL ANIMAL–NEPHROLOGY / UROLOGY

ABSTRACT NU-2
PROTEIN- LOSING NEPHROPATHY ASSOCIATED WITH MUTATIONS IN NPHS1 (NEPHRIN) AND KIRREL2 (NEPH3/FLTRIN) IN SOFT-COATED WHEATEN TERRIERS. MP Littman, CA Wiley, MG Raducha, PS Henthorn. University of Pennsylvania School of Veterinary Medicine, Philadelphia, PA

Soft-coated Wheaten Terriers are genically predisposed to adult onset protein-losing nephropathy (average onset, 6.3 ± 2.0 years). A genome-wide association study, using the Illumina CanineHD BeadChip with 177,000 validated SNPs for genotyping, revealed a single statistically interesting region (p value ≥ 2.2 x 10⁻⁸) when comparing DNA samples from affected and geriatric (≥14 years) unaffected Wheatens. Criteria for phenotypic selection included blood, urine, and histopathologic findings. Gene sequencing of candidate genes in the region revealed a single nucleotide change in each of two closely linked genes, NPHS1 and KIRREL2, which encode the slit diaphragm proteins nephrin and Nephr3/fltrin, respectively. Mutations in nephrin and decreased expression of filtrin are associated with podocyteopathy and protein-losing nephropathy in humans. The polymorphisms change a glycine to arginine in nephrin and a proline to arginine in a conserved proline-rich region in filtrin. These novel mutations are not described in other species, nor found in 753 dogs of 114 other breeds, except in 3 dogs, including 2 Airedales, 1 of which is doubly homozygous/affected and 1 is doubly heterozygous for the mutations (n = 186). Inheritance appears complex, with incomplete penetrance, variable expression, possibly additional genes and/or environmental triggers modifying the phenotype. This is the first canine inherited podocyteopathy described.

ABSTRACT NU-3
EVALUATION OF WHITE COAT HYPERTENSION IN DOGS AND CATS USING THE PETMAP OSCILLOMETRIC BLOOD PRESSURE MONITOR. SA Stewart, WW Muir, CE Langston. Animal Medical Center, New York City, NY

White coat hypertension is hypertension in hospital that normalizes at home. It is believed to result from stress-associated pressor release, and is documented in people, cats and dogs. If its magnitude is severe enough, patients may be erroneously diagnosed with true hypertension. The purpose of this study was to use the indirect oscillometric petMAP device to compare blood pressures in hospital with those measured at home by owners, to determine if we can differentiate between white coat and true hypertension. We performed a prospective observational study involving 55 client-owned animals (39 dogs and 16 cats) presented over a 15 month period. We collected a minimum of 6 systolic, diastolic and MAP measurements from each patient in hospital and then at home, and compared results using a paired 2-tailed t-test. We also compared the effect of temperament, age, gender, weight, disease status, administration of antihypertensives and limb used on blood pressure using non-paired 2-tailed t-tests and one-way ANOVA. There was a statistically significant difference between at home and in hospital readings for all parameters (dog systolic: 27 mmHg difference, p = 0.0001, diastolic: 14 mmHg, p = 0.0006, MAP: 17 mmHg, p = 0.0005; cat systolic: 20 mmHg, p = 0.015, MAP: 14 mmHg, p = 0.03) except cat diastolic (10 mmHg, p = 0.13). Statistically significant differences were also found for limb used in hospital (37 mmHg systolic higher in hindlimbs versus forelimbs, p = 0.0009, 16 mmHg diastolic, p = 0.02, 26 mmHg MAP, p = 0.001) and dog age for diastolic (13 mmHg, p = 0.025) and MAP (17 mmHg, p = 0.014) readings in hospital. We concluded that white coat hypertension exists and can be successfully documented.

ABSTRACT NU-4
THE EFFECT OF BODY POSITION ON INDIRECT SYSTOLIC BLOOD PRESSURE MEASUREMENT IN DOGS. DA Weinstein, ME Mackalonis, RS Hess. Department of Clinical Studies-Philadelphia, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, PA

The effect of body position on indirect systolic blood pressure (BP) measurement in dogs is unknown. The objectives of this study were to determine whether there is a difference in systolic BP measurement by Doppler ultrasonography in sitting compared to recumbent body position and to determine the degree of BP measurement variability in each of these body positions.

A prospective, randomized, crossover study was performed. Systolic BP was measured in 51 healthy or sick dogs in sitting and laterally recumbent positions using Doppler ultrasonography. The position of the first set of BP measurements was determined randomly for each dog by a coin-flip. The first of seven consecutive measurements in each position was discarded from the analysis.

Mean systolic BP was significantly higher in the sitting (172.1 ± 33.3 mm Hg) compared to the recumbent position (147.0 ± 24.6 mm Hg, P < 0.0001). Systolic BP was higher in the sitting versus recumbent position in 86% of dogs (44/51). The mean difference in systolic BP measured in the two positions was 25.1 ± 25.7 mm Hg. Repeated BP measurements for each dog had a significantly (P < 0.00006) higher reproducibility in the sitting position compared to the recumbent position.

BP measurements in dogs are significantly affected by body position and are higher in the sitting position than in a laterally recumbent position, in most dogs. The sitting body position is preferred for BP measurements because measurements in this position are less variable than in the sitting position.
**ABSTRACT NU-5**

**FEEDING A RENAL DIET IS ASSOCIATED WITH A REDUCTION IN PLASMA FIBROBLAST GROWTH FACTOR 23 (FGF-23) IN CATS WITH STABLE CHRONIC KIDNEY DISEASE (CKD)**, RF Geddes, J Elliott, HM Syme. Royal Veterinary College, London, UK

FGF-23 is a phosphaturic hormone, which increases as renal function declines and is further elevated in hyperphosphatemic cats with azotemic CKD. FGF-23 concentrations decrease with dietary phosphate restriction in humans and rodents. The aim of this study was to investigate the effect of dietary phosphate restriction on plasma FGF-23 concentration in cats with stable azotemic CKD.

Anomeric (plasma creatinine concentration ≥ 2.0 mg/dl and USG < 1.035) geriatric (> 9 years) cats seen at two London first opinion practices since August 2000 were included. Cats offered a commercially available protein and phosphate restricted diet (Royal Canin Renal or Renal Special) were included in the study if they had blood samples taken on both the day they started diet (baseline) and 28-56 days later (on diet). Cats were excluded from the study if plasma creatinine concentration changed ≥ 25% during the study period, if the cat refused to eat the renal diet or if they had evidence of concurrent disease (with the exception of systemic hypertension controlled with medication). Cats were classified as hyper- or normophosphatemic based on the IRIS targets for plasma inorganic phosphorus concentration (iP): stage 1 target iP ≤ 5 mg/dl, stage 2 target iP ≤ 5 mg/dl, stage 4 target iP ≤ 6 mg/dl.

Plasma FGF-23 concentrations were measured using a previously validated human intact FGF-23 ELISA. Comparisons were made using the Wilcoxon signed rank test, with significance determined at P<0.05. Results are reported as means and 25th and 75th percentiles. Plasma FGF-23 concentrations decreased with dietary phosphate restriction in normophosphatemic cats (n=16) eating renal diet was associated with a significant decrease in plasma concentrations of iP (from 5.9 [4.8, 7.4] to 4.1 [3.8, 4.5] mg/dl, P<0.001) and FGF-23 (from 1316.5 [491.9, 4227.6] to 537.7 [388.8, 1539.2] pg/ml, P=0.008), but not plasma creatinine concentration (2.7 [2.3, 3.2] vs. 2.7 [2.1, 2.9] mg/dl, P=0.255). In normophosphatemic cats (n=18) eating renal diet was associated with a significant decrease in plasma FGF-23 concentration (from 682.9 [352.9, 1610.4] to 561.3 [259.7, 1006.1] pg/ml, P=0.006), but not plasma concentrations of iP (3.5 [2.9, 4.0] vs. 3.3 [3.0, 3.7] mg/dl, P=0.478) or creatinine (2.6 [2.3, 3.0] vs. 2.4 [2.1, 2.9] mg/dl, P=0.102).

In conclusion, the feeding of a renal diet is associated with a reduction in plasma FGF-23 concentration in hyper- and normophosphatemic cats with stable azotemic CKD. This suggests that dietary phosphate and protein restriction has effects on phosphate homeostasis, even when plasma iP concentration does not significantly change.

**ABSTRACT NU-6**

**ACUTE KIDNEY INJURY IN DOGS HOSPITALIZED IN THE INTENSIVE CARE UNIT: A PROSPECTIVE STUDY (INTERIM ANALYSIS)**, A Eatropp, C Langston. The Animal Medical Center, New York, NY

This report details an interim analysis of a study with the following objectives: determine the incidence of acute kidney injury (AKI) in the canine intensive care unit (ICU); identify risk factors for AKI in the ICU; and determine if AKI is associated with length of ICU and hospital stay, and hospital survival. Dogs were eligible for inclusion if the ICU stay exceeded 24 hours. Dogs were excluded if they weighed less than 2.5 kg or were diagnosed with AKI on admission. Serum creatinine concentrations were measured every 24 hours. Serial changes in creatinine were evaluated by the Risk, Injury, Failure, Loss of function, End-stage renal disease (RIFLE) and the Acute Kidney Injury Network (AKIN) schemes, and a newly proposed scheme (Cowgill). One hundred and nine dogs were included. All classification schemes reported similar incidences of AKI (9%, 10%, and 9%, respectively). Those receiving fluorquinolones were more likely to develop AKI (odds ratio [OR], 4.4; 95% confidence interval [CI], 1.2 to 15.8) by cumulative failure type (AKIN, RIFLE, or Cowgill’s scheme) and more likely to develop AKI (OR, 4.4; 95% CI, 1.1 to 17.9) by RIFLE. Those receiving digoxin were more likely to develop AKI (OR 4.6; 95% CI, 1.2 to 17.1) by cumulative failure type, more likely to develop AKI (OR 5.6; 95% CI, 1.4 to 21.7) by AKIN, and more likely to develop AKI (OR, 5.9; 95% CI, 1.4 to 22.9) by Cowgill’s scheme. There was no association between AKI and lengths of ICU and hospital stays, or survival.

**ABSTRACT NU-7**

**LONG-TERM RENAL OUTCOME OF DOGS WITH ACUTE KIDNEY INJURY, 1** Kisz1, A Schweighauser1, T Franco1. 1Veterinarte University of Berne, Switzerland, 2University of Zagreb, Croatia

Most studies on acute kidney injury (AKI) state only short-term survival data while long-term follow-up is very sparsely documented. All dogs diagnosed with AKI in 2007-2009 at the University of Berne were included in this study and grouped according to the underlying etiology as leptoospirosis (L) and AKI from other causes (NL). Short- and long-term survival was determined at 10d and >6m after discharge, respectively. Renal outcome of the survivors was re-assessed prospectively, including clinical and laboratory evaluation.

Of the 121 dogs diagnosed with AKI during the study period (89L, 32NL), 69 dogs were treated with hemodialysis (49L, 20NL). Median peak creatinine during hospitalisation was 739 μmol/l (IQR 491-1035). 63 dogs survived short-term (48L (54%), 15NL (47%) and 47 of them could be re-evaluated (38L, 9NL). L-survivors were diagnosed with normal renal function (n=18, 47%), chronic kidney disease (CKD) IRIS stages 1 (n=13), 2 (n=3), 3 (n=3), and 4 (n=1). NL-survivors were diagnosed with normal renal function (n=4, 44%), CKD stages 1 (n=1), 2 (n=1), and 3 (n=2). Development of CKD was neither associated with the etiology group (P=0.87) nor with the presenting or the peak creatinine concentrations (P=0.42 and 0.29), but with the requirement for hemodialysis (P<0.02) in a univariate logistic regression analysis.

In conclusion, the high prevalence of CKD in dogs recovered from AKI warrants close long-term monitoring of their kidney function.

**ABSTRACT NU-8**

**ACUTE AND CHRONIC EFFECTS OF TEPOXALIN ON RENAL FUNCTION IN DOGS WITH CHRONIC KIDNEY DISEASE AND OSTEARTHRITIS, A Lomas1, S Lyon2, MW Sanderson2, GF Grauer3. 1Departments of Clinical Sciences, Kansas State University, Manhattan, KS, 2Diagnostic Medicine and Pathobiology, Kansas State University, Manhattan, KS**

Chronic kidney disease (CKD) and osteoarthritis (OA) are common in older dogs. We assessed effects of tepopaxalin on renal function in dogs with OA and Stage 2 or 3 CKD (serum creatinine [SrCr] 1.6-3.5 mg/dl). Inclusion criteria were OA and stable CKD (assessed by SrCr, ioheoxol plasma clearance, urine protein/creatinine ratio, enzymuria, and systolic blood pressure at -14 and -7 days). Dogs then received tepopaxalin (10 mg/kg PO once daily) for 28 days (acute phase, 16 dogs), and 6 months (chronic phase, 10 dogs). Check-ups were performed weekly (acute phase) and then at 1, 3, and 6 months (chronic phase). Three owners elected not to continue beyond week 4.

Adverse events that resulted in withdrawal included: increased SrCr in one dog (week 1), collapse and then at 1, 3, and 6 months (chronic phase). Three owners elected not to continue beyond week 4.

Treatment discontinuation resulted in stabilized renal function in the first dog and resolution of 4 of the 5 adverse events. This rate of adverse events is similar to those listed for dogs with normal renal function.

Renal function parameters were analyzed using repeated measures ANOVA. There was no difference over time for any parameter in dogs that were not withdrawn for adverse events. Results suggest that with close monitoring, tepopaxalin may be used in dogs with OA and stable Stage 2 or 3 CKD.
ABSTRACT NU-9
ULTRASOUND-GUIDED PLACEMENT OF URETHRAL STENTS IN DOGS. T Archer, E Brinkman-Ferguson, A Dedeaux, B Geesaman, AMackin. Mississippi State University College of Veterinary Medicine, Mississippi State, MS

Neoplasia, particularly transitional cell carcinoma and prostatic carcinoma, is a common cause of urethral obstruction in the dog. Stranguria is a common clinical sign, with partial or complete obstruction occurring in approximately 10% of these patients. One method for relieving malignant obstruction in dogs is the use of self-expanding metallic stents (SEMS). Placement of a urethral stent is a fast and effective means of rapidly achieving urethral patency with a reduced risk of complications compared to more aggressive surgical procedures. Stents are typically placed under the guidance of fluoroscopy, thereby limiting the availability of this technique to academic institutions and large referral practices.

The purpose of our study was to develop a technique for placement of SEMS under ultrasound guidance without fluoroscopy. Five canine cadavers (2M, 3F; wt 12-15 kg) were used. Positive contrast retrograde urethrocytography or vaginourethrocytography was performed prior to stent placement in males and females respectively to establish landmarks for assessment of stent location. Our goal was to place the cranial edge of the stent 2 cm cranial to the neck of the bladder. In males, a hydrophilic guide wire was inserted in the penile urethra and fed into the bladder, and the stent deployment device was passed over the wire. In females, a modified polypropylene urinary catheter was passed through the urethra into the bladder, and the deployment device was passed through the catheter. The bladder was expanded with a standardized fluid volume to facilitate ultrasonography. The cranial tip of the deployment device was identified on ultrasound and positioned 2 cm cranial to the bladder neck. The stent was then slowly deployed while the position of the cranial end of the stent was continuously monitored via ultrasound. Repeat radiographs were performed to determine the final position of the stent. In all 5 dogs, the urethral stent was successfully placed within 0.5 cm of the target location.

Our study confirms that urethral stents can be successfully placed in normal dogs under ultrasound guidance without fluoroscopy. Our technique can be utilized in practices that do not have access to fluoroscopic equipment. Further investigation in tumor-bearing dogs is indicated.

Ultrasound image demonstrating a deployed urethral stent within the bladder. The thick arrow indicates the cranial edge of stent, and the thin arrow indicates the pubis.

ABSTRACT NU-10
URINARY NGAL: A BIOMARKER FOR EARLY IDENTIFICATION OF ACUTE KIDNEY INJURY IN DOGS. CA Palm1,2, JL Westropp1,2, B LeRoy3, G Segev3, LD Cowgill4, JL Platell1. 1UC Davis School of Veterinary Medicine, Davis, CA, 2Abbott Laboratories, 3Koret University

Despite advances in the treatment of acute kidney injury (AKI), the death rate among dogs remains high. A key factor contributing to AKI-associated fatalities is lack of sensitive tests allowing for early diagnosis. There is a growing interest in the development of biomarkers, which are natural substances that can be detected in urine or blood, and may allow for early AKI diagnosis. Neutrophil gelatinase-associated lipocalin (NGAL) is expressed in low concentrations in healthy dogs and humans, however, expression is markedly increased by compromised renal epithelium. Urinary NGAL (uNGAL) has been identified as one of the earliest and most robustly induced proteins in animal models of AKI. A canine specific ELISA kit for uNGAL has been developed for research purposes (BioPorto Diagnostics SA); pilot data shows uNGAL increases 7- to 200-fold in dogs with documented renal disease. Therefore, the purpose of this study was to evaluate the utility of unNGAL in a canine model of AKI.

Six dogs were administered gentamicin (10 mg/kg SC q 8hours) and uNGAL and serum creatinine were measured twice daily. Data available for two dogs revealed that uNGAL concentrations increased 7-fold above baseline by day 5 and 9, respectively, while serum creatinine remained within the reference range until days 14 and 16, respectively. When serum creatinine values increased by 50% in these two dogs, uNGAL had increased an average of 789-fold.

uNGAL may be a useful diagnostic tool for early detection of AKI in dogs and therefore may allow for improved patient outcomes.

ABSTRACT NU-11
ACCURACY OF URICULT® VET PADDLES FOR THE DIAGNOSIS AND IDENTIFICATION OF BACTERIAL CYSTITIS IN DOGS AND CATS. WL Ybarra, JE Sykes, YW Zingale, BA Byrne, PH Kass, JL Westropp. UC Davis School of Veterinary Medicine, Davis, CA

Quantitative urine culture is the gold standard for diagnosis of bacterial urinary tract infections, but this can be costly. The purpose of this study was to evaluate the accuracy of the Uricult® Vet system, an in-practice urine culture kit marketed for companion animal use.

In this prospective blinded study, urine specimens submitted to the UCD-VMTH microbiology laboratory for urinalysis and aerobiotic bacterial culture were selected by a veterinary technician for parallel analysis using the Uricult® Vet system. Paddles were inoculated by two investigators and incubated according to manufacturer’s instructions. Each investigator’s results were compared with each other and to those of the laboratory using McNemar’s test.

A total of 207 urine specimens were analyzed, 64 of which yielded growth in the laboratory. The two investigators’ results agreed for 190/207 (91.8%) paddle results. The mean sensitivity and specificity for identification of bacterial growth, regardless of the pathogen identified, was 92.4% and 98.9%, respectively. Investigator 1 correctly identified 52/64 (81.3%) and investigator 2 46/64 (71.9%) uropathogens. The mean sensitivity and specificity for identification of Escherichia coli was 88.7% and 98.0%; for Enterococcus spp. was 60.5% and 98.9%; and for Staphylococcus spp. was 61.6% and 99.0%, respectively.

The Uricult® Vet paddles appear to be a useful screening tool for identification of bacterial growth. However, inaccuracies occurred when paddles were used for organism identification, particularly when multiple uropathogens were present. When growth occurs, paddles or urine should be submitted to a commercial microbiology laboratory for identification and antimicrobial susceptibility testing.

ABSTRACT NU-12
ASYMPTOMATIC BACTERIURIA ESCHERICHIA COLI STRAIN 83972 IN COMPETITION WITH EMERGING, HIGHLY VIRULENT MULTI-DRUG RESISTANT ESCHERICHIA COLI STRAINS IN CANINE URINE. MF Thompson1, JS Gibson1, PC Mills2, MA Schembri3, JL Platell2, DJ Trott1. 1The University of Queensland, Gatton, QLD, 2The University of Queensland, St Lucia, QLD, 3The University of Adelaide, Roseworthy, SA

Deliberate colonization of susceptible dogs with the human asymptomatic bacteriuria Escherichia coli strain 83972 may repre-
sent a viable alternative for management of recurrent urinary tract infection (UTI). The strain outcompetes human uropathogenic \textit{E. coli} (UPEC) in human urine in vitro, likely underpinning its success in prevention of recurrent UTI. We examined the growth of \textit{E. coli} 83972 in competition with isolates representing three successful emerging multi-drug resistant (MDR) \textit{E. coli} clonal groups in canine urine. Mixed cultures were grown in pooled canine urine inoculated 1:1 with freshly grown pre-cultures of \textit{E. coli} 83972 and one of three previously published successful MDR UPEC isolates cultured from canine UTIs (QUC07 [O75:ST1193]; QUC13 [ST313]; QUC18 [O15:K52:H1]). The cultures were grown aerobically at 37 °C for 17 hours and viable counts were obtained. All experiments were performed in duplicate. In two competition experiments (QUC07 vs. 83972 and QUC13 vs. 83972), there was no significant difference in mean viable counts at 17 hours. In the remaining competition experiment (QUC18 vs. 83972), \textit{E. coli} 83972 was present in significantly lower numbers than the MDR \textit{E. coli} strain after 17 hours ($P < 0.05$).

Given that the starting ratio in dogs following prophylactic bladder colonisation would favour \textit{E. coli} 83972, it is feasible that it will outcompete MDR UPEC strains. Investigation of variables such as alternative bacterial concentrations, resistance, coeliac production and virulence characteristics will enhance our understanding of the mechanisms by which \textit{E. coli} 83972 grows in urine and its suitability for use in prophylactic treatment.

**ABSTRACT NU-13**

GLOMERULAR FILTRATION RATE ESTIMATION ON THE BASIS OF PLASMA CLEARANCE OF INULIN IN DOGS. M Nishida, M Uechi. Nihon University, Kanagawa, Japan

Accurate timed urine collections for the measurement of glomerular filtration rate (GFR) may be impractical in animals. The purpose of this study was to compare plasma clearance of inulin (P-CL) without urine collection with urinary clearance of inulin (U-Cin). The study included 23 healthy beagle dogs and 5 experimental dogs with renal failure. GFR was estimated on the basis of P-CL of inulin by using the trapezoidal method (P-CLTR) and 1-compartment method (P-CLC1c) and on the basis of U-Cin. U-Cin was calculated following formula: U-Cin (ml-min-1) = infusion rate of inulin (mg·min-1) /serum inulin concentration (mg·ml-1). P-CL was calculated from the serum inulin concentration versus time data by using the basic formula: P-CL (ml·min-1) = dose of inulin (mg) /area under the curve (mg·ml-1·min-1). P-CLTR was calculated for 9 blood samples, and P-CLC1c was calculated for 2 blood samples in each dog. Regression analysis was performed to establish correction formulas for predicting the U-Cin from the P-CLC1c values. The U-Cin could be predicted from the P-CLC1c values for 2 samples and 3 hours after inulin injection (P-CLC1c 2.3) by using the formula U-Cin = -0.023 (P-CLC1c 2.3)2 + 0.73 (P-CLC1c 2.3) + 0.023 (R2 = 0.95).

In conclusion, GFR was estimated on the basis of plasma inulin clearance with 2 blood samples at 2 and 3 hours after inulin injection.

**ABSTRACT NU-14**

ESTIMATION OF GLOMERULAR FILTRATION RATE ON THE BASIS OF INULIN INFUSION CLEARANCE IN DOGS WITH AND WITHOUT RENAL FAILURE. M Nishida, M Uechi. Nihon University, Kanagawa, Japan

The gold standard method for measuring glomerular filtration rate (GFR) uses urinary inulin clearance (U-Cin). However, this method is not generally used because determining the exact urine volume in dogs is difficult. The aim of this study was to evaluate an inulin infusion-clearance (INF-Cin) method that does not require urine sampling for pharmacokinetic measurement of GFR during continuous inulin infusion in dogs. The study included 64 dogs with suspected renal dysfunction. GFR was simultaneously measured using U-Cin, urinary endogenous creatinine clearance (U-Ccr), and the INF-Cin method. U-Cin and U-Ccr was calculated by formula: U-Cin or U-Ccr (mL·min-1) = urinary output of inulin or creatinine (mg·min-1) /serum inulin or creatinine concentration (mg·min-1). INF-Cin was calculated by formula: INF-Cin (mL·min-1) = infusion rate of inulin (mg·min-1) /serum inulin concentration (mg·min-1). The mean (standard deviation) U-Cin, U-Ccr, and INF-Cin values were 2.6 (1.3), 2.8 (1.4), and 3.0 (1.1) mL·min-1·kg-1, respectively. A significant correlation was observed between U-Cin and INF-Cin ($R^2 = 0.91$, $P < 0.001$) and between U-Cin and U-Ccr ($R^2 = 0.82$, $P < 0.001$). However, the INF-Cin method overestimated the U-Cin in dogs with renal failure. In conclusion, these results indicate that the INF-Cin method can be used to measure GFR without urine collection in healthy dogs, whereas it may overestimate the GFR in dogs with renal failure.

**ABSTRACT NU-15**

CLINICAL UTILITY OF PLASMA INULIN CLEARANCE AS A MEASURE OF GLOMERULAR FILTRATION RATE IN DOGS. CP Sturgess1, MD Dunning2. Vet Freedom Ltd, Hampshire, UK. 1University of Nottingham, School of Veterinary Medicine and Science, Nottingham, UK

Glomerular filtration rate (GFR) is acknowledged to give a significantly more accurate assessment of renal function than standard biochemistry and urinalysis. Inulin clearance is well established as a ‘gold standard’ measure of GFR in humans. Further, inulin is commercially available, stable in plasma, requires a small sample volume, is inexpensive to assay and a canine reference range has been established. A retrospective study of the clinical utility of using plasma clearance of inulin to measure GFR in dogs was performed investigating ease of use, quality of the clearance curve produced, potential side effects and clinical benefit.

Inulin clearance was performed on 45 dogs with 4 dogs having more than one test performed over time. A standard method was used giving 3000mg inulin/m2 body surface area (Inutest 25% solution Fresenius Kabi) as an intravenous bolus via a catheter. Six timed blood samples were obtained over a 6 hour period (approximately 5-10, 20, 40, 100, 180 and 360 minutes). The exact time that the blood sample was acquired was recorded and used for data analysis. High pressure liquid chromatography was used to measure the inulin concentration in each sample by the same external laboratory (Alomed). GFR was calculated using commercial software (Inusoft - Laevosan).

Timed blood samples were collected in all dogs (weight range 4-55kg, 17 breeds, 10-156 months of age). No side effects were observed following inulin injection, during the test period or over subsequent hospitalisation. The results obtained produced a good curve-fit in the majority of cases. Occasional aberrant results occurred that were unexplained and were discarded by the software. Calculated inulin clearances were from 12 to 140ml/min/m2 [ref: 85-144].

The use of inulin to measure GFR was straightforward, reproducible and without observed side effects. It was felt to be of value to diagnose or rule-out early renal disease (IRIS stage I and II) in non-azotemic dogs with polyuria/polydipsia, to assess the extent of long-term renal damage following acute renal failure in patient’s whose urea and creatinine had normalized and to monitor progression of cases to help decide whether further intervention e.g. biopsy was appropriate. The value in dogs with established IRIS stage III-IV renal disease was unclear.

**ABSTRACT NU-16**

AST-120 ATTENUATES SERUM LEVELS OF THE UREMIC TOXIN, INDOXYL SULFATE, IN CATS WITH DECREASED RENAL MASS. BH Schmidt1, R Kebber2, M Murphy2, T van derStaay1. 1 Bayer Animal Health GmbH, Leverkusen, Germany, 2 Bayer CropScience AG, Monheim, Germany, 3 Charles River Laboratories Preclinical Services Ireland Ltd., Ballina, Ireland, 4 University of Utrecht, The Netherlands

Previous work has shown that there is an accumulation of the putative uremic toxin, 3-Indoxyl sulfate (IS), in serum of cats
with chronic kidney disease (CKD) similar to the situation in human CKD patients. Since IS is derived from bacterial tryptophan metabolism to indole in the intestines, the present study was undertaken to assess whether the potent activated carbon-based adsorbent, AST-120 (also known as Kremezin™ drug substance or CovazinTM, Kureha Corp., Tokyo, Japan) is able to reduce the systemic burden of IS in cats with reduced renal mass.

Two experiments were performed using the same colony of laboratory cats that had undergone a unilateral nephrectomy and ligation of branches of the renal artery supplying the remaining kidney. Both were approved by the local ethical committee. At the start of the first study, 12 cats were switched to a suitable moist diet in order to allow for mixing the test item into the feed. The animals were sequentially treated with 0 (control phase), 50, 100, and 200 mg AST-120 per kg body weight daily. Each dose was administered for a period of 14 days. This treatment series was completed with a 2-week wash-out period. The second study involved 11 of the cats which participated in the first experiment and consisted of three successive periods of 4 weeks each: no treatment, AST-120 100 mg/kg daily, and a final wash-out. In both experiments, serum samples were taken at study start and at the end of each dosing phase. The primary efficacy variable was serum IS. Secondary variables comprised serum levels of creatinine, urea, and inorganic phosphate. The cats remained on the same diet from the start of the first experiment to the end of the second one. The results were statistically analyzed by repeated measures ANOVA, followed by t-test. The level of statistical significance was $p<0.05$.

Serum IS levels were significantly lower than baseline following administration of 100 and 200 mg AST-120 per kg body weight, but there was no difference between administration of these two doses. No difference from baseline could be observed for the dose of 50 mg/kg. All parameters except serum urea, which was reduced compared to baseline, were unaffected at 100 mg/kg. The second study confirmed the attenuation of serum IS levels by the dose of 100 mg/kg, while the reduction in serum urea levels was not confirmed. In both studies, the AST-120 induced changes were not abolished and persisted beyond the wash-out period. AST-120 was well tolerated by the study animals at all doses tested.

The results indicate that the dose of 100 mg AST per kg body weight is necessary and sufficient to mediate a significant and clinically relevant reduction in serum IS levels. Further studies are required to investigate the reason for the persistence of the beneficial effects upon discontinuation of treatment.

### ABSTRACT NU-17

**EVALUATION OF 3 STRUVITE-OXALATE PREVENTATIVE DIETS IN HEALTHY CATS**, T Gluhek, JW Bartges, A Callens, G Galyon, S Cox, CA Kirk. College of Veterinary Medicine, The University of Tennessee, Knoxville, TN

There are 3 feline “oxalate-struvite” preventative diets available. We hypothesized that (a) these 3 diets would induce lower urinary saturation estimated by relative supersaturation for struvite (RSS\(_{\text{struvite}}\)) and calcium oxalate (RSS\(_{\text{caox}}\)) than an adult maintenance diet.

Six healthy short-hair cats, 2 FS aged 3 yr, 2 FS aged 6 yr, and 2 MC aged 3 yr, were randomly assigned to consume 1 of 3 dry struvite-oxalate preventative diets (CD = Prescription Diet c/d MultiCare, SO = Royal Canin s/o, and UR = Purina UR St/Ox) or a maintenance adult food (M = Science Diet Maintenance) in a Latin-square design. Diets fed for 3 weeks and a 24-hour urine sample was collected. All cats consumed all 4 diets. Data were analyzed using ANOVA with significance of $p < 0.05$.

Differences were not found for body weight; 24-hour excretions of magnesium, oxalate, citrate, or creatinine; or RSS\(_{\text{struvite}}\) and RSS\(_{\text{caox}}\) between diets. Differences between diet groups were found for 24-hour urinary excretion of sodium, potassium, calcium, ammonia, phosphorous, chloride, and 24-hour urine volume.

Despite differences, estimated RSS were not different between CD, SO, UR, and M, although RSS\(_{\text{caox}}\) tended to be highest on M and lowest on UR. Twenty-four-hour urinary excretion of sodium and chloride and urine volume was greatest with SO and UR because these diets contain greater amount of sodium chloride than CD and M; 24-hour urinary excretion of calcium was lowest with CD. The 3 oxalate-struvite preventative diets tend to induce a lesser degree of urine saturation for calcium oxalate than the maintenance diet by differing dietary modifications.

### ABSTRACT NU-18

**EVALUATION OF CULTURE TECHNIQUES AND BACTERIAL CULTURES FROM CANINE AND FELINE UROLITHS**, L Perry, PH Kass, DL Johnson, R Shiraki, AL Ruby, JL Westropp. University of California Davis School of Veterinary Medicine, Davis, CA

Canine struvite uroliths can form due to an infection, while others can act as a nidus. Published techniques for culturing uroliths are variable; washing the uroliths four times and culturing the core has been reported. The objectives of this study was two-fold: 1) prospectively evaluate urolith culture protocols and 2) report bacterial isolates from uroliths and their association with signalment, stone type, and previous antimicrobial use.

For part 1, 50 urolith pairs were cultured by washing each stone either 1 or 4 times and then culturing the core. For part 2, a retrospective search of isolates collected from uroliths submitted to our laboratory was recorded; the signalment, stone type, and previous antimicrobial use were reviewed. McNemar’s Tests were performed on the prospective data. A multiple logistic regression were used to analyze the retrospective data.

Regarding stone culture techniques, no differences in bacterial isolates from the urolith core were found. Washing the stone four times does not appear warranted. In part 2, we evaluated culture results from 520 canine and 168 feline uroliths. We found struvite-containing uroliths had an increased risk for positive culture...
ABSTRACT NU-19
THE USE OF DARBEPOETIN ALFA IN CATS WITH CHRONIC KIDNEY DISEASE. JE Markovich, MA Labato, EH Fiocchi, EA Rozanski. Tufts University Cummings School of Veterinary Medicine, North Grafton, MA

End stage chronic kidney disease (CKD) is often associated with the development of non-regenerative anemia due to decreased production of endogenous erythropoietin. Therapy with recombinant human erythropoietin is effective at raising the hematocrit, but is associated with the development of pure red cell aplasia (PRCA). Darbepoetin alfa is a newer synthetic human recombinant erythropoietin analog and has been suggested as less likely to cause the development of antibody-associated PRCA.

The purpose of this study was to describe the use of darbepoetin in cats with CKD in a prospective observational study. Cats with CKD IRIS stage II-IV, with a non-regenerative anemia of 23% were enrolled in the study. Darbepoetin at a dose of 1 mcg/kg/week was administered intravenously or subcutaneously until the patient PCV = 30%. Blood pressure, PCV/TS, and creatinine were monitored throughout the study. Descriptive statistics were used.

Seven cats were enrolled. The length of time to achieve a PCV 30% was a median of 47 days (range 7-52 days). No cats developed cell- anemia during therapy or other evidence of PRCA. Survival times from the initiation of darbepoetin therapy to death ranged from 42-296 days (mean 133 days; median 78 days). All cats were IRIS Stage III or IV throughout the study. At achievement of the target PCV of 30%, there was no significant increase in blood pressure in any cat from the start of the study, and in one cat the blood pressure normalized.

In this pilot study, 1 mcg/kg/week was effective in raising the hematocrit of cats with CKD without evidence of pure red cell aplasia. Further investigation of darbepoetin in cats is warranted.

ABSTRACT NU-20
INTRAVESICAL GLYCOSAMINOGLYCANS AS A NOVEL THERAPY FOR FELINE IDIOPATHIC CYSTITIS – A PILOT STUDY. A Bradley, MR Lappin. Department of Clinical Sciences, Colorado State University, Fort Collins, CO

Feline idiopathic cystitis (FIC) is a common, frustrating condition with few proven therapeutic options. Its recurrence rate is approximately 50% and FIC can result in urethral obstruction. One of the proposed causes of FIC is a defective glycosaminoglycan (GAG) layer lining the urinary bladder mucosa. Exogenous GAGs adhere to damaged bladder uroepithelium, and promising data exist for their use in human interstitial cystitis. The objectives of this prospective study were to evaluate the safety of intravesical GAGs while gathering pilot data for a larger study.

At the time of abstract submission, 13 cats presenting for urethral obstruction were enrolled. Previously treated cats, as well as cats with severe azotemia or hyperkalemia, urolithiasis, and/or uroabdomen were excluded. Cats were treated as similarly as possible (sedation or anesthesia for urinary catheter placement, fluid therapy, buprenorphine, phenoxycobenzamine, canned urinary diet) and randomized to receive either intravesical GAGs (hyaluronic acid, chondroitin sulfate, glucosamine; A-CYST, Arthrodynamics Laboratories, Lexington, KY) or intravesical saline placebo at the time of catheter placement and again 12 and 24 hours later. Outcomes included urinalysis at day 0, 3, and 7, urine culture at day 0 and 7, standardized pain scoring, and incidence of repeat urethral obstruction.

There was no significant difference in presenting potassium or creatinine levels or in pain score between the treatment group (n = 6) and the placebo group (n = 7). The mean urine specific gravity of the treatment group was 1.030 versus 1.043 for the placebo group (p = 0.05), and the mean protein content of the treatment group was 2.8 versus 1.6 for the placebo group (p = 0.03). Three of the cats that received the placebo developed repeated urethral obstruction within one week of initial presentation with 2 of 3 cats re-enrolled in the treatment group. When these results were combined, 3 of 7 cats (42.9%) in the placebo group and 0 of 8 cats in the treatment group developed a repeat obstruction (p = 0.08). No adverse reactions to intravesical GAGs were observed.

This GAG was previously shown to be safe administered IM and appears to be safe for instillation into the urinary bladders of cats with urethral obstruction. A lower percentage of treated cats developed a repeat urethral obstruction compared to the saline placebo, however, results were not significantly different, and so larger studies are indicated to further evaluate the efficacy of this novel therapeutic option for FIC.

SMALL ANIMAL – NEUROLOGY

ABSTRACT N-1
CEREBELLAR ABIOTROPHY IN FOUR RELATED POMERANIANS. C Levine1, J Evans1, RC Longshore2, SB Plummer3, GC Johnson3. 1Veterinary Neurological Center, Phoenix, AZ, 2Gulf Coast Veterinary Specialists, Department of Neurology/Neurosurgery, Houston, TX, 3University of Missouri, Veterinary Medical Diagnostic Laboratory, Columbia, MO

Cerebellar abiotrophy is the result of premature death or degeneration of related groups of neurons, usually Purkinje cells, in the cerebellar cortex, due to an inborn metabolic error resulting in their unexpected degeneration. This disease has been described in a number of the domesticated species, primarily the dog, but also in the cat, cattle, sheep, and horses. The disease can manifest as neonatal, juvenile, or adult onset forms and an autosomal recessive pattern of inheritance has been described in several species. The symptoms of the disease are characteristic of cerebellar dysfunction, such as ataxia, dysmetria, falling, intention or generalized tremors, and occasionally apparent blindness, though not all clinical signs may be manifested. Four purebred young adult Pomeranians with a history of slowly progressive signs of cerebellar ataxia such as hypermetria, falling over backwards, and visual deficits were examined. Diagnostic tests were unremarkable and empirical treatment did not alter the progression of signs. Necropsy was performed on 3 of the dogs and identified extensive loss of Purkinje neurons consistent with a cerebellar abiotrophy. Analysis of the pedigrees showed that these dogs were directly related and an autosomal recessive mode of inheritance was likely. Cerebellar abiotrophy has been best characterized in the dog, but has not been previously reported in the Pomeranian.

ABSTRACT N-2
DOES CEREBROSPINAL FLUID CYTOLOGY PREDICT CENTRAL NERVOUS SYSTEM HISTOLOGY? U Jeffery, N Jeffery. Iowa State University, Ames, IA

CSF analysis of cell count, cytology and total protein has been shown to provide diagnostically useful, but non-specific, information. However, CSF samples are often low volume, so tests must be prioritized. This study determined how frequently CSF cytology alone was able to predict: 1) the precise histologic diagnosis,
CEREBROSPINAL FLUID CLUSTERIN IS A POTENTIAL BIOMARKER OF CANINE NEURODEGENERATIVE DISORDERS, INF Shafie 1, M McLaughlin 1, P Montague 2, PEJ Jackson 3, J Penderis 2, TJ Anderson 1, School of Veterinary Medicine, 1Institute of Infection, Immunity and Inflammation, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, UK

The diagnosis of canine neurodegenerative disorders relies on a combination of clinical evaluation, imaging modalities and, if available, genetic assessment and often requires neuropathological examination for confirmation. Despite the continual improvement in the range of diagnostic tests, confirmation of specific diagnosis for canine neurodegenerative disorders such as degenerative myelopathy (DM) can be elusive in the clinic, complicating decision-making and therapeutic management. The purpose of this study was to explore the potential of canine cerebrospinal fluid (CSF) as a source of biomarkers for supporting clinical diagnosis of DM.

Clinical material for this study was derived from cases undergoing routine neurological investigation at the University of Glasgow Small Animal Hospital, with ethical approval. All cases were diagnosed using routine techniques including haematology, biochemistry, CSF analysis and advanced imaging. Additionally, all cases were genotyped as to the presence of the SOD1 mutation that is associated with DM; using an in house protocol. CSF protein profiling by gel electrophoresis demonstrated an abundant protein in DM that was subsequently identified by mass spectrometry as clusterin (also known as apolipoprotein J). Initial semi-quantitative Western blot analysis of canine CSF confirmed that clusterin was significantly elevated in DM (n=5) compared to IE (n=7) (p<0.01). A further comparison across a range of neurological conditions found that clusterin was elevated in DM (n=4) and chronic intervertebral disk disease (cIVDD) (n=4) compared to IE (n=7) (DM vs. IE, p<0.001; cIVDD vs. IE, p<0.05) and meningitis (n=8) (DM vs. meningitis, p<0.01; cIVDD vs. meningitis, p=0.05). There was no significant difference in CSF clusterin between DM and cIVDD. An investigation of plasma clusterin level in DM (n=5) and IE (n=7) found no significant difference in the protein level, although a proportion of DM cases (3/5) demonstrated a gel shift which may indicate a post translational modification.

Clusterin mRNA level in the thoracic spinal cord of DM and control cases (dogs unaffected by neurological diseases) was compared by RT-PCR. For this comparison tissue was derived from archival post mortem material and SOD1 genotyping was undertaken to support the histopathological diagnosis. CSF samples were not available for these cases. The mean mRNA level was elevated by 42% in DM (n=4) compared to control cases (n=4), a difference bordering on statistical significance (p=0.05).

These observations suggest CSF clusterin may be considered as a potential biomarker for canine neurodegenerative conditions, potentially those associated with neuronal dysfunction and death. Clusterin may therefore represent one component in a panel of emerging biomarkers that may combine to distinguish specific neurodegenerative disorders such as DM in the clinic.
Two female Yorkshire terrier dogs were evaluated because of generalized tonic-clonic seizures. The dogs underwent a magnetic resonance imaging study of the brain. T1-weighted, T2-weighted and fluid-attenuation inversion recovery sequences were obtained in different planes. These images revealed bilaterally symmetrical, diffuse regions of grey matter hyperintensity on T2-weighted and FLAIR images, which were most prominent in the parietal cerebral cortex, thalamus, mesencephalon and cerebellum. Postcontrast T1-weighted sequences showed no contrast enhancement. Based on the imaging findings, differential diagnoses included metabolic or toxic encephalopathies.

To investigate the possibility of an intrinsic metabolic disorder, urinary organic acid and amino acid profiles were quantified by gas chromatography-mass spectrometry and were consistent with diagnosis of L2-HGA.

In both affected dogs a homozgyous pathogenic mutation at the translation initiation codon of the L2HGDH gene was detected (c.1A>G; p.Met1?) confirming the diagnosis L-2-HGA at the DNA level. To our knowledge these are the first two cases described of L-2-HGA in Yorkshire terriers, with a different mutation to the Staffordshire bull terriers.

**ABSTRACT N-6**

**DIAGNOSTIC VALUE AND DISCRIMINATORY ABILITY OF PROTON MAGNETIC RESONANCE SPECTROSCOPY FOR INTRACRANIAL NEOPLASIA IN DOGS. KR Mikoloski, PA March, D Faissler. Cummings School of Veterinary Medicine at Tufts University, North Grafton, MA**

Metabolic profiles have been developed using proton magnetic resonance spectroscopy (1H-MRS) in humans to aid in distinguishing types of intracranial neoplasia. The goal of our study was to determine whether 1H-MRS was useful in differentiating these types of intracranial neoplasia in dogs.

Ten dogs with intracranial neoplasia and 2 normal dogs underwent single voxel 1H-MRS in addition to a standard MRI. Metabolites were greater in dogs with meningiomas than in dogs with metastatic disease. The more prominent and consistent (Glx/MM), making precise measurement difficult. Lacine (mIG), and Cho were measured on short TE spectra. At active peaks. Creatine (Cr), Choline (Cho), and N-acetyl aspartate (NAA) were measured on long TE spectra. Cr, myo-inositolglycine (mILG), and Cho were measured on short TE spectra. At short TE, the NAA peak was partially obscured in many cases by a broad overlapping glutamine/glutamate/macromolecule complex (Glx/MM), making precise measurement difficult. Lactate (Lac), lipids, and alanine (Ala) were also subjectively evaluated.

A histopathologic diagnosis with either necropsy or surgical biopsy was obtained in seven dogs (3 meningiomas, 2 gliomas, 2 metastatic tumors). Presumptive diagnoses were made in the remaining three dogs based on MRI and clinical findings (probable meningioma in 1 dog and probable glioma in 2 dogs). mILG resonance on short TE spectra was over 4 times greater in gliomas than meningiomas (1.98 versus 0.45) as compared to 0.86 in normal dogs. The Glx/MM/NAA complex on short TE spectra was subjectively more prominent in meningiomas than in gliomas. Ala was noted in one dog with a meningioma on short TE spectra. On long TE spectra, both Cr and NAA were reduced in all tumor groups compared to normal dogs. The mean Cr resonance at long TE was lower in meningiomas compared to gliomas (0.98 versus 1.21). Cho concentrations on long TE spectra were greater in dogs with intracranial neoplasia compared to normal dogs (3.84 versus 2.83). Lac and lipid peaks were subjectively higher in dogs with metastatic neoplasia than in dogs with primary neoplasia.

Based on the results of this study, meningiomas and gliomas appear to have some important differences on 1H-MRS that may help differentiate these tumors. The more prominent and consistent differences were seen in mILG and Glx/MM metabolites on short TE spectra. mILG was greater in dogs with gliomas than in normal dogs and in dogs with meningiomas. The Glx/MM metabolites were greater in dogs with meningiomas than in dogs with gliomas. 1H-MRS spectra may be a valuable method to non-invasively differentiate meningiomas from gliomas. More cases will be needed to determine if these differences in their metabolite profiles are statistically significant.

**ABSTRACT N-7**

**MAGNETIC RESONANCE IMAGING FEATURES OF INTRACRANIAL GRANULAR CELL TUMORS IN SEVEN DOGS. CC Anwer1, KM Vernau1, RJ Higgins1, PJ Dickinson1, BK Sturges1, RA LeCouteur1, RT Bentley2, ER Wisner3. University of California Davis, Davis, CA, 1Purdue University, West Lafayette, IN**

Intracranial granular cell tumors (GCTs) are rarely reported in dogs. Histopathological descriptions exist, however magnetic resonance (MR) imaging features have been described in only two dogs. The goal of this retrospective study is to describe the MR characteristics of intracranial GCTs in a larger number of dogs.

Seven dogs with histologically confirmed intracranial GCTs and complete MR imaging were studied. MR images were evaluated for tumor location, size, gadolinium enhancement, signal intensity, contrast enhancement, and peritumoral edema. In MR images of 6/7 patients, GCTs were well-defined and extra-axial, with a plaque-form, sessile distribution involving the meninges. These six tumors were located along the convexity of the cerebrum, the falk cerebri, or the ventral floor of the cranial vault and were mildly hyperintense on T1-weighted images, and iso- to hyperintense on T2-weighted images. A moderate to marked degree of peritumoral edema and mass effect was evident in all six patients. Interestingly, 1/7 dogs had a small suprasellar GCT that was isointense on T1- and T2-weighted images, and did not have a plaque-form shape, peritumoral edema, or mass effect.

In summary, hyperintensity on T1-weighted MR images, plaque-form distribution, and marked peritumoral edema and mass effect were consistent findings. However these findings are not unique to GCTs. In addition, MR imaging features of the solitary suprasellar GCT differed from the other GCTs in the study.

**ABSTRACT N-8**

**SIGNALMENT, CLINICAL FINDINGS, MAGNETIC RESONANCE IMAGING FEATURES AND SURGICAL OUTCOMES WITH HISTOPATHOLOGICALLY CONFIRMED EPIDURAL AND SUBDURAL SPINAL CORD HEMATOMA IN DOGS. DW Hague1, WW Bush1, EN Glass1, AC Durham2. 1Bach Veterinary Neurology Service, Leesburg, VA, 2Red Bank Veterinary Hospital, Tinton Falls, NJ, 3University of Pennsylvania School of Veterinary Medicine Department of Pathobiology, Philadelphia, PA**

Epidural spinal cord hematoma has been described in veterinary medicine in association with neoplasia, intervertebral disc disease, and snake envenomation. In human medicine there are rare reports of spontaneous epidural or subdural spinal cord hematoma where there was no known cause. Spontaneous spinal cord hematoma has not been described in veterinary medicine. The purpose of this study is to describe the signalment, clinical findings, magnetic resonance imaging features and surgical outcomes in histopathologically confirmed epidural and subdural spinal cord hematomas in dogs with no identified underlying etiology.

Five dogs were included with a histopathologic diagnosis of epidural or subdural spinal cord hematoma not associated with an underlying cause. Magnetic resonance imaging and surgical outcomes were evaluated. Large breed dogs (>25 kg) accounted for 4/5 of the cases. There were 3 spayed females and 2 neutered males. The mean age was 5.4 years. On presentation, most dogs (4/5) were ambulatory with paresis and ataxia and only one patient was non-ambulatory and parietic. In most dogs (4/5), local spinal pain was elicited on examination. All patients had an acute onset and then progression of clinical signs. There was a range of 1-13 days between the onset of clinical signs to magnetic
resonance imaging. Hematoma was located at the vertebral column level C2, C4-5, C5, T13-L1 and L5.

Magnetic resonance imaging and surgery showed 3 patients had epidural and 2 patients had subdural hematoma formation. All the dogs had normal signal within the spinal cord and variable spinal cord compression ranging from 20-50%. All hematomas had mild to moderate T2W hyperintensity and mild to strong contrast enhancement. They appeared isointense in 3 cases and mildly hyperintense in 2 cases on the T1W pre-contrast sequences. Prior to surgery and histopathology the primary differential in most cases was neoplasia.

The underlying etiology of the hematomas was not identified in all cases. All dogs had adequate platelet numbers. A coagulation panel performed on one dog was normal. Two dogs had intracerebral cultures which were negative.

All dogs underwent surgical decompression with dorsal or hemilaminectomy and all patients returned to normal or near normal neurologic function following surgery. Follow-up on the patients (ranging between 14-188 days) shows no progression of neurologic symptoms or conditions associated with increased bleeding. The prognosis with spontaneous spinal cord epidural and subdural hematoma with surgical decompression appears to be favorable.

ABSTRACT N-9
MRI ASSESSMENT OF DOGS WITH DESCENDING TRANS-TENTORIAL AND/OR FORAMEN MAGNUM BRAIN HERNIATIONS.

Marc R. Barker, J. Robert Faissler, David T. Faissler, Christian F. Teymouri, and W. Oechtering1, M Scholz 2, Department of Small Animal Medicine, Leipzig, Germany; 1School of Veterinary Medicine at Tufts University, North Grafton, MA

The aim of this study was to develop a scoring system of MRI images assessing backwards movement of the brain in the caudal fossa caused by supratentorial space occupying lesions. A semi-quantitative approach determining CSF filling in eight regions, and a quantitative measurement of four different parameters were designed. MRI images were examined for lesion location and laterazation. Total brain and lesion volume, surrounding edema, and relative volume of the mass were calculated. Clinical signs were grouped into seizure, abnormal cranial nerve function, cranial nerve dysfunction combined with abnormal gait and endocrine disease. Pairwise data analysis was performed comparing affected with unaffected dogs using the SPSS 19 software package.

81 affected and 81 control dogs were analyzed. Sex and breed distribution were similar in both groups. All semi-quantitative and the quantitative parameters of tentorial angle, foramen magnum line and brainstem ratio showed a significant difference between study and control dogs. Tentorial angle, cerebellar height, length, their ratio, spinal cord height and brainstem to spinal cord ratio were significantly correlated to the degree of CSF filling. Lesions in the frontal or olfactory lobes caused significantly less herniation when compared to masses in other brain areas. Total and relative lesion volumes were significantly correlated to all semi-quantitative measurements, tentorial angle and cerebellum length.

In conclusion, our semi-quantitative measurements and tentorial angle best determinate the magnitude of brain herniation. The ratio of lesion and edema volume to brain volume can predict degree of herniation best when used in conjunction with lesion location.

ABSTRACT N-10
KINETIC GAIT ANALYSIS USING 3-D MOTION CAPTURE IN DOBERMAN PINCHERS WITH AND WITHOUT CERVICAL SPONDYLOMELOPATHY.

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The most widely used method for determining the response to treatment in patients with cervical spondylomyelopathy (CSM) is based off of the owner and clinician’s perception of the gait. This form of evaluation is highly subjective and can suffer from observer bias. The purpose of this study was to utilize digital video motion capture to compare multiple kinematic parameters between Doberman Pincher dogs with and without CSM.

Nineteen Doberman Pinchers were prospectively studied: 10 clinically normal dogs and 9 with CSM. Neurologic examinations were performed in all dogs prior to enrollment. Clinically normal dogs also underwent transcranial magnetic stimulation to further exclude any underlying neurologic abnormalities. All CSM-affected dogs had their diagnosis confirmed with a 3.0 T MRI. All dogs were fitted with a lycra bodysuit and 32 reflective markers representing specific anatomic landmarks from all four limbs, head and trunk were applied. 3-D motion capture was performed with 15 infrared cameras in a designated capture space using the Vicon® motion capture system.

Using Vicon IQ 2.0 software (Vicon, CA), the markers were used to reconstruct a 3-D stick diagram representation of each dog. This representation was then used to measure multiple parameters of interest. Parameters evaluated included stride duration, stride length, stride height, maximal and minimal spinal angles, elbow and stifle flexion and extension, and maximum and minimum distances between the thoracic and pelvic limbs. At least 45 seconds of high quality data capture were used for statistical analyses. The means of all parameters were compared between normal and CSM-affected Dobermans using a random effects linear regression model.

Due to space constraints only portion of results will be presented and discussed. Minimum thoracic limb distance was significantly smaller (P=0.024) in CSM-affected dogs (mean=116 mm) versus normal dogs (mean=146 mm), as was maximum thoracic limb distance (P=0.001) with a mean of 184 mm in CSM-affected dogs and 222 mm in normal dogs. Additionally, stride duration in the thoracic limbs was also significantly smaller (left thoracic: P=0.013; right thoracic P=0.016) in CSM-affected dogs (mean=0.7 sec) when compared to normal dogs (mean=0.8 sec).

In conclusion, the thoracic limb distances and thoracic limb stride duration were found to be significantly smaller in CSM-affected Doberman Pinchers when compared to normal Dobermans. Interestingly, these findings suggest that when using combined kinematic gait analysis to compare the gait between normal and CSM-affected Dobermans, the thoracic limbs appear to reveal more consistent differences than the pelvic limbs.

ABSTRACT N-11
THE VACUUM PHENOMENON IN INTERVERTEBRAL DISC DISEASE OF DOGS BASED ON COMPUTED TOMOGRAPHY IMAGES.

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The term “vacuum phenomenon” is used to describe accumulation of gas within tissues such as degenerated intervertebral discs. Thus this phenomenon is sometimes used to localise a herniated disc. The purpose of this study therefore was 1. to determine the frequency of the vacuum phenomenon in dogs surgically treated for intervertebral disc diseases, 2. to evaluate factors influencing the frequency of the vacuum phenomenon and 3. to determine the value of the vacuum phenomenon for localizing disc herniation.

Computed tomography scans of dogs with confirmed intervertebral disc herniation were examined for a vacuum phenomenon. Patients were included if the computed tomography images or necropsy report. Inclusion criteria were met by 187 dogs. Dogs were divided for statistical analysis into the following subgroups: chondrodystrophic dogs (61%), non chondrodystrophic dogs (15%) and such of unclear classification (24%).

The median number of scanned discs was 14 (range 4-26). Vacuum phenomenon was found in 19.8% of dogs. The prevalence in subgroups was 14.9% in chondrodystrophic dogs, 34.5%
in non chondrodystrophic dogs, and 24.4% in dogs of unknown classification respectively. The frequency of vacuum phenomena was significantly higher in chondrodystrophic than in non chondrodystrophic dogs (P = 0.03). Age has a significant influence on the appearance of the vacuum phenomenon. With every additional year of age the relative risk to show a vacuum phenomenon increases by 15% (P = 0.04).

The vacuum phenomenon appeared in the currently herniated intervertebral disc in 64.1%. The frequencies in the subgroups of chondrodystrophic, non chondrodystrophic dogs and such of unknown classification were 67%, 40%, and 82% respectively. The correspondence between vacuum phenomenon and herniated disc in dachshunds only was 56%. Non chondrodystrophic dogs were less likely to show a vacuum phenomenon in the currently herniated disc (P = 0.03). Age does not have a significant influence on the concurrence between the site of the phenomenon and the actual herniated disc except in chondrodystrophic dogs, where the relative probability increases by 22% every year (P = 0.02).

In conclusion, vacuum phenomenon is a frequent but inconsistent finding in intervertebral disc disease in dogs. It does, however, not allow localizing the currently herniated disc.

ABSTRACT N-12
MUTATION ASSOCIATED WITH NEONATAL CEREBELLAR CORTI CAL DEGENERATION IN BEAGLE DOGS IDENTIFIED BY GENOME-WIDE MRNA SEQUENCING. E. Beltran, O. Forman, C. Mellersh, J. Stewart, L. De Riso. Animal Health Trust, Newmarket, UK

Neonatal cerebellar cortical degeneration is a neurodegenerative disease described in several canine breeds including Beagle dogs, for which autosomal recessive mode of inheritance has been suggested. The affected dogs are unable to ambulate normally since the onset of walking and the main pathological finding includes Purkinje neuron loss with swollen dendritic processes. The aim of the study was to investigate whether a mutation in one of the candidate genes was responsible for this disease.

A four-week old Beagle dog presented to the Animal Health Trust with progressive signs of cerebellar ataxia. The neuron-atomic localization was to the cerebellum. Hematology and comprehensive biochemistry were normal. The owner elected euthanasia. Histopathology was consistent with neonatal cerebellar cortical degeneration. Genome-wide mRNA sequencing (mRNA-seq) from post-mortem cerebellum tissue was used as a method of candidate gene sequencing. After analysis of the canine orthologues of spinocerebellar ataxia associated genes from human studies, we identified a homozygous 8 bp deletion in a candidate gene previously associated with spinocerebellar ataxia in humans. Genotype analysis of the sire, dam and six clinically unaffected siblings showed the mutation to fully segregate with the disorder. Previous studies have demonstrated that this protein is critical for Purkinje cell development, and its absence can lead to cell damage through excitotoxicity, explaining the observed Purkinje neuron loss, degeneration of dendritic processes and associated neurological dysfunction. The mentioned mutation has been found, at a low frequency, in the United Kingdom population of Beagles and a DNA test is being developed.

ABSTRACT N-13

Meningiomas are the most common brain tumor reported in cats. The purpose of this study was to report clinical features and outcome of a large group of cats with surgically removed intracranial meningiomas.

Data were collected from 121 cats with intracranial meningiomas removed surgically and confirmed histopathologically.

Breed, sex, age, clinical signs, duration of clinical signs, drugs used before and after surgery, biopsy results, imaging reports, and outcome were recorded for each case. 83 of the 121 cats were domestic short-hairs with 46 neutered, 23 entire, and 34 intact females. Body weight ranged from 1.5 to 8.7 kg (median 4.95 kg). Age ranged from 3.3 to 19.2 years (median age 12.2 years). 81 cats displayed behavior changes, 46 were ataxic, 32 had seizures, 31 had visual deficits, 24 were circling, and 14 were paraparetic. Duration of neurologic signs ranged from 0 to 23 months (median 1.25 months). The duration of non-neurologic signs ranged from 0 to 18 months (median 2 months). At the time of data collection, 41 cats were alive, 26 were dead or euthanized, and 54 were lost to follow-up. Of the 26 cats that died, 5 were due to causes directly related to the meningioma and/or surgery. 8 dogs died due to causes that were thought to be related to the original tumor, surgery, or regrowth of the tumor. The mean survival time for cases, excluding those lost to follow-up 17.8 months (range 0-71 months). Overall, cats with meningiomas treated with surgery alone had a good prognosis.

ABSTRACT N-14
EFFECT OF CHLORIDE IN INFUSION FLUID ON SERUM BROMIDE CONCENTRATION IN DOGS. K. Orito, K. Fukunaga, H. Matsumoto, M. Wate, M. Munetani, M. Saito. 1Department of Physiology II, 2Department of Veterinary Surgery II, School of Veterinary Medicine, Azabu University, Sagamihara, Kanagawa, Japan

Bromide is frequently used for the management of epilepsy in canine medicine. Dogs with high dietary chloride content reportedly show a reduction of serum bromide concentration. However, it is unclear how chloride content in infusion fluid affects serum bromide concentration in dogs. It is also unclear whether the chloride lowers serum bromide concentration dependently on the initial serum bromide concentration. In the present study, therefore, the effects of saline transfusion on various serum concentration of bromide were examined in beagles.

Potassium bromide was administered to beagles with a loading dose of 25 mg/kg, PO, BID. After stabilization of the serum bromide concentration, saline was infused intravenously at different rates for 5 h. Serum and urine were collected before and 1, 2, 3, 4, 5, 6, and 7 h after the initiation of transfusion. Bromide concentrations of serum and urine were measured using high-performance liquid chromatography and an ion-selective electrode, respectively.

Serum bromide concentration decreased and urine bromide concentration increased when saline was transfused for 5 h. These effects were marked when saline was infused at a higher rate. The rate of reduction of serum bromide concentration was higher when the initial serum bromide concentration was higher.

In conclusion, serum bromide concentration is affected by chloride content of infusion fluid, and the concentration of serum bromide is the determinant of the rate of reduction of serum bromide.

ABSTRACT N-15
DOES BODY CONDITION SCORE INCREASE RECOVERY TIME IN DOGS TREATED WITH HEMILAMINECTOMY FOR ACUTE ONSET DISC RUPTURE? CC Williams, G Barone. Veterinary Medical Center of Long Island, West Islip, NY

Intervertebral disc disease (IVDD) was initially reported in the 1800’s, with surgical intervention first being described in the 1950’s. One previous study conducted showed a correlation between body dimensions and the risk of IVDD. However, there have been no studies indicating a relationship with body condition and post-operative recovery rate. In this study, we hypothesized that dogs with a higher body condition score (BCS) that underwent hemilaminectomy to repair acute onset intervertebral disc rupture would have a lengthier recovery time.

Medical records from fifty-one dogs that had undergone hemilaminectomy to repair acute IVDD (surgically confirmed) in the
ABSTRACT N-16
IMMUNOHISTOCHEMICAL QUANTIFICATION OF INTERLEUKIN-6 AND INTERLEUKIN-8 EXPRESSION IN CANINE INTRACRANIAL MENINGIOMAS. S Al-Nadaf, SR Platt, N Kent, N Northrup, EW Howerth. 1North Carolina State University, College of Veterinary Medicine, Raleigh, NC, 2University of Georgia, College of Veterinary Medicine, Athens, GA

Meningiomas are the most common intracranial tumors of dogs. Although surgical excision is the primary treatment available, recurrence remains prevalent. The expression of pro-inflammatory cytokines, interleukin-6 (IL-6) and interleukin-8 (IL-8), has been detected in human intracranial meningiomas, and these cytokines have been shown to both promote and inhibit growth of the tumor; additionally, the over-expression of IL-6 has been recorded as a marker of malignancy in human gliomas. However, meningiomas in dogs have yet to be investigated for IL-6 and IL-8 expression despite sharing similar histological appearance to human meningiomas.

The purpose of this study was to evaluate IL-6 and IL-8 immunohistochemical expression in canine intracranial meningiomas.

Immunohistochemistry was performed on 19 formalin-fixed, paraffin-embedded canine intracranial meningioma samples using mouse anti-canine IL-6 monoclonal antibody and mouse anti-canine IL-8 monoclonal antibody. Normal canine tonsil lymphoid tissue, canine carcinoma tumor tissue and a canine malignant histiocytic cell line (DH82 cells) challenged with lipopolysaccharide served as controls. Each tumor was evaluated for staining intensity and the percent area of positive staining cells using a subjective scoring system. The percent area of positive staining was scored as follows: 0, 0% of cells stained; 1, 1-30% of cells stained; 2, 31-60% of cells stained; 3, 61-100% of cells stained. Intensity was scored as: 0, negative expression; 1, weak expression; 2, moderate expression; 3, marked expression.

Of the 19 meningiomas, immunohistochemistry staining for IL-6 expression was positive in five (26%), and IL-8 expression was positive in none (0%). In the five samples positive for IL-6 expression, the percent staining area was greater than 61% (score of 2) staining intensity. In conclusion, IL-6 expression, but not IL-8, was demonstrated in a subset of canine intracranial meningiomas. Further studies are needed to determine the role of IL-6 in canine intracranial meningioma tumorigenesis and whether IL-6 expression in a subset of these tumors could be used as a potential cell marker and as targeted immunotherapy.

ABSTRACT N-17
A NOVEL ANTI-CANINE CD133 ANTIBODY COLOCALIZES WITH GFAP IN NORMAL AND NEOPLASTIC CANINE BRAIN TISSUE. D York, RJ Higgins, RA LeCouteur, PJ Dickinson. University of California Davis, Davis, CA

CD133 is a penta-transmembrane protein that has been proposed as a potential marker for a variety of stem cells and also brain tumor stem-like cells. However there is much controversy over its specificity and value in relation to therapeutic targeting. Expression based on a variety of CD133 antibodies has been conflicting and is complicated by alternative transcription and variable glycosylation patterns.

We developed a novel polyclonal antibody targeted against a canine specific 16aa peptide in the intracellular C-terminal domain of the canine CD133 protein. On western blotting, the antibody recognizes an approximately 80kDa protein in canine adult brain and kidney, neonatal brain, canine glioma cell lines. Minimal signal was seen in murine tissues. We compared the antibody to one previously reported in canine tissue (Clone 13A4) and found strong staining only in murine tissues with 13A4.

Immunohistochemistry revealed staining of astrocytic-like cells in normal canine and murine brain and orthotopic canine glial tumors. Neurospheres derived from neonatal dog brain also had positive staining. Almost all cells in the normal canine brain staining positive for CD133 co-stained for GFAP, as did neurospheres and cells within orthotopic tumors. Co-staining was also seen in peritumoral tissue from human glioblastoma multiforme. GFAP has been reported as a marker of adult neural stem cells, however CD133/GFAP co-localization differs from previous studies where GFAP did not generally co-stain with CD133. These findings have potential implications for the use of CD133 as a marker for stemness and therapeutic targeting in canine brain tumors.

ABSTRACT N-18
CLINICOPATHOLOGIC AND MAGNETIC RESONANCE IMAGING CHARACTERISTICS OF HYPERTENSIVE ENCEPHALOPATHY IN TWO CATS AND TWO DOGS. J O’Neill, M Kent, E Glass, SR Platt. 1College of Veterinary Medicine, University of Georgia, Athens, GA, 30602, 2Red Bank Veterinary Hospital, Tinton Falls, NJ 07724

Two dogs and two cats were evaluated for an acute onset of neurologic dysfunction. Signs were referable to the prosencephalon consisting of abnormal mentation, recumbency, and blindness. All cases had consistent systemic hypertension ranging from 180mm Hg to 260mm Hg as measured using Doppler ultrasonography. Magnetic resonance imaging (MRI) of the brain disclosed non-contract enhancing, ill-defined T2-weighted hyperintensities in the white matter of the cerebrum in the areas of the frontal, parietal, temporal, and occipital lobes. Lesions were observed in the caudate nuclei and thalamus in two animals, respectively. There was scant contrast enhancement of the caudate nuclei in one case. Retinal lesions consisting of retinal hemorrhages and or detachment were observed in three animals. Hypertension was presumed secondary to renal disease in three animals; a primary underlying disorder was not identified in one animal. Normalization of blood pressure was achieved within the first 3-5 days with enalapril (0.1mg/kg PO Q24hr). In one cat, hypertension spontaneously resolved. In three cases, neurological improvement occurred within 24-48 hours of normalization of blood pressure. The presumptive diagnosis of hypertensive encephalopathy is supported by the MRI findings similar to humans and neurologic dysfunction coincident with systemic hypertension in which the neurological dysfunction improves with treatment of hypertension. All cases were alive and doing well at follow-up. Follow-up times ranged from 8.5months to 18months. The prognosis appears good for the resolution of neurological deficits with normalization of blood pressure in animals with hypertensive encephalopathy.

ABSTRACT N-19
RELATIONSHIP BETWEEN SPINAL CORD SIGNAL CHANGES AND CLINICAL AND MRI FINDINGS IN DOGS WITH CERVICAL SPONDYLOMELYELOPATHY – 102 CASES. RC da Costa. Dpt. of Vet Clinical Sciences, College Vet. Medicine, The Ohio State University, Columbus, OH

Spinal cord signal changes (SCSC) are frequently seen in the MR (magnetic resonance) images of dogs with cervical spondylomelyelopathy (CSM). However, little is known about the factors
ABSTRACT N-20
FORCE PLATE GAIT ANALYSIS IN DOBERMAN PINCERS WITH AND WITHOUT CERVICAL SPONDYLOMELOPATHY, K. Foss\textsuperscript{1}, RC da Costa\textsuperscript{2}, M Allen\textsuperscript{1}, PJ Rajala-Shultz\textsuperscript{2}. \textsuperscript{1}Department of Veterinary Clinical Sciences, \textsuperscript{2}Department of Veterinary Preventive Medicine, The Ohio State University, Columbus, OH, USA

Currently, the most accepted means of evaluating the response to treatment in a patient with cervical spondylomyelopathy (CSM) has been a subjective measure based on the owner and clinicians’ perception of the patient’s gait. The goal of this study was to identify differences in force plate (FP) parameters between Doberman Pinchers with and without CSM and then use this information to subsequently develop a more reliable system for detecting, quantifying, and differentiating gait abnormalities in CSM.

Nineteen Doberman pinchers were prospectively studied; 10 clinically normal dogs and 9 with CSM. Neurologic examinations were performed in all dogs. Clinically normal dogs underwent transcranial magnetic stimulation to further exclude any underlying neurologic abnormalities. CSM-affected dogs had their diagnosis confirmed with a 3.0 T MRI. Force plate analysis was performed in all four limbs of all dogs using a stationary force plate and computer system (Kistler Model 9867A). At least 4 runs of ipsilateral limbs were collected from each dog. Parameters evaluated included the peak vertical force (PVF), peak vertical impulse (PVI), peak braking force (PBF), peak braking impulse (PBI), peak propulsive force (PPF), peak propulsive impulse (PPI), peak mediolateral force (PMLF), and peak mediolateral impulse (PMLI). All force peaks were represented as a percentage of body weight and the mean value of each parameter was calculated. In addition, the coefficient of variation (CV) within each limb was also calculated for each individual parameter. A repeated measures approach was used to analyze the data.

In regard to peak forces and impulses, there were no significant differences between PVF, PVI, PBF, PPI, or PMLI in thoracic or pelvic limbs in affected versus normal dogs. PMLF of all limbs was significantly higher in normal dogs compared to CSM-affected dogs (P=0.0062). By performing an analysis related to variability using the CV, there was significantly more variability of PVF in the CSM-affected dogs compared to normal dogs (P=0.0045). In addition, variability of PVF in the thoracic limbs was significantly higher in CSM-affected Dobermans compared to the thoracic limbs of normal ones (P=0.0019).

In conclusion, the variability of PVF in all four limbs and in particular the thoracic limbs, seems to consistently distinguish clinically normal Dobermans from those with CSM. Even though ataxia and weakness are manifested primarily in the pelvic limbs of dogs with CSM, this data suggests that FP analysis should evaluate all limbs, and the thoracic limbs may be more sensitive to differences than the pelvic limbs.

ABSTRACT N-21
CHARACTERIZATION OF A NOVEL CANINE GBM-DERIVED CELL LINE (G06A) AND ORTHOTOPIC TUMORS IN MICE. D York, RJ Higgins, RA LeCouteur, PJ Dickinson. University of California Davis, Davis, CA

Glioblastoma multiforme (GBM), grade IV astrocytoma, is the most common primary brain tumor in humans, and carries a poor prognosis with current therapies. Canine spontaneous brain tumors bear striking similarities to their human tumor counterparts and may provide a valuable translational model system for novel therapies. Veterinary preclinical assessment and development of targeted therapies has been hampered by a lack of suitable canine glioma cell lines and murine xenograft models. We have established a novel canine glioma cell line (G06A) derived from a spontaneous canine GBM. The G06A cells grow adherently in standard serum media, with an average doubling time of 22 hours. Cells express wild type p53 and overexpress IL13R2 consistent with the original tumor.

Intracranial implantation of 10^5 G06A cells resulted in orthotopic tumors in 7/7 NOD scid gamma (NSG) mice and 3/3 NCr Nude mice 8-13 months following implantation. Routine histopathology revealed extensive, invasive tumors consistent with a high grade, mixed glial phenotype. Tumor invasion occurred throughout the neuropil involving both white and grey matter and was not limited to perivascular spaces. Both oligodendrogial and astrocytic characteristics were present, reflective of the original tumor. Based on immunohistochemistry, cells within the tumor mass had positive staining for GFAP, Olig2, Nestin, and CD133. Although the tumor latency period makes in vivo therapeutic testing problematical, the cell line may be valuable for in vitro screening and investigation of factors involved in tumor progression and host/tumor oncogenic signaling.

SMALL ANIMAL – NUTRITION / METABOLISM
ABSTRACT NM-1
NUTRITIONAL IMMUNOMODULATION: BOVINE COLOSTRUM FOR IMMUNE & GUT HEALTH IN DOGS. E Satyaraj, A Reynolds. Nestle Purina Research, St. Louis, MO

While the need for colostrum in neonates is well established, the immunomodulatory effect of feeding bovine colostrums [BC] to adult humans is gaining increased attention. However, no such studies in dogs have been reported. The aim of this study was to evaluate the immunomodulatory effect of BC in dogs.
The trial was conducted in two phases: Pre-test [8 wks] and Test [40 wks]. 24 dogs [mean age 2.5 yrs] were randomized into two groups. In 'Pre-test' phase both groups were fed a nutritionally complete diet. At the end of 'Pre-test' phase all dogs received a Canine Distemper Vaccine (CDV), and dogs from 'test' group were switched to diet supplemented with spray dried BC. Response to CDV vaccine was evaluated by measuring vaccine specific plasma IgG. Gut Associated Lymphoid Tissue [GALT] response was assessed by measuring fecal IgA. Gut microflora was evaluated by Temporal Temperature Gel Electrophoresis (TTGE) methodology. Repeated measures analysis of variance was used to test for differences between groups and statistical significance was considered to be \( p < 0.05 \).

Dogs fed diets supplemented with BC demonstrated enhanced immune status by showing significantly higher vaccine response and significantly higher levels of fecal IgA as compared to the control group. Supplementing diets with BC also resulted in significantly increased gut microflora variety and stability [both measures of enhanced gut health] in the test group. In conclusion, diets supplemented with BC significantly enhanced immune health and gut health in dogs.

**ABSTRACT NM-2**

**EFFECTS OF WEIGHT LOSS IN OBSESE DOGS ON A RANGE OF RENAL BIOMARKERS.** A Tvarojanovicuic et al., J.Ceron et al., SL Holden 2, PJ Morris 3, V Biourge 4, 1Affinity-Petcare, Barcelona, Spain, 2School of Veterinary Medicine, Ghent University, Merelbeke, Belgium, 3Department of Animal Medicine and Surgery, Veterinary School, University of Murcia, Spain, 4Department of Obesity and Endocrinology, University of Liverpool, UK, 1WALTHAM Centre for Pet Nutrition, Waltham-on-the-Wolds, UK, 2Royal Canin Research Centre, Aimargues, France

Human obesity is a risk factor for development and progression of CKD, and weight loss can reverse the associated manifestations. To date, information is limited regarding the potential for altered renal function in canine obesity. The aim of the current study was to measure a range of renal biomarkers in obese dogs, both before and after weight loss.

Thirty-seven overweight client-owned dogs undergoing weight loss were studied, representing a range of breeds, ages and genders. Both before and after weight loss, body composition was measured by dual-energy X-ray absorptiometry, and plasma concentrations of urea, creatinine, homocysteine, cystatin C, and clusterin were measured using validated assays. Urinalysis was also performed, which included measurement of specific gravity (by refractometer) and protein:creatinine ratio [UPCR].

Urea \((P = 0.043)\) and urine specific gravity \((P = 0.012)\) increased with weight loss, whilst creatinine decreased \((P = 0.026)\). Homocysteine \((P = 0.001)\), cystatin \((P = 0.001)\) and clusterin \((P = 0.001)\) also decreased with weight loss. UPCR was more commonly abnormal pre-weight loss than post-weight loss \((8/27 vs. 1/27; P = 0.015)\). On multivariable linear regression analysis, change in body mass was associated with percentage weight loss (greater weight loss, more lean tissue loss; \(R^2 = -0.67\), \(R^2 = 0.45\), \(P < 0.001\)) and pre-weight-loss plasma clusterin concentration (greater clusterin, more lean tissue loss; \(R = 0.48\), \(R^2 = 0.23\), \(P < 0.003\)).

These results suggest possible subclinical alterations in renal function in canine obesity, which improve with weight loss. Further work is required to determine the nature of these alterations and, most notably, the reason for the association between pre-weight loss plasma clusterin and subsequent lean tissue loss during weight management.

**ABSTRACT NM-3**

**MRNA EXPRESSION RESPONSE OF ADIPOKINES TO FELINE OBESITY DEPENDS ON ADIPOSE TISSUE LOCATION.** H. Van de Velde, GPJ Janssens, H de Rooster, I Polis, K Piron, T Plassera, A Verbrugghe, M Hestu. 1Faculty of Veterinary Medicine, Ghent University, Merelbeke, Belgium, 2School of Veterinary Science, University of Bristol, Bristol, United Kingdom

Obesity is an emerging problem in many species, including companion animals. Concomitant disorders such as insulin resistance, diabetes mellitus and dyslipidemia are directly or indirectly linked with an increase of adipose tissue (AT). In humans and rodents obesity is associated with enlarged adipocyte cell size, subsequently creating hypoxia in AT. This altered perfusion can result in necrosis whereby macrophages and lymphocytes are attracted. In contrast to the situation in humans and rodents where data on inflammation in AT -explaining the co-morbidities in obesity- exist, this information is lacking in cats. Therefore, AT mRNA expression of chemokines and adipokines was measured in chronically obese cats. The aim of the present study was to increase the knowledge of the development of obesity and related disorders in cats.

Ten chronically obese cats with a mean body weight (BW) of \(6.2 \pm 0.4\) kg and a body condition score (BCS) of \(5 \pm 0.2\) on a 9-point scale were included in this study. Ten lean cats with a mean BW of \(3.9 \pm 0.2\) kg and BCS of \(5 \pm 0.1\) were included as control group. Under general anesthesia, samples were taken at five different fat depots, namely subcutaneous (SC) abdominal AT, SC inguinal AT, bladder AT, renal AT and omental AT. mRNA expression was determined in the AT using a two-step quantitative real time RT-PCR for leptin, adiponectin, IL-6, IL-10, TNF-\(\alpha\), IFN-\(\gamma\), IL-8, MCP-1 (a chemokine for monocytes) and RANTES (a chemokine for T-lymphocytes). A relative copy number value was calculated for each gene sample with the results related to the three stably expressed housekeeper genes (HPRT1, YWAZ and RPS7). Statistical analyses were performed using a one-way ANOVA for which significance was set at \(P < 0.05\).

Body weight and BCS was significantly higher in obese cats compared to lean cats \((P = 0.011)\). Obese cats showed higher leptin mRNA expression in the five fat depots \((P < 0.01)\, SC\) inguinal AT \(P = 0.039\), with lower adiponectin mRNA expression in bladder \((P = 0.017)\) and renal AT \((P = 0.047)\), compared to lean cats. In SC inguinal AT, mRNA expression of obese cats was higher for IFN-\(\gamma\) \((P = 0.045)\, MCP-1 \((P = 0.03)\) and RANTES \((P = 0.004)\) than in lean cats. At other AT locations, higher expression of inflammatory cytokines was observed in obese cats compared to lean cats, but they failed to reach the level of significance.

This study indicates that the response of feline AT to obesity is present and differs according to its location. Expression in SC inguinal AT showed most changes, suggesting that this AT location might best reflect the changes in inflammatory and immune status of the obese cat. The increase of RANTES and MCP-1 illustrates the attraction of lymphocytes and monocytes into the AT, which suggests a local inflammation of this latter tissue during feline obesity.

**ABSTRACT NM-4**

**COMPARISON OF TWO WEIGHT LOSS DIETS IN OVERWEIGHT CATS.** J. Jeusette, A. Tvarojanovicuic, J. Ceron et al., A. Salas, N Sanchez, M Compagnucci, S Fernandez, L1 Vilaseca, C Torre. 1Affinity-Petcare, Barcelona, Spain, 2Veterinary Faculty, University of Murcia, Murcia, Spain, 3DOC's veterinary clinic-Premia, Barcelona, Spain

Inflammatory and oxidative pathways are involved in the pathophysiology of feline obesity. Dietary supplementation with olive oil or flavonoids induces lower oxidative stress and better inflammatory status in overweight cats. High-protein low-starch diets improve body composition and insulin sensitivity in obese cats, however, they have been suggested to affect negatively bone or renal status. The purpose of this study was to compare 2 diets for body weight loss (BWL) in cats. The hypothesis was that diet A \(\{\text{as is, measured metabolisable energy (ME) 3290 kcal/kg, protein 36\%, fat 8\%, carbohydrate 23\%, 1\% fish oil, 0.5\% olive oil, 0.06\% flavanoids}\} would induce a safe BWL with improved body composition, glycemic control, inflammatory status and oxidative stress, compared to diet B \(\{\text{ME 3310 kcal/kg, protein 36\%, fat 8\%, starch 28\%, TDF 18\%, Ca 1.9\%, P 1.0\%, omega-3 fatty acids 0.15\%}\}\) used as a regular obesity control diet.

Healthy colony cats \(n = 11\) with body condition score > 7/9 were fed a maintenance diet until T0. Then, 6 cats were fed diet A and 5 cats diet B to induce a BWL between 1 and 2% of starting BW per week. Fasting blood and urine were obtained at T0,
after 3 weeks and after 3 months of energy restriction. Complete blood count, serum biochemistry profile, serum fructosamine, amylase, haptoglobin, paraoxonase type 1 (PON-1, an anti-inflammatory and anti-inflammatory enzyme), IgF-1, butyrylcholinesterase activity, urine analysis (protein, creatinine, albumin, fractional excretion of ions), body composition (deuterium dilution), markers of bone formation (serum bone alkaline phosphatase, BAP) and resorption [serum carboxy-terminal telopeptide fragment (CTX), urinary total deoxypyridinoline (DPD)] and ultrasound of the abdomen were assessed. To evaluate any difference between diets, differences from baseline T0 were compared (univariate ANOVA). To assess diet and BWL effects, multivariate ANOVA for repeated measurements was performed (diet, time, diet*time effects). Values are considered as statistically different for P value < 0.05.

No difference between diets was observed for energy intake and BWL. Diet A resulted in a significantly better lean mass preservation, higher decrease in fructosamine and haptoglobin and in higher increase in PON1 than diet B. Both diets significantly decreased basal insulin, amylase, butyrylcholinesterase, alkaline phosphatase and BAP concentrations, and increased urinary Ca excretion and serum Ca with time.

In conclusion, both diets resulted in a safe and similar BWL. However, diet A showed additional benefits for lean mass preservation, glucose control (fructosamine), oxidative and inflammatory status (haptoglobin, PON1), without side effects for renal health (BUN, creatinine, urinary albumin) and liver health (liver enzymes, ultrasound). A decreased marker of bone formation with both diets at T3, with a trend for increased resorption marker (DPD), requires further research.

**Abstract NM-6:**

**SEASON AND MONTH EFFECTS ON FOOD INTAKE IN ADULT COLONY CATS.**

*Abstract NM-6:*

**Comparisons of high fiber and low carbohydrate diets on owner-perceived satiety of cats during weight loss.**

**Abstract NM-5:**

**Comparison of high fiber and low carbohydrate diets on owner-perceived satiety of cats during weight loss.**

**Abstract NM-7:**

**Influence of different sources of corn starch on stool characteristics in dogs of differing body sizes.**

**Table 1.** Least square means of food intake per month of adult colony cats from 2004 to 2009.

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
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<th>June</th>
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<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
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<tr>
<td>Food intake (g)</td>
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<td>56.3</td>
<td>54.8</td>
<td>52.8</td>
<td>53.2</td>
<td>52.0</td>
<td>50.4</td>
<td>51.5</td>
<td>54.5</td>
<td>55.7</td>
<td>58.0</td>
<td>57.9</td>
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<tr>
<td>SEM</td>
<td>2.0</td>
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a crossover design. Diets contained the same protein sources but varied in the source of corn starch (flour, purified, and high-amyllose). Fresh feces were collected and their consistency was scored daily, from 1 (hard) to 5 (liquid). Fecal volume, moisture, pH, lactate and short chain fatty acid (SCFA) concentrations were measured. Fecal microbial communities were characterized by 454-pyrosequencing of the 16S rRNA gene. Effects of diet or breed on fecal parameters were statistically tested using Friedman and Kruskal-Wallis tests. The Unifrac metric followed by analysis of similarity (ANOSIM) was used to assess differences in microbial communities among diets and breeds.

Regardless of diet, a breed effect was found for all fecal parameters (p < 0.017) and microbial communities (p < 0.001). *Lactobacillus* were significantly higher in fecal samples of GS compared to MS. Unifrac analysis revealed significant differences in microbial communities between both breeds. In GS, corn starch sources had a significant effect on fecal consistency and lactate concentrations (p < 0.007), as well as on pH, fecal volume, and SCFA concentrations (p < 0.022). MS appeared more tolerant and only fecal volume (p < 0.015) and lactate concentrations (p < 0.022) were affected. Dogs on the high-amyllose diet had the lower fecal pH, and higher SCFA and lactate concentrations, and increased fecal volume. In contrast, dogs on the starch diet had stools with a higher consistency, a decreased fecal volume and decreased concentrations of fermentation products. The sources of corn starch had an impact on microbial communities in both breeds (p < 0.035). *Firmicutes* were lower on the corn flour starch diet [64.30% (53.90%)] compared to the purified and high-amyllose starch diets [97.82% (91.86%) and 96.48% (87.98%)]. This change was associated with a decrease in *Fusobacteria* and *Bacteroidetes*.

These results suggest that the source of corn starch has an impact on fecal consistency, fecal microbial communities, and fermentation products. These effects of the starch sources were not consistent and may be due to differences in fermentative activities as well as microbial communities between dog breeds.

**ABSTRACT NM-8**

A 8.5-YEAR LONGITUDINAL STUDY TO IDENTIFY RISK FACTORS OF OBESITY IN COLONY CATS: S Serisier 1, A Feugier 1, C Venet 1, Y Soulard 1, V Bourge 1, JF German 1, 1Royal Canin Research Center, Aimargues, France, 2Department of Obesity and Endocrinology, Institute of Ageing and Chronic Disease, University of Liverpool, Liverpool, United Kingdom

Several transverse studies have assessed factors predisposing cats to becoming overweight. Generally, demographic factors (e.g., breed, age, gender, sex status, housing), activity and diet have been examined in adult cats, but early-life factors have not been considered. In humans, studies have demonstrated that the risk of being overweight in adulthood is largely determined early in childhood. The aim of this retrospective cohort study was to identify risk factors for the development of overweight in colony cats fed dry diets *ad libitum*.

A total of 80 colony-cats were studied, representing 14 different breeds, with 36 males (34 neutered) and 44 females (24 neutered). Of these cats, 36 were determined to be overweight (OW; body condition score [BCS] > 5/9), whilst the remaining 44 were in ideal condition (I; BCS = 5/9). The effects of various factors (including age, gender, neuter status, breed [pure vs. mixed], in ideal condition (I; BCS=5/9). The effects of various factors

BW differences at this age. Nonetheless, identifying at-risk cats at 12 months, even before the onset of obesity, could enable strategies aimed at preventing feline obesity to be better targeted.

**ABSTRACT NM-9**

BALL FEEDING INCREASES PHYSICAL ACTIVITY AND REDUCES BODY WEIGHT REGAIN AFTER A WEIGHT LOSS DIET IN CATS. A Salas, I Jeuissete, M Compagnoucci, L Vilaseca, C Torre. Affinity Petcare, Barcelona, Spain

After a weight loss program, cats have difficulties to maintain body weight (BW) and usually they regain their initial BW quicker than desired. A lack of owner compliance and a decrease in energy expenditure are the main causes for this quick regain. Feeding enrichment with puzzle feeders, from which food has to be obtained by rolling, have been proposed to help obese cats to lose BW while improving physical welfare. The purpose of this study was to evaluate if enrichment with a feeding ball would increase objectively-measured physical activity, food intake and its repercussion on BW after a weight loss diet.

Eleven healthy colony cats were used for this study. Cats had been firstly energy-restricted for 3 months to induce a 15% BW loss with 2 different low-fat energy-restricted diets [diet A (n = 6), as measured: metabolizable energy (ME) 3290 kJ/kg, protein 28%, fat 40%, fat 11%, starch 17%, total dietary fiber (TDF) 22%; diet B (n = 5), as is, ME 3310 kcal/kg, protein 36%, fat 8%, starch 28%, TDF 18%]. Then, in a cross-over design, each group of cats received during 3 months their low-fat diet *ad libitum* in 2 different feeding conditions: in a conventional bowl (CB) or in a feeding ball (FB). Daily physical activity was monitored by accelerometers that cats wore in the harness. Daily food intake and weekly body weight were recorded. A general linear model (GLM) with repeated measures was performed to assess feeding condition, period and diet effects on physical activity, BW regain and food intake. Values were considered as statistically significant for P value < 0.05.

As there was no difference between diets, data from both diets were pooled and only feeding condition and period effects are discussed. A significant effect of the cross-over period was observed on food intake and BW regain independently of the type of feeding, during the first 3-months period, food intake was higher [55.7 ± 7 kcal/kg BW vs 46.7 ± 5 kcal/kg BW; p = 0.000] and BW regain was faster (0.8% week vs 0.09%/week; p = 0.000) than in the second period in both diet groups, probably due to a seasonal effect and/or a compensatory effect after energy restriction. *Feeding ad libitum* with a FB versus CB resulted in an increased physical activity (+ 34%, p = 0.000), in a reduced food intake (- 3.74 kcal/kg BW, p = 0.000) and in a lower BW regain of the cats (3.8 ± 2.2% vs 7.6 ± 2.5%, p = 0.014).

In conclusion, feeding with FB could be an interesting strategy to apply in overweight cats after weight loss programs to increase physical activity, reduce food intake and consequently slow down BW regain or simply to promote physical activity and consequently improve the wellbeing of normal or overweight cats.
PLASMA ADIPOKINE CONCENTRATIONS IN LEAN AND OBSESE DOGS. N Berghoff1, R Stone2, JS Suchodolski1, JM Y Pan1, Steiner1, DL Zoran3. 1Gastrointestinal Laboratory, Texas A&M University, College Station, TX, 2North Houston Veterinary Specialists, Humble, TX, 3Department of Small Animal Clinical Sciences, Texas A&M University, College Station, TX

White adipose tissue does not only provide energy storage, but also produces inflammatory cytokines, as well as adipokines necessary for normal metabolism. In humans, the release of these mediators is believed to lead to a state of chronic low-grade inflammation, which may play a role in the development of insulin resistance and diabetes mellitus. Studies investigating plasma cytokine and adipokine concentrations in dogs with naturally occurring obesity are lacking. Thus, the aim of this study was to measure plasma cytokine and adipokine concentrations in client-owned lean and obese dogs, and to determine if a sub-inflammatory state is present in obese dogs.

Blood samples were collected from 24 healthy lean dogs (body condition score [BCS]: 4-5 out of 9) and 19 otherwise healthy obese dogs (BCS: 7-9 out of 9). Plasma concentrations of cytokines (GMCSF, IFN-γ, IL-2, IL-4, IL-6, IL-7, IL-8, IL-10, IL-15, IL-18, MCP-1, TNF-α), leptin, adiponectin, resistin, and insulin were measured using a multiplex bead antibody assay system (Millipore, MA). C-reactive protein (CRP) concentrations were measured by ELISA (Tridelta, NJ). Complete blood count (CBC) and plasma biochemical analyses were carried out using routine automated analyzers. Test results were compared between lean and obese dogs using an unpaired Student’s t-test or Mann-Whitney U test, as appropriate. Statistical significance was set at p<0.05.

Plasma leptin and insulin concentrations were significantly higher in obese dogs than in lean dogs (p<0.0001 and p=0.0324, respectively). No differences were found for adiponectin, resistin, any of the cytokines, or CRP concentrations between the two groups. Monoclonal antibodies (MABs) (Cambio, Cambridge, UK) were used to detect specific cytokines in plasma. A mixed linear model using Proc Mixed (SAS, Cary, NC) was used to evaluate the influence of obesity on the cytokine concentrations. A p-value of <0.05 was considered statistically significant.

Leftover frozen fecal samples from five research dogs utilized in a previous low level fructan supplementation study were analyzed. Briefly, five diets that contained either cellulose alone or that were supplemented with either inulin or short-chain fructooligosaccharides (scFOS) each at 0.2% or 0.4% were evaluated in a 5 × 5 Latin square design. Bacterial DNA was extracted from each fecal sample and evaluated for the abundance of specific bacterial groups such as Ruminococcaceae, Faecalibacterium spp., Turicibacter spp., and Bacteroides. Fructans are considered to have a prebiotic effect and have the potential to modulate the intestinal microbiota. The aim of this study was to evaluate the effect of low level fructan supplementation on the abundance of those bacterial groups that are frequently found to be decreased in dogs with gastrointestinal disease.

Recent metagenomic studies in dogs with gastrointestinal disease have shown a decrease in specific bacterial groups such as Ruminococcaceae, Faecalibacterium spp., Turicibacter spp., and Bacteroidetes. Fructans are considered to have a prebiotic effect and have the potential to modulate the intestinal microbiota. The aim of this study was to evaluate the effect of low level fructan supplementation on the abundance of those bacterial groups that are frequently found to be decreased in dogs with gastrointestinal disease.

Leptin and insulin concentrations were significantly higher in obese dogs than in lean dogs (p<0.0001 and p=0.0324, respectively). No differences were found for adiponectin, resistin, any of the cytokines, or CRP concentrations between the two groups. Monoclonal antibodies (MABs) (Cambio, Cambridge, UK) were used to detect specific cytokines in plasma. A mixed linear model using Proc Mixed (SAS, Cary, NC) was used to evaluate the influence of obesity on the cytokine concentrations. A p-value of <0.05 was considered statistically significant.

In conclusion, in this study low level fructan supplementation did not significantly alter the abundance of selected bacterial groups in healthy adult research dogs. Further studies are needed to evaluate the effect on the abundance of these bacterial groups at higher levels of fructan supplementation.

SOY GERM ISOFLAVONES SUPPLEMENTATION REDUCED BODY FAT ACCUMULATION AND ENHANCED ENERGY METABOLISM IN DOGS. Y Pan. Nestlé Purina Research, Checkerboard Square, St. Louis, MO

Up to 40% dogs in developed countries are either overweight or obese. Obesity increases the incidence of many chronic diseases in dogs. One of the known risk factors for obesity in dogs is spaying/neutering which results in significant decline in energy metabolism due to loss of sex hormones. So reversing the decline in energy metabolism by natural estrogen analogs will be very effective in reducing the risk of obesity in spayed/neutered dogs by maintaining healthy energy metabolism. Published research shows that purified daidzein and glycitein were able to mimic estrogen to prevent body fat accumulation.
Since the isoflavones in soygerm meal are mainly daidzein and glycine, we investigated the effects of isoflavones from soygerm meal (SGM) on body fat accumulation, and energy metabolism in spayed/neutered dogs with normal body weight. Baseline body weight may be a critical energy requirement (MER), body weight, and % body fat, spayed/neutered Labradors or Poodles with normal body weight were randomized into two groups: control, and isoflavone diets. Both the control and isoflavone diets had comparable levels of metabolizable energy, protein, fat, carbohydrates, and minerals. The dogs were allowed to ingest 25% more than their baseline MERs for 6 months. Body composition using DEXA, thyroid function, complete blood count, and blood clinical chemistry parameters were measured at the baseline and every three months after initiation of the feeding trial. Total energy expenditure was measured using doubly-labeled water protocol at the end of the study. The results showed that the isoflavones from SGM significantly increased daily energy expenditure and reduced body fat accumulation in dogs without reduction in food intake.

SMALL ANIMAL – ONCOLOGY

ABSTRACT O-1
CHARACTERIZATION OF BETA-CATENIN EXPRESSION IN CANINE ORAL MELANOMA. E Chon, V Thompson, M Huelsmeyer, T Stein. University of Wisconsin – Madison, Madison, WI

Canine oral melanoma is a highly aggressive malignancy associated with poor survival. Perturbation of the Wnt/beta-catenin signaling pathway has been implicated in the progression of human melanoma. However, there currently is no information regarding this pathway’s role in canine oral melanoma. Our objective was to characterize beta-catenin expression in canine oral melanoma tumors and cell lines.

Initial characterization of beta-catenin expression was performed with immunohistochemistry of twelve archived canine oral melanoma tumors. For further characterization, we utilized nine cell lines derived from spontaneously arising canine oral melanomas. Cell lysates from each cell line was fractionated and beta-catenin protein expression was semi-quantitatively determined with Western Blot analysis. A human melanoma cell line having a known stabilizing mutation in beta-catenin served as a positive control.

Among the twelve histologic samples, nine stained positive for beta-catenin. Differential intracellular staining (cytoplasmic vs. nuclear or membranous staining) was evident in positively stained tumors. Similarly, subcellular fractionation of cell line lysates revealed differential staining between cell lines and within subcellular fractions.

Differential expression of beta-catenin suggests the Wnt/beta-catenin signaling pathway may be active in a subset of canine oral melanomas. (VCS Award Winner)

ABSTRACT O-2
AGREEMENT BETWEEN FLOW CYTOMETRY, PCR FOR ANTIGEN RECEPTOR RARREARRANGEMENT, AND IMMUNOHISTOCHEMISTRY IN CANINE LYMPHOMA. LB Thalheim, SE Suter, LB Borst, LE Williams. North Carolina State University College of Veterinary Medicine, Raleigh, NC

Immunohistochemistry (IHC), flow cytometry (FC), and PCR for antigen receptor rearrangement (PARR) are utilized to help diagnose ambiguous cases of canine lymphoma and to determine immunophenotype. Objectives of this study were to calculate level of agreement between IHC, FC, and PARR in canine lymphoma and to determine the ability of FC and PARR to correctly predict immunophenotype as defined by IHC.

Medical records were searched to identify dogs with lymphoma that had concurrent FC, PARR and IHC performed. Fifty-two cases were identified. Immunophenotype results were categorized as T-cell, B-cell, dual T-/B-cell, and negative. The percent agreement on baseline mutation was calculated. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of FC and PARR in correctly determining immunophenotype were also calculated.

The percent agreement between FC and IHC was 94.2%, between PARR and IHC was 65.4%, and between all three tests was 59.6%. For B-cell cases, the sensitivity, specificity, PPV, and NPV for FC were 92%, 100%, 100%, and 81% respectively, and for PARR were 62%, 100%, 100%, and 46% respectively. For T-cell cases, the sensitivity, specificity, PPV, and NPV for FC were 100%, 97%, 93%, and 100% respectively, and for PARR were 77%, 97%, 91%, and 93% respectively.

The percent agreement between FC and IHC was significantly higher compared to PARR and IHC. While the PPVs are similar between FC and PARR, the overall sensitivity of PARR in detecting correct phenotype is lower compared to FC. Based on these results, FC is superior to PARR in determining immunophenotype. (VCS Award Winner)
ABSTRACT O-4
PHASE II CLINICAL TRIAL OF VINORELBINE AND PIROXICAM FOR DOGS WITH TRANSITIONAL CELL CARCINOMA OF THE URINARY BLADDER. ME Kaye1, JA Lawrence2, K Weishaar2, DH Thamm2, 1University of Georgia College of Veterinary Medicine, Athens, GA, 2The Animal Cancer Center, Colorado State University, Fort Collins, CO

Transitional cell carcinoma (TCC) of the urinary bladder in dogs is an invasive, locally aggressive disease with limited effective therapies. Vinorelbine is a semisynthetic vinca alkaloid that has demonstrated activity in advanced human TCC. The purpose of this study was to evaluate the anti-tumor activity and toxicities of vinorelbine and piroxicam in dogs with TCC.

Dogs were treated with vinorelbine (15 mg/m² IV) once weekly for four doses followed by every other week until tumor progression. Piroxicam (0.3 mg/kg PO) was administered daily. Tumor response was determined according to Response Evaluation Criteria in Solid Tumors (RECIST); toxicities were graded according to Veterinary Cooperative Oncology Group (VCOG) criteria. Median time to progression (TTP) and median survival time (MST) were calculated using Kaplan-Meier analysis.

Fourteen dogs were enrolled. A median of 6.5 doses of vinorelbine (1-16) were administered. Two dogs (14%) had partial responses, 4 dogs had extended stable disease for a median of 100 days (56-239d); 2 had progressive disease. Response could not be assessed in 2 dogs. Subjective improvement in clinical signs was noted in 11 dogs. Of 89 total doses of vinorelbine administered, 3 grade IV and 3 grade III neutropenias, 1 grade III thrombocytopenia, and 1 grade III gastrointestinal toxicities were documented. The median TTP was 93 days. The MST from the first vinorelbine treatment was 168 days; MST from initial diagnosis was 432 days.

Vinorelbine and piroxicam appear to have antitumor activity against canine TCC and may be a therapeutic option when managing this disease.

ABSTRACT O-5
COMPUTED TOMOGRAPHIC APPEARANCE OF CANINE THYROID TUMORS. K Deitz1, L Gilmour1, V Wilke2, E Riedesel1. 1Iowa State University, College of Veterinary Medicine, Ames, IA, 2University of Minnesota, College of Veterinary Medicine, St. Paul, MN

Computed tomography is often used to help determine the treatment approach to canine thyroid tumors. This study was undertaken to describe the computed tomographic features of canine thyroid tumors.

Nineteen dogs with computed tomographic images of a histopathologically confirmed thyroid tumor were identified. Each CT scan was evaluated by 3 clinicians for various characteristics independently and then by consensus.

There were 17 carcinomas and 2 adenomas. Tumor consistency was heterogeneous in 16/19 (84%). Most (12/19) had internal mineralization, although in 2 there was extensive bone destruction which made the presence of tumor mineralization difficult to determine. Sixteen tumors (84%) were unilateral. Of these, 11/16 were left-sided, and 5/16 were right-sided. The remaining 3 were considered bilateral or ventral. All tumors had some degree of contrast enhancement. Eighteen had heterogeneous enhancement, with 7/19 having more contrast enhancement peripherally than centrally. Most (16/19) had well-defined margins post-contrast. Location of tumors compared to bony structures was variable, with most having their cranial margin somewhere along the level of the second cervical vertebra (13/19) or at the junction of the second and third cervical vertebrae (1/19). Some were much more cranially located, with the cranial margin at the level of the temporomandibular joint (1/19) or bulla (4/19). The caudal extent was variable, and was anywhere from mid C1 to caudal C5.

Common CT features of canine thyroid tumors include unilateral location in the neck anywhere from the temporomandibular joint to C5, with heterogeneous consistency, internal mineralization, and heterogeneous contrast enhancement with well-defined margins.

ABSTRACT O-6
MULTI-INSTITUTION RETROSPECTIVE STUDY OF 85 CASES OF CANINE THYROMA (1999-2010). C Robat1, L Cesario2, R Gaeta1, D Schrempf1, R Chun3, 1ONCOVET (France), 2Michigan State University, 3University of Pennsylvania, University of Wisconsin-Madison

Thymomas are uncommon tumors of the thymic epithelium in dogs. The objective of the study was to compile a large number of cases and further characterize the disease in regards to presentation and outcome.

Data was collected retrospectively from 85 cases from 4 institutions over an 11-year period (1999-2010). Signalment, clinical presentation, diagnostic testing, treatment specifics, adverse events, and survival were evaluated.

Eighty-five dogs were included in the study. Labrador Retrievers and Golden Retrievers represented 38% of the population. The mean age was 9.4 years. The most common presenting signs were cough, lethargy/weakness and tachypnea. Eleven dogs (13%) had clinical signs compatible with myasthenia gravis (7 were confirmed). Total calcium was high in 24/85 dogs (28%) (high ionized calcium in 25/37 dogs). Three dogs had pulmonary metastasis at the time of diagnosis. Surgery was performed in 56/85 patients. Phrenic nerve section occurred in 20% of dogs. Thirteen percent had tumor recurrence (mean 682 days post surgery, median 547d (32-2170)). Thirteen percent of dogs developed a second tumor. For dogs receiving surgery the median survival time was 758 days and without surgery was 103 days. There was no difference in survival time between dogs with and without hypercalcemia or myasthenia gravis at diagnosis.

This study confirms that thymoma is a rare disease with a good prognosis post surgery, even in dogs with a large tumor burden or presenting a paraneoplastic syndrome. An interesting finding is that 13% of dogs developed a second tumor.

ABSTRACT O-7
EVALUATION OF SECRETED FRIZZLED-RELATED PROTEIN 2 EXPRESSION IN CANINE THYROID TUMORS USING RT-PCR AND IMMUNOHISTOCHEMISTRY. K Deitz1, K Metivier2, V Wilke2, M Ackermann1, C Wang1. 1Iowa State University, College of Veterinary Medicine, Ames, IA, 2University of Minnesota, College of Veterinary Medicine, St. Paul, MN

We have previously reported up-regulation of secreted frizzled-related protein 2 (SFRP2) gene expression in canine thyroid tumors using microarray and SFRP2 protein expression and cellular localization were characterized with immunohistochemistry (IHC). The purpose of this study was to validate the gene expression of SFRP2 using RT-PCR. Additional samples were also evaluated via IHC and analyzed statistically with the samples from the initial study to increase statistical power. Tissue samples were obtained from dogs undergoing neck mass removal with informed client consent. Only dogs with thyroid carcinomas confirmed by histopathology were included in the study. Control samples of histologically normal thyroid were obtained from dogs lacking thyroid disease that were euthanized for unrelated reasons. Thyroid tumors from the dogs were categorized based on the degree of invasion: tumor cells confined to the capsule were classified as non-invasive, and those with capsular or vascular invasion were classified as invasive. There were 9 samples in each of the 3 groups (control, non-invasive, and invasive). For RT-PCR, a 1-2cm² section of tissue was placed in RNA later® and samples were assessed for RNA quality by agarose gel electrophoresis. Only samples with no evidence of degradation were used for further analysis. Beta actin was used as the internal reference gene. The mean expression of SFRP2 mRNA in invasive carcinoma was 288 times higher versus control samples. Mean SFRP2 mRNA expression in non-invasive versus control samples was 50 times higher.

Samples for IHC were placed in formalin and assessed for SFRP2 antigen using goat anti-SFRP2 antibody. There were a total of 35 tumor samples (including 20 from the previous study) and 10 controls (including 4 from the previous study). In all samples, SFRP2 antigen was present in the cytoplasm of neoplastic thyroid follicular epithelial cells. Tumor samples had significantly
Abstract of the study:

**ABSTRACT O-8: Investigating in vitro Anti-Cancer Effects of Benzimidazoles in Canine Osteosarcoma**

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Introduction: Benzimidazole (BZ) drugs have demonstrated anti-cancer effects in various tumor models and their direct effects on cell proliferation and apoptosis are hypothesized to be due to microtubule inhibitory actions as well as indirect anti-angiogenic effects via vascular disruption and VEGF modulation. Canine osteosarcoma is a common tumor with an aggressive clinical course and angiogenic phenotype. Despite advances in veterinary medicine, the overall survival has not dramatically improved in recent years, warranting investigation of novel therapies. The aims of this study were to assess effects of the clinically-used benzimidazoles [mebendazole (MBZ), fenbendazole (FBZ), and albendazole (ABZ)] in canine OSA cell lines.

Materials and Methods: Canine osteosarcoma cell lines D17 and HMPOS were incubated for 24-48 hr with varying doses of BZs (ABZ, FBZ, and MBZ). Soluble canine VEGF protein was assessed via commercial ELISA (R&D Systems).

Results: In D17 and HMPOS canine OSA cell lines BZs induce a time and dose dependent decrease in cell proliferation and modulate VEGF secretion.

Conclusions: Benzimidazole drugs (albendazole, mebendazole, and fenbendazole) demonstrate in vitro anti-angiogenic effects in canine OSA cell lines. Further investigation is ongoing to evaluate the molecular mechanisms of BZ anti-angiogenic function and the potential for BZs as novel adjuvant treatment for veterinary cancers.

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**ABSTRACT O-9: Multidrug Resistance Gene Expression by Real-Time PCR in Canine Osteosarcoma Cell Lines From Dogs Normal and Increased Serum Alkaline Phosphatase Concentration**

LCR Rodrigues 1, CM Piskun 1, V Thompson 1, TJ Stein 2. 1Department of Medical Sciences, School of Veterinary Medicine, University of Wisconsin-Madison, Madison, WI, USA

Osteosarcoma (OSA) arises from malignant osteoblasts in dogs and human and is highly metastatic and frequently develops chemotherapy resistance resulting in short survival time even for treated patients. An increase in serum alkaline phosphatase (ALP) concentration at diagnosis is a negative prognostic factor for OSA patients. We have generated canine primary OSA cells from OSA-bearing dogs with increased serum ALP concentration and have found these cells to be more resistant to chemotherapy in vitro than OSA cell lines from dogs with normal serum ALP. This study evaluated the expression of multidrug resistance genes in canine OSA cell lines generated from OSA-bearing dogs with normal and increased serum ALP concentration.

Six cell lines were used, 3 from OSA dogs with normal ALP, 3 from OSA dogs with increased ALP. Quantitative RT-PCR was used to measure the mRNA expression levels of ABCB1, ABCC1, ABCG2, and ERCC1. The ribosomal 18S mRNA was used as an endogenous reference and RNA from normal bone was used to compare against.

OSA cell lines associated with increased serum ALP have an increased relative expression of ABCB1, ABCC1, ABCG2, and ERCC1. The most striking difference was a 17-fold increase in relative expression of ABCG2 between cell lines associated with increased and normal serum ALP (3.48 vs. 0.199, respectively). In addition, the difference in relative expression was 10-fold for ERCC1 (15.61 vs. 1.52) and 7-fold for ABCG2 (5.58 vs. 0.75).

Finally, relative expression of ABCB1 was increased nearly two-fold (10.99 vs. 6.08) in cell lines associated with increased serum ALP compared to normal serum ALP cell lines. Despite these increases, the differences failed to reach statistical significance (p < 0.05) using a two-tailed Mann-Whitney test.

An increased serum ALP concentration is a negative prognostic factor in dogs with osteosarcoma. Similarly, cell lines from OSA-bearing dogs with increased serum ALP are more resistant to chemotherapy compared to cell lines from OSA-bearing dogs with normal serum ALP. We evaluated the relative expression level of multidrug resistance genes in OSA cell lines associated with different serum ALP concentrations. We found increased relative expression of 4 multidrug resistance genes in OSA cell lines associated with increased serum ALP, though the differences failed to reach significance. One potential reason for the poorer prognosis in this population may be the differences in chemosensitivity, possibly due to differences in the expression of multidrug resistance genes. However, further studies are necessary to better understand this relationship.

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**ABSTRACT O-10: Continuous Low-Dose (Metronomic) Oral Chemotherapy of Canine Appendicular Osteosarcoma**

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Osteosarcoma is the most common primary bone tumour in dogs with most dogs dying of metastatic disease despite surgery and maximum tolerated dose (MTD) adjuvant chemotherapy. In veterinary oncology, continuous low-dose (metronomic) schedules of chemotherapy have become more popular for patient management. Therefore, the purpose of this study was to retrospectively investigate the effectiveness of the addition of low-dose metronomic chemotherapy following curative-intent amputation and adjuvant carboplatinum chemotherapy to dogs with appendicular osteosarcoma.

Dogs presented to the Ontario Veterinary College with a diagnosis of appendicular osteosarcoma who underwent limb amputation followed by adjuvant carboplatinum chemotherapy were eligible for this study. Dogs completed the amputation and carboplatinum chemotherapy and either received no further treatment (control); or continued with a metronomic chemotherapy protocol (treated) consisting of cyclophosphamide (10-25 mg/m² q 24-48h); nonsteroidal anti-inflammatory (NSAID); and doxycycline (5 mg/kg q24h).

Sixty-one dogs entered the study and 21 dogs were evaluable. The control group had 13 dogs with a median metastasis-free interval of 178 days and a median survival time of 504 days. The treatment group had 8 dogs with a median metastasis-free interval of 332 days (P = 0.16) and a median survival time of 340 days (P = 0.55).

Low-dose metronomic chemotherapy had few adverse effects; however, efficacy was difficult to determine perhaps due to lack of prospective randomization of the dogs into the groups. Future studies are needed to determine selection of metronomic agents (timing and dosing schedules); biomarkers for efficacy and toxicity; and combinations with standard drug dosing, newer targeted drugs, or immunotherapy.

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**ABSTRACT O-11: Serum C-Reactive Protein Concentrations in Cats With Alimentary Lymphoma Undergoing Chemotherapy**

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C-reactive protein (CRP) is an acute-phase protein that is used as a marker of infection and inflammation. Recently, it has been used as a predictor of survival in some neoplastic conditions in dogs and human beings, but there are few studies about CRP in cats. The goal of this study was to evaluate CRP during chemotherapy and its relation with remission in cats with alimentary lymphoma. CRP was measured by the use of a commercial species-specific immunoassay test (Elisa Kit Cat CRP- Icllab – USA)
in thirteen healthy cats and eight cats with alimentary lymphoma, confirmed by histopathologic examination. The eight cats with lymphoma did not receive any treatment prior to the diagnosis. In healthy cats only one sample was collected. The cats with alimentary lymphoma were evaluated at 2-week intervals along 12 weeks, when they presented clinically stable. For both groups, samples were collected, harvested and frozen at -70°C until tested. Mann-Whitney test followed by multiple Tukey’s tests were used to compare the groups and weeks of treatment. Mean CRP concentration was significantly higher (p = 0.0002) in cats with alimentary lymphoma (270,8±112,µg/mL) at the diagnosis than in healthy cats (88,76±23,72µg/mL). At all other times while cats were in treatment, CRP concentrations decreased, specially at 12th week (181,9±86,63µg/mL) but the difference was not statistically significant (p = 0.113) in relation to the diagnosis. In conclusion, CRP concentration was higher in cats with alimentary lymphoma before chemotherapy and did not decrease to normal values during chemotherapy.

ABSTRACT O-12
SERUM AMYLOID A CONCENTRATIONS IN CATS WITH LYMPHOMA DURING CHEMOTHERAPY. VM Winkel, SRR Lucas, VABF Wirthl. School of Veterinary Medicine and Animal Science – University of São Paulo, São Paulo, SP, Brazil

Serum amyloid-A (SAA) is an acute-phase protein that has been used as a biomarker of inflammation, infection, neoplastic conditions and trauma, considered as a part of the innate host defense system. Lymphoma is one of the most common neoplasia in cats. The purpose of this study was to evaluate SAA concentrations at diagnosis and remission in cats with lymphoma. SAA was measured by the use of a commercial immunoassay kit (PHASETM Serum Amyloid A Assay (SAA) – Multispecies – Tridelta Ltd - Ireland) in two groups of cats: 13 healthy cats and 16 cats with lymphoma (alimentary, mediastinal, renal and multifocal) with chemotherapy. ANOVA test followed by multiple Tukey’s tests were used to compare the groups. The mean of SAA concentration was significantly higher (p<0.0001) in cats with lymphoma (9,72±16,34µg/mL) at the diagnosis than in healthy cats (0,05±0,13µg/mL). SAA levels decreased when lymphoma remission was achieved, and was significantly different (0,79±0,09µg/mL) until 12th week (0,36±0,49µg/mL) of treatment (p = 0.0076), when compared to the moment of diagnosis. In conclusion, SAA concentrations decreased at remission in cats with lymphoma undergoing chemotherapy but the levels didn’t return to the normal values.

SMALL ANIMAL – OTHER

ABSTRACT OT-2
HOSPITAL VERSUS COMMUNITY ACQUIRED INTRA-ABDOMINAL INFECTION OF GASTROINTESTINAL ORIGIN IN DOGS. ANK Flores, CR Sharp. Tufts Cummings School of Veterinary Medicine, North Grafton, MA

Intra-abdominal infections (IAI) are common and associated with high mortality rates in dogs. In human medicine, hospital acquired (HA-IAI) is more commonly associated with multidrug resistant (MDR) bacteria, and thus higher mortality, than community acquired (CA-IAI). The purpose of this study was to determine whether significant differences in bacterial culture and susceptibility profiles and outcome exist between HA-IAI and CA-IAI in dogs. Medical records of dogs with IAI of gastrointestinal origin were retrospectively reviewed. Age, sex, breed, etiology of infection, culture & susceptibility, and outcome were recorded. Fifty three dogs were identified; 24 had CA-IAI, 8 had HA-IAI from another hospital, 13 developed HA-IAI in our hospital. Ninety percent were in remission at the time of presentation and later developed HA-IAI, and 1 dog presented with HA-IAI and following source control developed another HA-IAI in our hospital. E. coli and Enterococcus spp. were isolated most frequently regardless of whether CA- or HA-IAI, however organisms associated with HA-IAI were more likely to be MDR. Twenty five dogs survived to discharge (47.7%), 20 (37.7%) were euthanized and 8 (15.1%) died. Dogs with HA-IAI that developed in our hospital were less likely to survive to discharge when compared with dogs presenting with CA-IAI, however this did not hold true for dogs that presented with HA-IAI from another hospital. Results suggest that dogs with HA-IAI are more likely to have infections with MDR bacteria and have a higher mortality than CA-IAI. The results of this study have implications for antibiotic choice and prognosis for dogs with HA-IAI.

ABSTRACT OT-3
MULTI-CENTER EVALUATION OF THE ADMINISTRATION OF CROTALID ANTIVENOM IN CATS. MB Pashmakova1, MA Bishop1, DM Black1, SI Johnson1, JW Bätt2. 1Texas A&M University, College Station, TX. 2Emergency Animal Hospital of Northwest Austin, Austin, TX

Anecdotally cats are considered to be relatively resistant to snake envenomation; therefore, the collective experience with antivenom administration in cats is limited. The purpose of this study was to describe administration criteria, complication frequency, and overall survival following crotalid antivenom administration in cats.

Information about antivenom administration in cats from 2000 to 2011 was gathered from facilities that frequently manage crotalid envenomations. Medical records were reviewed for patients treated with antivenom including signalment, administration criteria, prophylactic medication, antivenom product, immediate reactions, and survival. A multiple-choice answer format was used to maximize response rate and facilitate data analysis. Preliminary data were analyzed and odds ratios were calculated using a Fisher’s exact test.

Sixty-eight of 203 (33.5%) envenomated cats received antivenom. The most frequently administered product was Antivenin (Crotalidae) Polyclonal (ACP) in 57/68 (83.8%) cats, followed by polyvalent F(ab’)2 in 9/68 (13.2%) cats and Crotalidae polyclonal immune F(ab’)2 (Crofab) in 2/68 (2.9%) cats. The most frequent indication was suspected rattlesnake envenomation in 66/68 (97.1%) cats, followed by hematologic abnormalities in 39/68 (57.4%) cats. Acute hypersensitivity reactions occurred in 15 cats (22.1%), of which 14 cats received ACP. Three cats died acutely, none of which received treatment with antihistamines or glucocorticoids before administration of antivenom (OR:19.4, 95% CI:1.0-395.1, P = 0.0227). Overall, 64/68 cats (94.1%) receiving antivenom survived to discharge. In conclusion, antivenom was well tolerated in cats and survival following administration was excellent. Premedication may decrease frequency of reactions and improve survival; however, severity of illness rather than product administered may affect outcome.

ABSTRACT OT-4
ENDOSCOPIC-GUIDED LASER ABLATION OF VESTIBULOVAGINAL DEFECTS IN 36 DOGS. S Burdick, A Berent, C Langston, C Weisse. The Animal Medical Center, New York, NY

The purpose of this report is to describe and retrospectively evaluate short and long-term outcomes in female dogs after endoscopic-guided laser ablation (ELA) of vestibulovaginal septal defects.

36 female dogs with a persistent paramesonephric remnant (PPMR) (n=19), vaginal septum (n=11), or dual vagina (n=6) were included. All patients had complete cystourethrography. Simultaneous diagnosis and treatment was performed via vaginoscopic guidance. ELA was used to transect the vaginal membrane. Patients with intramural ectopic ureters (EU) were concurrently treated with cystoscopic-guided laser ablation. A repeat endoscopy was performed in 18 dogs approximately 6 weeks post ELA and all vaginal and ureteral defects were re-assessed.
26 dogs presented for urinary incontinence, 2 for recurrent urinary tract infections (UTI) and 8 for both incontinence and UTI. Thirty dogs had concurrent EU. The diode laser (n = 28) or Holmium-YAG laser (n = 8) were used. Five dogs had mild post-operative dysuria, which resolved within 24 hours. One complication occurred (laser perforation of the vaginal wall). There were no negative effects from this event and at an 8 week re-scoping the tissue was fully healed. There was significant improvement incontinence scores in all dogs (p < 0.001) and a decreased incidence of UTIs after laser correction of the congenital malformation(s) in all dogs (p = 0.0287). The median follow-up time was 33 months (2-49 months).

ELA provided an effective, safe and minimally invasive treatment for various vestibulovaginal septal remnants, avoiding the need for more invasive surgery for a disease that has an unknown significance.

ABSTRACT OT-5
18F-FLT-PET/CT FOR NON-INVASIVE FUNCTIONAL IMAGING OF CANINE BONE MARROW. JA Rowe1, CJ LeBlanc1, SA Kania1, SJ Newman1, M Akula1, GD Guyon1, MJ Long1, SJ Kenne1, GW Kabalka2, AK LeBlanc1,2. University of Tennessee College of Veterinary Medicine;
2University of Tennessee College of Veterinary Medicine, Knoxville, TN.

Non-invasive techniques to evaluate bone marrow function are needed to optimize care of dogs with suspected or confirmed hematopoietic disorders. Positron Emission Tomography/Computed Tomography (PET/CT) using 18F-fluoro-l-deoxythymidine ([18F]FLT), a PET tracer that physiologically concentrates in bone marrow and acts as a marker of cellular proliferation, offers a non-invasive imaging technique for whole-body assessment of marrow proliferation.

Three (3) clinically normal, purpose-bred dogs were imaged using 18F-FLT for assessment of bone marrow proliferation at baseline and at 7 and 14 days post administration of a single dose of cyclophosphamide (225 mg/kg i.p.) to nonselectively suppress hematopoiesis. PET/CT images were acquired with dogs under light general anesthesia following a minimum 12 hour fast. Regions of interest were drawn over sites of clinical relevance and increased tracer uptake, including common marrow sampling sites. Standardized uptake values were analyzed using dedicated analysis software. Bone marrow aspirates from both the proximal humerus and wing of the ilium were assessed within 24 hours of each imaging timepoint by cytology and flow cytometric cell cycle analysis for comparison with PET imaging findings. Cytologic analysis included estimation of overall cellularity with a 200-cell differential count discriminating cells as early erythroid, late erythroid, early granulocytic, late granulocytic, monocyte/macrophage, lymphocyte, plasma cell, or other. CBCs were assessed daily after cyclophosphamide administration.

Despite development of profound circulating neutropenia (median neutrophil nadir 500 cells/μL, 8 days post-cyclophosphamide administration), no significant changes in overall marrow cellularity were detected. Statistically significant changes between sampling timepoints were detected in the granulocytic index (ratio of early to late granulocytic precursors) in the wing of the ilium aspirates (p = 0.007), and flow cytometric cell cycle analysis was indicative of DNA insult at all sites sampled. Strong physiologic 18F-FLT uptake remained present in axial and proximal appendicular marrow sites. Changes over time in SUVmax were significant (p = 0.003) in proximal humerus but not wing of ilium sites.

Reports in humans with myeloproliferative diseases demonstrate utility of 18F-FLT-PET in characterizing such diseases. Changes observed in bone marrow samples in this study preclude correlation between 18F-FLT signal and marrow function, likely due to cyclophosphamide-induced cell cycle arrest rather than cytotoxicity. Future studies using site-specific marrow ablative techniques are planned to produce more conspicuous marrow hypocellularity.

ABSTRACT OT-6
LIPOPOLYSACCHARIDE, TUMOR NECROSIS FACTOR, AND INTERLEUKIN-1B INDUCE NT-PRO C-TYPE NATRIURETIC PEPTIDE SECRETION FROM CANINE VASCULAR ENDOTHELIAL CELLS. KA Osterbur, DH Yu, AE DeClue. University of Missouri College of Veterinary Medicine, Columbia, MO.

The N-terminal portion of pro C-type natriuretic peptide (NT-proCNP) has shown promise as a biomarker for sepsis in humans and dogs. NT-proCNP is thought to be primarily secreted from the vascular endothelium, however the mechanism of NT-proCNP induction in dogs is unknown. We hypothesized that bacterial pathogen associated molecular pattern motifs (PAMPs) would induce NT-proCNP secretion from canine vascular endothelial cells to a significantly greater degree than inflammatory mediators. To test our hypothesis, we stimulated canine vascular endothelial cells with PAMPs (lipopolysaccharide, lipoteichoic acid, and peptidoglycan), inflammatory mediators (TNF, IL-1β, IL-6, CXCL-8, IL-10, IL-21, Interferon-γ, and Vascular Endothelial Growth Factor) or control (Phosphate Buffered Saline [PBS]). Statistics were performed using the Mann Whitney Rank Sum Test or Kruskal-Wallis One Way Analysis of Variance on Ranks with post-hoc Dunn’s Method (P < 0.05 considered significant).

NT-proCNP concentrations were significantly greater after lipopolysaccharide (median, Q1, Q3: 13.3, 12.1, 14.5 pmol/L; P = 0.012) and IL-1β (24.1, 19.4, 28.1 pmol/L; < 0.001) stimulation compared to PBS (1.7, 1.1, 2.1 pmol/L). The other stimulants did not result in NT-proCNP secretion compared to PBS. Lipopolysaccharide, TNF and IL-1β induction of NT-proCNP secretion were both dose and time dependent in nature.

Of the compounds tested, IL-1β, TNF, and lipopolysaccharide resulted in the greatest CNP secretion from canine vascular endothelial cells. This study provides insight into why dogs with sepsis have higher serum concentrations of NT-proCNP when compared to dogs with other forms of critical illness.

ABSTRACT OT-7
PENTOSAN POLYSULFATE AND N-ACETYL GLUCOSAMINE COMBINATION ENHANCES INHIBITION OF INTERLEUKIN-8 PRODUCTION BY MELOXICAM IN CANINE CHONDROCYTES. KE Walker1, AN Johnson*, MW Gream1, CG Frondeza1,2. *Nutramax Laboratories, Inc., Edgewood, MD, 1Mississippi State University, Mississippi State, MS, 2Johns Hopkins University, Baltimore, MD

The pathogenesis of osteoarthritis (OA) in humans and animals is characterized by excess production of pro-inflammatory mediators including cytokines and chemokines. Chemokines such as interleukin-8 (IL-8) are thought to play a role in OA as by acting as signaling molecules and pain inducers. Meloxicam, a non-steroidal anti-inflammatory drug (NSAID), is commonly used to treat OA in dogs. However, its efficacy is hampered by life-threatening side effects ranging from the question whether dosing can be reduced through combining with other agents. Non-pharmacologic compounds, such as pentosan polysulphate (PPS) and N-acetyl glucosamine (NG), have been reported to promote chondrocyte anabolic activity and could be disease modifying. We hypothesized that the combination of [PPS+NG] enhances the effect of low concentrations of meloxicam on IL-8 production in canine chondrocytes.

Canine chondrocyte monolayer (5x104 cells/well) or microcarriers (4000 cells/flask) were used, IL-1β (1 µg/mL) was added, and meloxicam-1 (IL-1 50ng/ml) for 24 hours and then incubated with: (a) control media alone, (b) a clinically relevant concentration of [PPS+NG] (AUPEN5000TM, PPS: 125µg/mL, NG: 200µg/mL), (c) a sub-therapeutic concentration of meloxicam (11.7ng/ml), or (d) [PPS+NG] + meloxicam (11.7ng/ml) for an additional 24 hours. Cell culture supernatant was analyzed for IL-8 production by ELISA. Statistical analysis was run using one-way ANOVA and the Holm-Sidak method with significance set at P < 0.05.
Non-activated chondrocytes produced low levels of IL-8 (~5000 pg/ml) in both monolayer and microcarrier cultures. IL-1β activation increased IL-8 production (~3-fold P < 0.001). The sub-therapeutic concentration of meloxicam decreased IL-8 production by ~20-30% (P < 0.001). Treatment with [PPS + NG] reduced cytokine-induced IL-8 production by ~20-50% (P < 0.001). The combination of [PPS + NG] with meloxicam showed a more profound decrease in IL-8 production by ~50-70% (P < 0.001) in both monolayer and microcarrier cultures. Here we report that [PPS + NG], when combined with a sub-therapeutic concentration of meloxicam, potentiates the inhibition of IL-8 production in canine chondrocytes. Our finding suggests that this combination strategy may minimize adverse side effects while maintaining anti-inflammatory activity (Research supported by Nutramax Laboratories, Inc.).

**ABSTRACT OT-8**

**COMPARISON OF PCR- AND CULTURE-BASED METHODS TO EVALUATE BLOOD FROM DOGS WITH SUSPECTED SEPSIS.** RM Heilmann,1 PG Xenoulis,1 J Barr,2 SE Dowd,3 JS Suchodolski,4 JM Steiner,5 1Gastrointestinal Laboratory and, 2Small Animal Veterinary Teaching Hospital, Texas A&M University, College Station, TX, 3Molecular Research DNA Lab, Shallowater, TX

Sepsis is associated with a poor outcome in critically ill dogs. Conventional blood culture, the current gold standard method for the detection of bacteremia in veterinary medicine, is associated with a long turnaround time, a low sensitivity for some organisms, and often fails to grow bacteria after initiation of antimicrobial treatment. Polymerase chain reaction (PCR)-based diagnostics may have a high sensitivity for detecting bacterial DNA in the bloodstream allowing early initiation of appropriate antimicrobial treatment. PCR-based diagnostics may have a high sensitivity for detecting bacterial DNA in the bloodstream allowing early initiation of appropriate antimicrobial treatment. Which may improve patient outcome. Molecular techniques have been considered as ancillary tools for the detection of bacteremia and identification of pathogens in humans and also in dogs with bacterial endocarditis, but have not been reported in dogs with suspected sepsis. The aim of this study was to compare PCR analysis and culture of blood for the detection of bacteremia in dogs with suspected sepsis.

Six dogs with suspected sepsis (median age [range]: 4 [1-10] years; 4 males, 2 females), referred to the Emergency Service at Texas A&M University, and 6 healthy control dogs (median age [range]: 6 [3-9] years; 2 males, 4 females) were prospectively enrolled. Sepsis was suspected in dogs that had ≥ 2 of the established systemic inflammatory response syndrome (SIRS) criteria: hypo- or hyperthermia, tachycardia, tachypnea, leukopenia or leukocytosis, and/or an increased number of band neutrophils. Patients included in the study were diagnosed with primary gastrointestinal (n = 2), systemic (n = 2), respiratory (n = 1), or pleural (n = 1) disease; four (66.7%) of the 6 dogs with suspected sepsis had received an antimicrobial drug within 1 week prior to sample collection. Two serial samples were obtained from 1 patient. Venous blood was collected aseptically for anaerobic and aerobic blood culture. Also, an aliquot was placed into an EDTA-tube, centrifuged, and blood cells were separated from plasma. DNA was extracted using a commercial kit and included a negative control. DNA in the bloodstream allowing early initiation of appropriate antimicrobial treatment that may improve patient outcome. Molecular techniques have been considered as ancillary tools for the detection of bacteremia and identification of pathogens in humans and also in dogs with bacterial endocarditis. PCR was negative for all samples were similar among the dogs, with Bacteroides and/or Clostridium accounting for over 70% of each dog’s oral flora, followed by Porphyromonas (4-19%), Fimbicutes (2-10%), and Fusobacteria (0.5-9%). Unclassified phylum-level sequences were uncommon (< 0.02%). Dogs varied in the number of genera identified (range 39-81). Porphyromonas and Capnocytophaga were identified in all dogs, and were the most abundant genera in most dogs (45-84%, and 5-46%, respectively). Eleven different Porphyromonas species were identified from the dogs. Nine zoonotic species were identified with ≥ 3 species present in each dog: Capnocytophaga canimorsus and C. cynodegmi were the most common. Streptobacillus moniliformis (causative agent of rat-bite fever) was identified in one dog.

Our methods amplified a large number of long sequences with high organism identity, revealing the utility of this technique for investigating the canine oral flora. The high genera diversity identified for surpassed culture-based studies, demonstrating a diverse and complex oral microbiota. All dogs carried multiple zoonotic bacterial species, highlighting the zoonotic potential of the oral flora of healthy dogs. These results are in contrast with culture-based studies and indicate both a greater degree of complexity than has been previously identified and the abundance of organisms often reported as absent or rare. These data provide insight into the oral microbiome of healthy dogs; a critical step in understanding the role of oral flora in disease.

**ABSTRACT OT-9**

**METAGENOMIC INVESTIGATION OF THE ORAL MICROBIOME OF HEALTHY DOGS.** JW Stull, A Sturgeon, M Costa, AS Peregrine, J Sargeant, JS Weese, Ontario Veterinary College, Guelph, Ontario, Canada

The body harbors complex and diverse bacterial populations (microbiomes) that are important for health and disease but which have been minimally investigated. Of particular interest is the oral microbiome, as it has been implicated in several diseases of varying anatomical locations including dental, respiratory, and cardiovascular disease, as well as cancer. The development of next generation sequencing platforms and advanced bioinformatics tools has allowed for proper characterization of these vast microbial populations. The objectives of this study were to determine the bacterial flora and diversity of the canine oral cavity.

Six dogs from different households were conveniently selected and an oral sample was taken by brushing the inside mouth with a sterile toothbrush. DNA was extracted and purified, 16S rRNA gene PCR performed and PCR products sequenced using next generation sequencing.

Over 10,000 sequences with mean lengths > 500 base pairs were amplified from each sample. Relative abundance of bacterial phyla in samples was similar among the dogs, with Bacteroides spp. accounting for over 70% of each dog’s oral flora, followed by Proteobacteria (4-19%), Firmicutes (2-10%), and Fusobacteria (0.5-9%). Unclassified phylum-level sequences were uncommon (< 0.02%). Dogs varied in the number of genera identified (range 39-81). Porphyromonas and Capnocytophaga were identified in all dogs, and were the most abundant genera in most dogs (45-84% and 5-46%, respectively). Eleven different Porphyromonas species were identified from the dogs. Nine zoonotic species were identified with ≥ 3 species present in each dog: Capnocytophaga canimorsus and C. cynodegmi were the most common. Streptobacillus moniliformis (causative agent of rat-bite fever) was identified in one dog.

Our methods amplified a large number of long sequences with high organism identity, revealing the utility of this technique for investigating the canine oral flora. The high genera diversity identified for surpassed culture-based studies, demonstrating a diverse and complex oral microbiota. All dogs carried multiple zoonotic bacterial species, highlighting the zoonotic potential of the oral flora of healthy dogs. These results are in contrast with culture-based studies and indicate both a greater degree of complexity than has been previously identified and the abundance of organisms often reported as absent or rare. These data provide insight into the oral microbiome of healthy dogs; a critical step in understanding the role of oral flora in disease.

**ABSTRACT OT-10**

**EFFECTS OF SPECIMEN TYPE (SERUM OR PLASMA) ON BIOCHEMISTRY RESULTS IN HEALTHY CATS.** BS Reynolds, C Brosse, M Legras, HP Lefebvre. Clinical Research Unit, National Veterinary School, Toulouse, France

Consecutive blood collection using different tubes can be difficult in cats. Serum or heparinized plasma is usually recommended for biochemical but the potential effect of other anticoagulants is poorly documented in cats. The objective of this study was therefore to compare the concentration of routine chemical variables in serum or plasma obtained using various anticoagulants.

Eleven healthy cats were used. Blood was drawn from a jugular vein into evacuated tubes with or without anticoagulants (Li-heparin, EDTA and citrate). After centrifugation, serum/plasma was obtained by use of dry slide technology analyzer for glucose, urea, creatinine, sodium, potassium, chloride, total CO₂, calcium, phosphate, proteins, albumin, ALT and ALP. Effects of specimen type on results were assessed by analysis of variance.

Results obtained from serum and heparinized plasma were statistically different for 4/13 variables, but the observed differences were clinically irrelevant. For EDTA plasma, potassium and calcium could not be assessed. Other results were not statistically different or very close from those obtained from heparinized plasma or serum. Results obtained from citrated plasma were strongly divergent except for albumin, ALT and ALP.

In conclusion, EDTA plasma could be an appropriate alternative if needed for most biochemistry assays in cats.
ABSTRACT OT-11
COMPELLING CAT ADOPTERS: EVALUATION OF OWNERS' MENTAL HEALTH STATUS AND ATTACHMENT TO PETS IN A POPULATION OF BRAZILIAN OWNERS OF MULTIPLE CATS.
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The acquisition of domestic cats as pets constitutes a worldwide phenomenon. In highly populated areas such as São Paulo region of Brazil, keeping a less demanding pet such as a cat better suits the busy daily routines people tend to have. For some individuals, however, satisfaction seem to come from keeping many cats at once, a condition frequently considered to be a matter of animal hoarding, deleterious for both parts, the cats and the owner. In order to explore the mental health status of such individuals, a survey was conducted with 30 owners of multiple cats (i.e. 20 cats or more - group 1). Comparative groups 2 and 3 were composed by 30 owners of 1-2 cats and 30 participants who did not own any pet, respectively. A questionnaire composed by the SI-R (Saving Inventory-Revised), HAD (The Hospital Anxiety and Depression Scale) and the LAPS (Lexington Attachment to Pets Scale), all in Portuguese language, were given to the participants to answer. Results indicated more cases of anxiety among the non pet owners (i.e. 9 in 30 – versus 4 in 30 in both groups 1 and 2) and more depression cases among the owners of multiple-cats (i.e. 4 in 30 – versus 1 in 30 in group 1 and 2 in 30 in group 3). Owners of multiple cats showed higher levels of attachment to pets, but their SI-R final scores did not differ from the other groups. In several ways, owning many pets seems to impair the social aspect of the owner’s life which can lead to isolation, -this maybe the reason why more depression was seen in group 1. At least for the owners of this study, acquiring many cats maybe analogous to the habit of collecting “things”, but yet at a non-pathological degree as from the questionnaire there was no evidence of animal hoarding. Alternatively, animal hoarding does not necessarily imply hoarding in general (as evaluated in the SI-R).

ABSTRACT P-1
SMALL ANIMAL - PHARMACOLOGY
THE PHARMACOKINETICS OF SINGLE DOSE EXTENDED RELEASE KEPPRA® WITH AND WITHOUT FOOD IN HEALTHY ADULT DOGS.
MJ Beasley1, NO Cruz1, A Reche-Junior1, MCI MacPhail3, MM Brewer3, A D Ramos3, NCR Cruz2, JAE Hernandez3.
1Department of Medical Clinicals, Faculty of Veterinary Medicine and Animal Science, University of São Paulo, Brazil. 2Department of Fundamentals of Psychology, Institute of Psychology, State University of Rio de Janeiro, Brazil

Levetiracetam appears to be a safe and potentially effective anticonvulsant for the control of epilepsy in dogs. However, its efficacy is challenged by a short half-life (often less than 2 hours). This half-life often results in subtherapeutic concentrations during an 8-hour dosing interval despite high oral doses. An extended release oral preparation recently has been approved in humans, which allows less frequent dosing intervals. The purpose of this study was to evaluate the pharmacokinetics of extended release levetiracetam (Keppra XR®) tablets in normal healthy dogs after a single oral dose with the goal of establishing a dosing regimen for the commercially available tablet that would allow 12 or 24 hour dosing intervals. The effect of food on drug movement was also evaluated.

Twelve client-owned dogs weighing at least 15 kg were studied using a crossover design. All dogs received intravenous levetiracetam, followed by a 24-hour washout period and then extended release levetiracetam orally (6 each with food or following a 12 hour fast; selection was random). All doses averaged 32.67 mg/kg. Blood samples were collected for 24 or 36 hours after intravenous or oral administration, respectively. Serum levetiracetam was quantitated using an ARK Diagnostic Levetiracetam Assay. Data was subjected to non-compartmental pharmacokinetic analysis.

Keppra XR® was well tolerated. Serum levetiracetam reached the targeted therapeutic range (5 ng/mL) within 100 or 200 minutes and stayed within the range for an average of 19.8 hours (range 15-24.2) or 20.7 hours (range 16.7-28.7), in fasted and fed animals, respectively. Bioavailability and time to maximum concentration was significantly higher in fed versus fasted dogs, however, half-life was not significantly different between groups. This study supports 12 hour dosing intervals for levetiracetam when administered as Keppra XR at approximately 30 mg/kg in dogs; 24 hour intervals may be acceptable for some dogs, although monitoring is recommended to confirm.

ABSTRACT P-2
LOCAL AND SYSTEMIC EFFECTS OF A COMMERCIAL PREPARATION OF CHONDROITIN SULFATE, HYALURONIC ACID AND N-ACETYL-D-GLUCOSAMINE WHEN ADMINISTERED INTRA-ARTICULARLY OR INTRAMUSCULARLY TO HEALTHY DOGS.
CM MacPhil, MM Brewer, JR Hawley, JK Ver, MR Lappin.
Department of Clinical Sciences, Colorado State University, Fort Collins, Colorado

Products containing glycosaminoglycans (GAG) are frequently administered by various routes to dogs to aid in the management of osteoarthritis (OA). However, little information is available concerning effects of these products when administered to dogs, particularly regarding biomarkers of OA. The purpose of this study was to determine local and systemic effects of a single intra-articular (IA) administration or repeated intramuscular (IM) administrations of a formulation of chondroitin sulfate, hyaluronic acid, and N-acetyl-D glucosamine in healthy dogs.

Eight healthy, young adult, mixed sex beagles were used in this study. Using procedures approved by the Institutional Animal Care and Use Committee, blood, serum, and synovial fluid (both stifle joints) were collected on Days -7, 0, 3, 7, 14, 35, 42, 49, 56, and 63. After arthrocentesis on Day 0, 1.5 ml of Polyglycan® (Arthrodynamic Technologies, Lexington, KY) was injected into the right stifle joint. Days 14 to 35 were designed as a washout period. After sample collection on Day 35, Polyglycan® was administered IM (0.1 ml/lb) to each beagle with repeated IM injections on Days 42, 49, and 56. Complete blood cell counts (CBC) and serum biochemical profiles were performed on Days -7, 0, 35 and 63. Aggrecan synthesis (epitope CS846), GAG, and prostaglandin E2 (PGE2) concentrations from serum and the synovial fluid of the treated stifle collected at all time points were determined using previously validated assays. The dogs were observed daily for changes in appetite, attitude, ambulation, and body temperature.

Other than evidence of transient lameness (< 24 hours) following synovial fluid sampling, no other clinical side-effects were noted. There were no significant changes in CBC or biochemical results over time. There were no significant changes in serum or synovial fluid concentrations of CS846 or GAG over time. While there were no significant changes in serum concentrations of PGE2 over time, synovial fluid concentrations of PGE2 were significantly lower on Day 56 (p = 0.03) and Day 63 (p = 0.02) when compared to Day 35 concentrations.

The results indicate administration of Polyglycan® using these routes of administration and dose schedule had no measurable side-effects. Repeated arthrocentesis in the presence of these Polyglycan® protocols had no measurable effect on serum concentrations of aggrecan synthesis, GAG, and or PGE2 or synovial fluid concentrations of aggrecan synthesis or GAG. However repeated IM injection resulted in a significant decrease in synovial fluid PGE2 concentrations, which may reflect a positive influence on synovial inflammation.

ABSTRACT P-3
EFFECTS OF ORAL CYCLOSPORINE ON CANINE T-CELL EXPRESSION OF IL-2 AND IFN-γ ACROSS A 12-HOUR DOSING INTERVAL.
C Fellman, T Archer, J Stokes, K Lunsford, A Mackin.
Mississippi State University College of Veterinary Medicine, Starkville, MS

Cyclosporine is a commonly used immunosuppressive drug in dogs, but dosing is often empirical and based on clinical
response. Pharmacokinetic monitoring of blood drug levels is performed, but often does not reliably predict clinical response. Pharmacodynamic assays measuring the effects of the drug on target cells more reliably predict immunosuppressive effectiveness in humans. Our laboratory has developed pharmacodynamic assays for measuring the effects of cyclosporine on canine T-cell cytokine production. The current study evaluates the effects of cyclosporine on IL-2 and IFN-γ expression across a 12-hour dosing interval using flow cytometry, and compares these values to traditionally-measured drug levels at similar time points.

Oral cyclosporine was given to 6 healthy dogs at 10 mg/kg every 12 hrs for 8 days. Blood was drawn before treatment (baseline), and then on day 8 at 0, 2, 4, 6, 8, and 10 hrs. Cyclosporine levels were measured post-treatment via immunoassay. For cytokine assays, blood was incubated with PMA and ionomycin, CD3 was used to label T-cells, and intracellular staining of IL-2 and IFN-γ was performed. Samples were evaluated with a FACSCalibur flow cytometer, and the mean fluorescence intensity of 5,000 lymphocytes was measured at baseline and day 8 (0, 2, 4 & 8 hrs).

Flow cytometry reflected consistent suppression of IL-2 and IFN-γ expression at all time points across the dosing interval (Figures A&B). At trough drug levels, cytokine expression was most variable, but was still markedly decreased from pre-treatment levels. Blood cyclosporine levels were highly variable among dogs, but still displayed a characteristic peak and trough (Figure C).

Suppression of IL-2 and IFN-γ was consistent among all dogs tested, and the slightly more variable cytokine suppression at 0 hrs was reflective of decreased trough drug levels. Further testing of pharmacodynamic cytokine assays to assess their utility in clinic patients is indicated.

Figure A: IL-2
Figure B: IFN-γ

Figures presented as mean +/- standard deviation. IL-2 Baseline MFI 54.2; IFN-γ Baseline MFI 11.9. Percentages superimposed below data points on Figures A&B represent percentage reduction of mean MFI from these original baseline values.

SMALL ANIMAL – RESPIRATORY

ABSTRACT R-1

COMPARISON OF BRONCHOALVEOLAR LAVAGE ASPIRATION TECHNIQUES IN HEALTHY DOGS: MANUAL ASPIRATION AND SUCTION PUMP ASPIRATION. K.S. Woods, AMN Defarges, ACG Abrams-Ogg, H Dobson, L Véziené, D Bienzle. Ontario Veterinary College University of Guelph, Guelph, ON, Canada

The purpose of the study was to compare the diagnostic quality of bronchoalveolar lavage fluid (BALF) cellular component acquired by manual aspiration via polyethylene tubing (MAPT) and suction pump aspiration (SPA) via suction trap connection techniques in healthy dogs.

In vivo bronchoalveolar lavage was performed under general anesthesia using bronchoscopic guidance in twelve healthy beagles. Following passage of the endoscope, sterile polyethylene tubing was inserted through the biopsy channel and MAPT performed with a 35 mL syringe attached to the tubing wedged in the bronchus. Similarly, SPA was performed using 5kPa negative pressure applied directly to the bronchoscope’s suction valve via disposable aspiration tube. MAPT and SPA techniques were performed in randomized order in opposite caudal lung lobes of each dog. Two lavages boluses were infused at each site using a weight-adjusted aliquot volume (1 mL/kg). The BALF samples were submitted and prepared for total nucleated cell count and differential cell count. A subjective scale for quality and percent of retrieved fluid were evaluated. Results were compared using a paired Wilcoxon sign rank test.

The proportion of BALF retrieved was significantly higher (mean difference 19.02%, p = 0.001) for SPA than MAPT. From the BAL cell differential analysis, a higher percentage of epithelial cells was present when compared to SPA (mean difference = 0.8%, p = 0.05).

The results suggest that SPA provided BALF samples of higher diagnostic quality than MAPT in healthy dogs. The SPA technique may improve the diagnostic accuracy and significance of BAL in dogs.

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ABSTRACT R-2

ENVIRONMENTAL AIR QUALITY, METEOROLOGICAL FACTORS, AND FELINE RESPIRATORY DISEASE. RH Stone1, M Mason2, JR Smith3. 1College of Veterinary Medicine and 2College of Public Health, University of Georgia, Athens, GA

Poor air quality and temperature extremes increase overall human mortality and hospitalization; the effect on animal health is undetermined. This study investigated if feline respiratory disease is associated with air quality or meteorological parameters.

Retrospective case review for adult, coughing cats. Monthly meteorological and Environmental Protection Agency data were gathered for 14 cities. Relationships between environmental variables and respiratory visits was evaluated with Poisson regression analysis. Demographic data were compared using ANOVA and Chi square analysis.

Of 594,032 primary care visits, 10,483 involved coughing. Respiratory diagnoses included asthma (1,352; bronchitis (853); tracheitis (481); laryngitis (46) and pneumonia (12). Siamese cats were overrepresented in coughing and asthma/bronchitis groups (RR 1.6 [CI 1.3-1.8], p < 0.0001). A negative association existed between ambient temperature and coughing (6.0% increase in visits/10°F temperature drop, p < 0.0001). A positive association was demonstrated for relative humidity and coughing (7.0% increase in visits/10% rise in humidity, p < 0.0001). For cats with asthma or bronchitis, only a negative association between ambient temperature and cough was found (9.0 % increase in visits/10°F temperature drop, p < 0.0001). No significant association was found for particulate or ozone concentrations. The city of residence was significant in all models (p < 0.0001).

In conclusion, relative frequencies of visits for coughing, asthma or bronchitis were associated with seasonal variables. The significant variation in respiratory caseload between cities demonstrates that other seasonal and regional air quality factors may impact feline respiratory health.

ABSTRACT R-3

TRACHEAL MALFORMATIONS IN YORKSHIRE TERRIERS. E Branter, C Weisse, A Berent. Animal Medical Center, NY, NY

Tracheal collapse is a syndrome describing various forms of functionally narrowed tracheal lumens. Focal tracheal cartilage malformations in Yorkshire Terriers is a previously unclassified manifestation of this syndrome.

The purpose of this study was to describe the clinical signs, diagnostic findings, and short-term outcome following endoluminal tracheal stenting for this unique population. Medical records were reviewed of all dogs presenting to the Animal Medical Center Interventional Radiology Service with a diagnosis of tracheal malformation. Clinical signs including dyspnea, honking/raspy breathing, and coughing were each serially classified by the owner on a scale of 0-10 (absent to continuous). Outcomes and complications were reported.

Thirteen dogs, all Yorkshire Terriers, were identified to have non-traditional cartilage malformations of the trachea. Thoracic radiographs found focal collapse at the thoracic inlet in all dogs. All dogs had tracheal stent placement. Tracheoscopy was per-
formed in 11/13 dogs and all of these had evidence of “W” shaped tracheal rings. Median pre-stent coughing score was 2 (0-10), post-stent was 2 (0-2), median pre-stent honking score was 6.5 (0-10) and post-stent was 0 in all. Median pre-stent dyspnea was 5 (2-10) and post-stent was 0 (0-2). Complications occurred in 5/13; 2 stent fractures not requiring intervention and 3 tissue ingrowth (1 resolved with prednisone, 2 required stent placement).

A subset of Yorkshire Terriers exists with a unique form of the tracheal collapse syndrome that can be identified pre-operatively and is treated in similar ways with expected outcomes and complications similar to those reported with other forms tracheal collapse.

### ABSTRACT R-4

**ORAL GLUCOCORTICOIDS MAY DIMINISH EFFICACY OF ALLERGEN-SPECIFIC IMMUNOTHERAPY IN EXPERIMENTAL FELINE ASTHMA.** CH Chang, AE DeClue, LA Cohn, H Liu, CR Reinerio. University of Missouri College of Veterinary Medicine, Columbia, MO

Allergen-specific rush immunotherapy (RIT) shows promise to treat asthma; however, pet cats would likely require concurrent glucocorticoids (GC) to control serious clinical signs. How GC's immunosuppressive effects of GC would impact RIT is unknown. We hypothesized that oral but not inhaled GC will diminish efficacy of RIT in experimental feline asthma.

Cats (n=6/group) were sensitized using Bermuda grass allergen (BGA) and randomized to receive BGA-specific RIT for 9 months with oral GC (prednisolone 10 mg SID), inhaled GC (budesonide 600ug SID) or placebo for the first 6 months. Bronchoalveolar lavage fluid (BALF) % eosinophils and other immune assays were performed.

Eosinophilic airway inflammation was suppressed similarly in all groups at month 6 (oral GC 5±2%; inhaled GC 13±4%; placebo 7±2%; p=0.176). At month 9, % BALF eosinophils did not differ significantly between groups (oral GC 25±8%; inhaled GC 13±4%; placebo 11±5%; p=0.084). However, 2 cats receiving oral GC/RIT at month 9 had markedly increased % BALF eosinophils (46% and 54%), comparatively, the highest % BALF eosinophils in the inhaled GC group was 23% and in the placebo/RIT group was 29%. No significant differences were found between groups at month 6 or 9 for lymphocyte blastogenesis, % blood Tregs, numbers of IL-10 producing cells or serum BGA-specific IgE.

While there was no statistically significant effect of oral or inhaled GC concurrent with RIT on airway eosinophilia, a subpopulation of cats treated with oral GC had diminished efficacy of RIT. Thus, inhaled GC may be a better option for asthmatic cats receiving RIT.

### ABSTRACT R-5

**FELINE T REGULATORY CELLS IN BRONCHOALVEOLAR LAVAGE FLUID AND WHOLE BLOOD IN HEALTHY AND EXPERIMENTALLY ASTHMATIC CATS.** CH Chang, BD Eason, AE DeClue, CR Reinerio. University of Missouri College of Veterinary Medicine, Columbia, MO

Regulatory T cells (Tregs) dampen harmful immune responses in allergic disease and are postulated to be deficient in number and/or function in allergic asthma. Evaluation of local Tregs in the feline respiratory tract has not previously been described. The purpose of this study was to develop a flow cytometric assay to measure Tregs in bronchoalveolar lavage fluid (BALF) and whole blood (WB), and to compare the %Tregs between healthy control (n=6) and experimentally asthmatic cats (n=8).

Asthma was experimentally induced using Bermuda grass allergen and samples collected 24 h after allergen aerosol challenge. Cells were stained with feline-specific and feline cross-reactive antibodies against CD4, CD5, and foxP3. A CyAn flow cytometer was used. The gating strategy involved identifying CD5+ cells on a CD5 vs SSC plot; these cells were analyzed for double staining with CD4 and foxP3 in a dot plot. The %Tregs was compared between groups and between WB and BALF within groups using a Mann-Whitney Rank Sum Test with P<0.05 considered significant.

Results (median, range) showed detectable CD5+(CD4+foxP3+) Tregs in WB (controls: 4.1%, 1.9-4.9%; asthmatics: 3.3%, 1.9-5.8%) and BALF (controls: 4.1%, 1.6-8.9%; asthmatics: 6.7%, 3.3-9.2%) with no significant differences between groups (P=0.949). The %Tregs was significantly higher in BALF compared with WB in asthmatic (P=0.015) but not healthy (P=0.931) cats.

In conclusion, flow cytometry is useful to identify feline Tregs. Experimentally asthmatic cats have significantly more local than peripheral Tregs, perhaps suggesting attempts to increase this regulatory population to dampen aberrant airway inflammation.

### ABSTRACT R-6

**LUNG PATHOLOGY ASSOCIATED WITH TOXOCARA CATI INFECTION IN CATS IS INDEPENDENT OF DEVELOPMENT OF ADULT INTESTINAL PARASITES.** AR Dillon, DM Tillson, J Hathcock, B Brawner, R Cattley, A Wooldridge, B Welles, S Barney, L Botzman, M Sermersheim. Auburn University, College of Veterinary Medicine, Auburn, AL

Lung disease associated with migrating T cati larvae in the cat has not been defined as to the timing of the arrival of the larvae in the lung, the nature of induced lung disease, or the correlation of lung disease to relevant diagnostic techniques. The purpose of this study was to describe the progression of T cati-induced lung lesions in kittens and adult cats, and determine if medication prescribed to prevent intestinal roundworm development alters the early larval migration through the lung.

Cats in infected groups were administered 5 oral doses of L3 T cati larvae. Four month old Specific Pathogen Free (SPF) kittens were randomly divided into three groups (6/group): an infected untreated group, an uninfected untreated control group, and an infected treated group (topical moxidectin and imidacloprid at the label dose, Advantage Multi for Cats, Bayer Animal Health). Six 2-3 year old adult multiparous female SPF cats were used as an infected untreated adult group. Cats were evaluated for the progression of the lung disease by serial CBCs, BALs, fecal examinations, thoracic radiographs, and thoracic CTs. Cats were euthanized 65 days after the initial infection and samples of intestine, liver, and fixed perfused lung were obtained. Lung samples were collected for bronchial ring reactivity via in vitro challenge. Adult worms in the intestine were collected for determination of sex and length.

All adult T. cati, of all stages, were recovered in infected untreated kittens (5/6) and infected untreated adults (5/6) in numbers consistent with spontaneous natural infections; most but not all cats with adult worms had eggs identified in the feces. No adult worms were identified in the infected controls or the infected treated group. All cats in the infected groups, including untreated cats and untreated cats which did not develop adult worms, had lung pathology based on histopathology, radiographs, and CT evaluation.

Evaluation of the serial data in the infected cats demonstrated a peripheral eosinophilia (CBC) and eosinophilic cytology (BAL), which usually preceded radiographically identifiable lung lesions. Lung lesions were identified by CT on day 10 after infection and were progressive in sequential CT evaluations. Disease was not uniformly distributed among lobes or within lung lobes. Thoracic radiographs showed a classic diffuse bronchial-interstitial pattern. Pulmonary arterial, bronchial and interstitial disease were prominent histological lesions. Based on statistical evaluation of the histopathologic and CT lung scores, infected treated cats had a subtle attenuation but not prevention of lung disease compared to infected cats. Significant lung disease in kittens and adult cats is associated with the early arrival of T cati larvae in the lungs and is independent of the development of adult worms in the intestine.
ABSTRACT R-7
CERVICAL LUNG LOBE HERNIATION IN DOGS WITH COUGH AS IDENTIFIED BY FLUOROSCOPY. LA Nafe, ID Robertson, EC Hawkins. North Carolina State University College of Veterinary Medicine, Raleigh, NC

Dogs with cervical lung lobe herniation (CLLH) have been described in few case reports. In our experience, CLLH is common in dogs with cough. The purpose of this study was to characterize CLLH in dogs evaluated at a referral hospital. We hypothesized that CLLH would be a frequent finding in coughing dogs, and that herniation would be associated with a chronic cough and with intra-thoracic large airway collapse. Study dogs underwent fluoroscopic evaluation of cough from 2008-2010. CLLH was diagnosed by the transient displacement of lung cranial to a line between the manubrium and the first thoracic vertebra. Cases were eliminated if cough or forced expiration did not occur during fluoroscopy. Patient discharge summaries and reports of thoracic radiographs and fluoroscopy were reviewed retrospectively. Findings were compared between dogs with CLLH and without CLLH (controls) using routine statistical methods. P < 0.05 considered significant. Of 121 study dogs, 85 (70%) had CLLH. There was no significant difference in median duration of cough between dogs with and without CLLH (12 months and 10 months, respectively; P = 0.792). Duration of cough was < 1 month in 8 (9%) dogs with CLLH. No associations were found between signalment, body weight, presence of heart murmur, or the radiographic findings of cardiomegaly or left atrial enlargement, and CLLH. Collapse of the intra-thoracic trachea, mainstem bronchi, or either during cough as identified fluoroscopically were associated with CLLH (P = 0.001, 0.004, and 0.041, respectively). The extra-thoracic trachea was noted to kink during herniation in 33 (39%) of dogs with CLLH. CLLH was present in the majority of cases evaluated fluoroscopically for cough and was associated with intra-thoracic large airway collapse, but not duration of cough. Kinking of the trachea during herniation may contribute to progression of cough in some patients.

ABSTRACT R-8
ASSESSMENT OF ARTERIALIZATION OF PERIPHERAL VENOUS BLOOD IN WELL-PERFUSED DOGS. Y Shiroshita 1,2, Y Yamane 1. 1Department of Veterinary Surgery, Faculty of Agriculture, Tokyo University of Agriculture and Technology, Tokyo, Japan, 2Sagamigaoka Animal Clinic, Kanagawa, Japan

Multiple arterial blood gas samples are essential for monitoring a patient during perioperative and critical care. In small animals, an indwelling arterial cannula is usually used for multiple blood gas sampling, although it may cause massive hematoma from rupture of the artery. In well-perfused humans, blood obtained from a superficial hand vein after heating the hands in hot water for several minutes has been reported as an appropriate substitute for arterial samples for the measurement of pH, PCO2, and lactate. The heated-hand technique is referred to as arterIALIZATION. Multiple blood gas samples can be obtained more easily and safely with this technique than with an indwelling arterial cannula. This study aimed to ascertain if arterialized venous blood samples can replace arterial blood gas sampling in well-perfused dogs.

Blood samples from the femoral artery (A), cephalic vein (CV), and saphenous vein (SV) were simultaneously collected from 8 lightly anesthetized dogs under conditions of experimentally induced metabolic acidosis, metabolic alkalosis, respiratory acidosis, and respiratory alkalosis in each dog. Samples were analyzed for pH, PCO2, PO2, [HCO3–], and base excess for each acid-base status. Metabolic acidosis was induced by continuous infusion of 0.6 M NH4Cl in 5% dextrose, and metabolic alkalosis was induced by administration of 1 M sodium bicarbonate solution. Respiratory acid-base disturbances were induced by mechanical ventilation. The forepaw and hindpaw were continuously heated at 37°C to arterialyze CV and SV. Mean arterial pressure was maintained at more than 80 mm Hg. Statistical analysis was performed using MANOVA and linear regression. Bland–Altman plots were used to assess the degree of agreement between the blood gas values of A and arterialized CV or SV. P < 0.05 was considered statistically significant.

pH, [HCO3–], and base excess values in arterialized CV and SV exhibited no significant differences from those in A, high correlations with those in A (coefficient of determination, r2 = 0.93–0.99), and a clinically approximate agreement with those in A, respectively. PO2 values under all acid-base statuses in arterialized CV and SV were significantly lower than those in A (P < 0.01) and not correlated with those in A (r2 = 0.51–0.75), respectively. PCO2 values under metabolic acidosis in arterialized CV and SV were significantly higher than those in A (CV, 38.7 ± 2.6; SV, 37.5 ± 2.6; A, 33.2 ± 3.0 (mean ± SD) mm Hg, P < 0.01). However, PCO2 in arterialized SV was closely correlated with that in A under both metabolic and respiratory acid-base disturbances (r2 = 0.93 and 0.99, respectively). It also demonstrated clinically acceptable agreement with that in A. In conclusion, arterialized SV blood samples can replace arterial blood gas samples for the measurement of pH, PCO2, [HCO3–], and base excess in well-perfused dogs for clinical purposes.