SUMMARY
2002 ACVR ANNUAL SCIENTIFIC MEETING
DECEMBER 3-7, 2002

TUESDAY, December 3, 2002
8:00 AM  Registration
Review Session: Radiographic and Alternate Imaging Artifacts For Veterinary Imaging Residents

WEDNESDAY, December 4, 2002
Registration
7:00 AM  Veterinary Ultrasound Society Meeting
8:00 AM  Opening Session with Welcoming Comments
8:15 AM  ACVR President’s Address--- Dr. Erik Wisner
8:30 AM  Keynote Address: Academic vs. Private Radiology
Dr. Robert Bree
9:45 AM  Morning Exhibitors Break
10:15 AM  Scientific Session: Small Animal Ultrasonography
12:15 AM  Lunch
12:30 PM  Nuclear Medicine Society Meeting
1:15 PM  Scientific Session: Nuclear Medicine
3:00 PM  Afternoon Exhibitors Break
3:30 PM  Scientific Session: Equine Ultrasound, MRI & CT
4:30 PM  Scientific Session: CT Topics & Orthopedics
Scientific Poster Sessions
6:30 PM  Reception Hosted by Exhibitors
THURSDAY, December 5, 2002
7:00 AM  CT & MRI Section Meeting
8:10 AM  Keynote Address: Neuroimaging
          Dr. James Smirniotopoulos
9:25 AM  Presentation of Resident-Authorized Paper Award
9:30 AM  Morning Exhibitors Break
10:00 AM Scientific Session: MRI & CT of the Head
11:10 AM Scientific Session: Spiral CT Thorax & Abdomen
12:15 PM Lunch
1:30 PM  ACVR Business Meeting—Diplomates Only
3:00 PM  Afternoon Exhibitors Break
3:30 PM  Imaging Interpretation Session (Film Reading)
          Scientific Poster Sessions

FRIDAY, December 6, 2002
7:00 AM  DACVR in Private Practice Meeting
8:00 AM  Scientific Session: General Diagnostic Radiology
10:10 AM Morning Exhibitors Break
10:30 AM ACVR-RO President’s Address—Dr. Margaret McEntee
11:00 AM Keynote Speaker—Radiation Oncology Dr. Mackie
12:00 PM Lunch Break
1:00 PM  Scientific Session #1: Radiation Oncology
3:00 PM  Afternoon Exhibitors Break
3:30 PM  Special Session: Radiation Oncology in Private Practice
4:30 PM  Business Meeting for Radiation Oncology
          Scientific Poster Sessions
6:30 PM  Reception for ACVR-RO (All Attendees Invited)

SATURDAY, December 7, 2002
8:15 AM  Scientific Session #2: Radiation Oncology
10:00 AM Morning Exhibitors Break
10:30 AM Special Session: RADIATION ONCOLOGY--
          NASAL TUMORS
12:30 PM Open Forum—Protocols for Nasal Tumors
1:00 PM  2002 Program Adjourns
TUESDAY, December 3, 2002

Review Session: Radiographic Artifacts and Alternate Imaging Artifacts for Veterinary Imaging Residents
Moderator—Dr. Ruby Perry, Michigan State University

8:00--8:10   WELCOMING REMARKS AND INTRODUCTIONS

8:10--9:30   ARTIFACTS SEEN IN DIAGNOSTIC RADIOLOGY
Dr. Clifford R. Berry, Central Florida Veterinary Radiology

9:30--9:40   MORNING REFRESHMENT BREAK

9:40--10:25  ARTIFACTS SEEN IN DIAGNOSTIC RADIOLOGY--Continued
Dr. Clifford R. Berry, Central Florida Veterinary Radiology

10:25-11:55  ARTIFACTS SEEN IN DIAGNOSTIC ULTRASONOGRAPHY
Dr. Sally K. Mitchell, University of Tennessee

11:55-12:40  LUNCH BREAK

12:40- 1:20  ARTIFACTS SEEN IN NUCLEAR MEDICINE
Dr. Brian Poteet, Gulf Coast Veterinary Diagnostic Imaging

1:20--2:50   ARTIFACTS SEEN IN COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE IMAGING
Dr. Amy Tidwell, Tufts University

2:50--3:00   AFTERNOON REFRESHMENT BREAK

3:00--4:00   LABORATORY REVIEW SESSION—ARTIFACT CASE STUDIES
All Residents will study in Groups with Faculty Present

4:00—5:00   REVIEW SESSION AND DISCUSSION OF WET LAB CASES
All Faculty

5:00   CLOSING COMMENTS
**WEDNESDAY, December 4, 2002**

**Scientific Session: Small Animal Ultrasonography**  
**Moderator—Dr. Robert R. Badertscher II, Arboretum View Veterinary Specialists**

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<td>10:15-10:25</td>
<td>ECHOCARDIOGRAPHIC FINDINGS IN INDUCED MITRAL REGURGITATION IN 31 HOUND DOGS.</td>
<td>Dr. M. Holland</td>
<td>Auburn University</td>
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<td>10:25-10:35</td>
<td>TISSUE HARMONIC ULTRASOUND FOR IMAGING NORMAL ABDOMINAL ORGANS IN DOGS AND CATS.</td>
<td>Dr. J S Matheson</td>
<td>University of Wisconsin-Madison</td>
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<td>10:35-10:45</td>
<td>DOPPLER ULTRASOUND EVALUATION OF HEPATIC VEINS DURING VARIABLE HEMODYNAMIC STATES IN HEALTHY ANESTHETIZED DOGS.</td>
<td>Dr. T S Smithenson</td>
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<td>10:45-10:55</td>
<td>ULTRASONOGRAPHIC DIAGNOSIS OF PORTOSYSTEMIC SHUNTS AND OTHER PORTAL ANOMALIES IN DOGS AND CATS.</td>
<td>Dr. Marc-Andre d’Anjou</td>
<td>Tufts University</td>
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<td>10:55-11:05</td>
<td>PRELIMINARY STUDY OF CONTRAST HARMONIC ULTRASOUND FOR THE DIAGNOSIS OF CONGENITAL PORTOSYSTEMIC SHUNTS IN DOGS.</td>
<td>Dr. R M Salwei</td>
<td>University of Wisconsin-Madison</td>
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<td>11:05-11:15</td>
<td>ULTRASONOGRAPHIC AND RADIOGRAPHIC FINDINGS IN FELINE ACUTE PANCREATIC NECROSIS.</td>
<td>Dr. H M Saunders</td>
<td>University of Pennsylvania</td>
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<td>11:15-11:25</td>
<td>DIAGNOSTIC VALUE OF ULTRASONOGRAPHY IN DIFFERENTIATING CANINE ENTERITIS FROM INTESTINAL NEOPLASIA.</td>
<td>Dr. Dominique Penninck</td>
<td>Tufts University</td>
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<td>11:25-11:35</td>
<td>SONOGRAPHIC FEATURES OF HISTIOCYTIC NEOPLASIAS IN THE CANINE ABDOMEN.</td>
<td>Dr. R Cruz-Arambulo</td>
<td>Colorado State University</td>
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<td>11:35-11:45</td>
<td>SEQUENTIAL ULTRASONOGRAPHIC FINDINGS IN CANINE RENAL TRANSPLANTATION PATIENTS.</td>
<td>Dr. M Holland</td>
<td>Auburn University</td>
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<td>11:45-11:55</td>
<td>PREVALENCE OF POLYCYSTIC KIDNEY DISEASE IN PERSIAN AND PERSIAN RELATED CATS IN FRANCE.</td>
<td>Dr. P Y Barthez</td>
<td>Ecole Nationale Veterinaire de Lyon</td>
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<td>11:55-12:05</td>
<td>SENTINEL NODE DETECTION USING CONTRAST-ENHANCED POWER DOPPLER ULTRASOUND LYMHOGRAPHY.</td>
<td>Dr. E R Wisner</td>
<td>University of California-Davis</td>
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<td>12:05-12:15</td>
<td>EVALUATING CONTRAST ENHANCED ULTRASOUND AS A METHOD FOR CLINICAL MONITORING OF TUMOR ANGIOGENESIS IN A RAT MODEL.</td>
<td>Dr. R E Pollard</td>
<td>University of California-Davis</td>
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WEDNESDAY, December 4, 2002

Scientific Session: Nuclear Medicine
Moderator—Dr. Brian Poteet,
Gulf Coast Veterinary Diagnostic Imaging

1:15-1:25  SCINTIGRAPHIC, RADIOGRAPHIC AND ECHOCARDIOGRAPHIC EVALUATION OF CHRONIC VALVULAR DISEASE IN CAVALIER KING CHARLES SPANIELS.
Dr. A Bahr, Texas A & M University

1:25-1:35  DIAGNOSIS OF CONGENITAL CARDIAC RIGHT-TO-LEFT SHUNTS WITH 99m-Tc-MAA.
Dr. F Morandi, University of Tennessee

1:35-1:45  PORTAL STREAMLINING AS A CAUSE OF NON-UNIFORM DISTRIBUTION OF THE RADIOISOTOPE WITHIN THE LIVER DURING PORTAL SCINTIGRAPHY.
Dr. G B Daniel, University of Tennessee

1:45-1:55  AVIAN RENAL SCINTIGRAPHY.
Dr. K L Marshall, University of Tennessee

1:55-2:05  EXTRARENAL PLASMA CLEARANCE OF 99m-Tc-MAG3 IN ANEPHRIC CATS.
Dr. W T Drost, The Ohio State University

2:05-2-15  HEPATIC UPTAKE OF 99m-Tc-MAG3 IN ANEPHRIC CATS.
Dr. W T Drost, The Ohio State University

2:15-2:25  EVALUATION OF RENAL OXIDATIVE METABOLISM WITH 11C ACETATE AND POSITRON EMISSION TOMOGRAPHY (PET) IN PIGS.
Dr. P Y Barthez, Ecole Nationale Veterinaire de Lyon

Dr. L S Ziemer, University of Pennsylvania

2:35-2:45  EVALUATION OF THE USEFULNESS OF THE DYNAMIC FLOW PHASE OF 3-PHASE OF 99m-Tc-MDP SCINTIGRAPHY IN THE DIAGNOSIS OF NAVICULAR SYNDROME IN HORSES.
Dr. J F Ekedahl, University of Georgia

2:45-2:55  EVALUATION OF MOTION CORRECTED AND CONVENTIONAL STATIC EQUINE SKELETAL SCINTIGRAPHY IMAGING IN THE DETECTION OF PHANTOM LESIONS.
Dr. E A Ferrell, University of Florida
WEDNESDAY, December 4, 2002

Scientific Session: Equine Ultrasound, MRI & CT
Moderator—Dr. Ruby Perry, Michigan State University

3:30-3:40  RADIOLOGY AND ULTRASONOGRAPHY OF THE EQUINE HYOID APPARATUS.
Dr. T C Spotswood, University of Pretoria

3:40-3:50- ULTRASONOGRAPHY OF NORMAL PERIPHERAL NERVES IN THE ADULT HORSE.
Dr. K Alexander, University of Guelph

3:50-4:00  EFFECT OF PERINEURAL ANESTHESIA ON THE ULTRASONOGRAPHIC APPEARANCE OF EQUINE PALMAR METACARPAL STRUCTURES.
Dr. L J Zekas, University of Wisconsin-Madison

4:00-4:10  THE ACOUSTIC PROPERTIES OF NORMAL AND DAMAGED EQUINE TENDON.
Dr. W J Hornof, University of California-Davis

4:10-4:20  MAGNETIC RESONANCE IMAGING OF THE DISTAL LIMBS IN THE STANDING HORSE.
Dr. T S Mair, Bell Equine Veterinary Clinic

4:20-4:30  COMPUTED TOMOGRAPHY OF THE NORMAL EQUINE PITUITARY GLAND.
Dr. T L McKlveen, VA-MD Regional College of Veterinary Medicine
WEDNESDAY, December 4, 2002

Scientific Session: CT Topics & Orthopedics
Moderator—Dr. Ruby Perry, Michigan State University

4:30-4:40  COMPUTED TOMOGRAPHY OF BRACHIAL PLEXUS MASSES IN DOGS.
Dr. S R Rudich, University of Minnesota

4:40-4:50  COMPUTED TOMOGRAPHY AND TANGENTIAL VIEW RADIOGRAPHY COMPARED TO CONVENTIONAL RADIOGRAPHY IN EVALUATION OF CANINE PELVIC TRAUMA. A PILOT STUDY.
Dr. J T Crawford, University of Wisconsin-Madison

4:50-5:00  ACCURACY OF ROUTINE PATIENT SETUP USING AN IMMOBILIZATION DEVICE: COMPARISON OF SINGLE PLANE RADIOGRAPHS AND A REMOTE CT SCANNER.
Dr. C Rohrer Bley, University of Zurich

5:00-5:10  SKELETAL SIZE AND DENSITY IN SIX DOG BREEDS.
Dr. D S Rosenstein, Michigan State University

5:10-5:20  BONE BRUISE: EFFECT OF WEIGHT-BEARING STATUS ON INFLAMMATION AND ARTICULAR SURFACE VIABILITY POST ACUTE MECHANICAL INJURY.
Dr. C S Sloan, Gulf Coast Veterinary Specialists

5:20-5:30  RADIOGRAPHIC ASSESSMENT OF NORMAL HEALING AND COMPLICATIONS ASSOCIATED WITH TIBIAL PLATEAU LEVELING OSTEOTOMY (TPLO).
Dr. L M Yanik, Gulf Coast Veterinary Specialists

5:30-5:40  TREATMENT OF DEGENERATIVE LUMBOSACRAL STENOSIS IN MILITARY WORKING DOGS BY DORSAL LAMINECTOMY AND PEDICLE SCREW STABILIZATION.
Dr. K Mann, Lackland Air Force Base
THURSDAY, December 5, 2002

Scientific Session: MRI & CT of the Head
Moderator—Dr. Amy Tidwell, Tufts University

10:00-10:10  MRI FINDINGS OF INFARCTION WITHIN THE CEREBELLUM OF 6 DOGS.
Dr. J F McConnell, The Animal Health Trust

10:10-10:20  MRI FINDINGS OF L-2 HYDROXYGLUTARIC ACIDURIA IN 6 STAFFORDSHIRE BULL TERRIERS.
Dr. J F McConnell, The Animal Health Trust

10:20-10:30  CHIARI TYPE 1 MALFORMATION IN CAVALIER KING CHARLES SPANIELS: NEOLOGIC SIGNS AND MRI FINDINGS IN 40 DOGS.
Dr. C R Lamb, The Royal Veterinary College

10:30-10:40  MR CHARACTERISTICS OF CHIARI-LIKE MALFORMATION IN POMERANIANS.
Dr. R Toal, SouthPaws Veterinary Referral Center

10:40-10:50  RADIOGRAPHIC, COMPUTED TOMOGRAPHIC, MAGNETIC RESONANCE AND RHINOSECONDIC FINDINGS IN DOGS WITH NASAL ASPERGILLOSIS.
Dr. J H Saunders, Ghent University

10:50-11:00  RETROSPECTIVE ASSESSMENT OF COMPUTED TOMOGRAPHIC IMAGING OF FELINE SINONASAL DISEASE IN 62 CATS.
Dr. W C Schoenborn, University of California-Davis

11:00-11:10  RADIOGRAPHIC SIGNS IN CATS WITH NASAL DISEASE.
Dr. C R Lamb, The Royal Veterinary College
THURSDAY, December 5, 2002

Scientific Session:  Spiral CT of Lung & Abdomen
Moderator—Dr. Amy Tidwell, Tufts University

11:10-11:20  HELICAL COMPUTED TOMOGRAPHY OF THE NORMAL FELINE LUNG.
Dr. J S Mattoon, The Ohio State University

11:20-11:30  QUANTITATIVE HIGH-RESOLUTION COMPUTED TOMOGRAPHY FOR CHARACTERIZATION OF A FELINE ASTHMA MODEL.
Dr. A C Hartman, University of California-Davis

11:30-11:40  USE OF CT IMAGING FOR LYMPH NODE ASSESSMENT IN DOGS WITH PRIMARY LUNG TUMORS.
Dr. M C Paoloni, University of Wisconsin-Madison

11:40-11:50  HELICAL DUAL-PHASE CT ANGIOGRAPHY OF THE NORMAL CANINE HEPATIC VASCULATURE AND PORTAL VEIN.
Dr. A L Zwingenberger, University of Pennsylvania

11:50-12:00  HELICAL CT ANGIOGRAPHY OF CANINE PORTOSYSTEMIC SHUNTS.
Dr. A L Zwingenberger, University of Pennsylvania

12:00-12:10  COMPUTED TOMOGRAPHY OF FOCAL SPLENIC MASSES IN DOGS.
Dr. W D Fife, The Ohio State University
FRIDAY, December 6, 2002

Scientific Session: GENERAL RADIOLOGY
Moderator—Dr. William Blevins, Purdue University

8:00--8:10 COMPARISON OF SEVEN DIGITAL CAMERAS FOR DIGITIZING IMAGES.
Mr. B Brault, Kansas State University

8:10--8:20 USE OF WEB COURSE TOOLS (WEB CT) IN TEACHING RADIOGRAPHY AND ULTRASOUND.
Dr. J A Hudson, Auburn University

8:20--8:30 CONFIGURING A PACS FOR A VETERINARY TEACHING HOSPITAL.
Dr. I D Robertson, North Carolina State University

8:30--8:40 RELATIONSHIP OF RADIOGRAPHIC vs. ECHOCARDIOGRAPHIC ASSESSMENT OF FELINE HYPERTROPHIC CARDIOMYOPATHY.
Dr. J S Mattoon, The Ohio State University

8:40--8:50 DETERMINATION OF NORMAL vs. HYPERTROPHIC CARDIOMYOPATHY IN CATS USING VERTEBRAL HEART SCORE.
Dr. J S Mattoon, The Ohio State University

8:50--9:00 TRANSVENOUS COIL EMBOLIZATION OF PORTOSYSTEMIC SHUNT IN 10 DOGS.
Dr. R Leveille, Veterinary Specialty Center

9:00--9:10 THE NORMAL LEFT LIMB OF THE PANCREAS IS VISIBLE ON SURVEY RADIOGRAPHS OF FAT CATS.
Dr. W E Blevins, Purdue University

9:10--9:20 HELICAL COMPUTED TOMOGRAPHY OF NORMAL FELINE PANCREAS.
Dr. J S Mattoon, The Ohio State University

9:20--9:30 EVALUATION OF THE FELINE PANCREAS USING COMPUTED TOMOGRAPHY AND RADIO.LabelED LEUKOCYTES.
Dr. L L Head, University of Tennessee

9:30--9:40 OSTEOPETROSIS IN CATS: CLARIFICATION OF A COMMON MISNOMER.
Dr. M W Wright, Auburn University

9:40--9:50 POSITIVE AND NEGATIVE PREDICTIVE VALUES FOR DIAGNOSING CANINE URETERAL ECTOPIA USING THREE DIFFERENT IMAGING TECHNIQUES.
Dr. V F Samii, The Ohio State University

9:50-10:00 THORACIC RADIOGRAPHIC APPEARANCE IN NORMAL ALPACA CRIAS.
Mr. N C Nelson, The Ohio State University
FRIDAY, December 6, 2002

Scientific Session #1: RADIATION ONCOLOGY
Moderator—Dr. Mark Dewhirst,
Duke University Medical Center

1:00—1:14 HELICAL TOMOTHERAPY: CONFORMAL AVOIDANCE AND MEGAVOLTAGE CT IMAGING.
Dr. L J Forrest, University of Wisconsin-Madison

1:15—1:29 MEASURING HYPOXIA IN TUMORS: FROM MICE TO MEN.
Dr. S M Evans, University of Pennsylvania

1:30—1:44 OXYGEN MEASUREMENTS USING POLARGRAPHIC NEEDLE ELECTRODES IN SPONTANEOUS CANINE TUMORS DURING FRACTIONATED RADIATION THERAPY.
Dr. R Achermann, University of Zurich

1:45—1:59 EXPRESSION OF CYCLOOXYGENASE-2 IN NATURALLY OCCURRING EPITHELIAL NASAL TUMORS IN DOGS.
Dr. M Kleiter, North Carolina State University

2:00—2:14 ASSESSMENT OF VASCULARITY IN SPONTANEOUS CANINE TUMORS WITH CONTRAST-ENHANCED DOPPLER ULTRASOUND AND COMPARISON TO TISSUE OXYGEN MEASUREMENTS USING THE EPPENDORF METHOD.
Dr. B Kaser-Hotz, University of Zurich

2:15—2:29 IN-VIVO MONITORING OF REAL TIME TISSUE PHARMACOKINETICS OF LIPOSOME/DRUG CONCENTRATION USING MRI.
Dr. M W Dewhirst, Duke University Medical Center

2:30—2:44 Co ADMINISTRATION OF NON-RADIOLABELED LIPOSOMES HAS NO EFFECT ON THE INTRATUMORAL DISTRIBUTION OF 99m-Tc-LIPOSOMES IN RATS.
Dr. L A Mohammadian, North Carolina State University

2:45—2:59 IN-VIVO DOSIMETRY USING AN IMPLANTABLE TELEMETRIC DOSEMERIC DEVICE IN TUMOR BEARING DOGS.
Dr. D Ruslander, North Carolina State University
SATURDAY, December 7, 2002

Scientific Session #2: RADIATION ONCOLOGY
Moderator—Dr. Lisa Forrest, University of Wisconsin

8:15—8:29  EFFECTS OF 153-SAMARIUM-EDTMP ON PHYSEAL AND ARTICULAR CHARTILAGE IN NORMAL JUVENILE RABBITS.
Dr. S C Essman, University of Missouri-Columbia

8:30—8:44  ACCURACY OF MAGNETIC RESONANCE IMAGING FOR ESTIMATING INTRAMEDULLARY OSTEOSARCOMA EXTENT IN PRE-OPERATIVE PLANNING OF CANINE LIMB SALVAGE PROCEDURES.
Dr. S T Wallack, University of California-Davis

8:45—8:59  EFFICACY OF RADIATION THERAPY FOR INCOMPLETELY EXCISED GRADE II MAST CELL TUMORS.
Dr. V J Poirier, University of Wisconsin-Madison

9:00—9:14  VINBLASTINE, PREDNISONE AND COARSE FRACTION RADIOTHERAPY FOR HIGH-RISK, CUTANEOUS MAST CELL TUMORS IN 24 DOGS.
Dr. M M Turek, University of Wisconsin-Madison

9:15—9:29  DOSE-RESPONSE RELATIONSHIP FOR FRACTIONATED HIGH DOSE RATE BRACHYTHERAPY IN CANINE CUTANEOUS TUMORS.
Dr. A P Theon, University of California-Davis

9:30—9:44  RADIATION THERAPY AS AN ADJUVANT TO CHEMOTHERAPY IN THE TREATMENT OF CANINE LYMPHOMA.
Dr. N R Gustafson, Colorado State University

9:45—9:59  HYPOFRACTIONATED RADIATION THERAPY IN CANINE ORAL MALIGNANT MELANOMA AT TUFTS UNIVERSITY.
Dr. C Azuma, Tufts University
SATURDAY, December 7, 2002

Special Session:  RADIATION ONCOLOGY--NASAL TUMORS

Moderator—Dr. Michael Walker, Texas A & M University

10:30--10:44  2-D VERSUS 3-D TREATMENT PLANNING FOR NASAL TUMORS.
Dr. D Ruslander, North Carolina State University, Abstract Not Available

10:45--10:59  USE OF A SOFT TISSUE EQUIVALENT MATERIAL INSIDE THE
CANINE NASAL CAVITY TO MAXIMIZE MEGAVOLTAGE DOSE
DISTRIBUTION TO THE FLOOR.
Dr. M Cohen, Auburn University

11:00--11:14  ACCELERATED RADIOThERAPY FOR CANINE NASAL
NEOPLASIA.
Dr. E M Green, University of Wisconsin-Madison

11:15--11:29  PRESURGICAL ACCELERATED RADIOThERAPY FOR CANINE
NASAL TUMORS.
Dr. W M Adams, University of Wisconsin-Madison

11:30--11:44  WHAT IS A RADIOSENSITIZER (?) : UPDATE ON GEMCITABINE
FOR CANINE SINONASAL CARCINOMA AND FELINE ORAL
SQUAMOUS CELL CARCINOMA.
Dr. T A LaDue, Florida Vet. Specialists & Southwest Vet. Oncology

11:45--11:59  IRRADIATION AND CARBOPLATINE CHEMOTHERAPY FOR
TREATMENT OF ADVANCED CANINE INTRANASAL
CARCINOMAS.
Dr. A P Theon, University of California-Davis

12:00--12:14  IRIDIUM BRACHYTHERAPY FOR NASAL TUMORS.
Dr. W Adams, University of Tennessee, Abstract Not Available

12:15--12:29  NORMAL TISSUE MORBIDITY FROM IRRADIATION OF NASAL
TUMORS.
Dr. S M LaRue, Colorado State University, Abstract Not Available

12:30---1:00  AUDIENCE INPUT REGARDING TREATMENT PROTOCOLS FOR
NASAL TUMORS AND SUGGESTED CHANGES FOR THERAPY.
Open Forum

1:00  2002 ACVR-RO Program Adjourns
HELICAL COMPUTED TOMOGRAPHY OF THE NORMAL FELINE THYROID.
   Dr. W T Drost, The Ohio State University

QUANTITATIVE EVALUATION OF PERFUSION AND PERMEABILITY USING
CONTRAST ENHANCED COMPUTED TOMOGRAPHY IN AN INDUCED RAT
TUMOR MODEL.
   Dr. R E Pollard, University of California-Davis

MAGNETIC RESONANCE IMAGING (MRI) FINDINGS OF PRIMARY BRAIN
   Dr. J M Gonzalo-Orden, Veterinary Faculty of Leon, Spain

MAGNETIC RESONANCE ANATOMY OF THE NORMAL CANINE NASAL
CAVITY AND FRONTAL SINUSES.
   Dr. J H Saunders, Ghent University

OBSERVER DIFFERENCES IN THORACIC RADIOGRAPHIC ASSESSMENT OF
NORMAL CATS AND CATS WITH HYPERTROPHIC CARDIOMYOPATHY.
   Dr. J S Mattoon, The Ohio State University

SONOGRAPHIC FEATURES OF CANINE EMBRYONIC AND FETAL DEATH.
   Dr. R Cruz-Arambulo, Colorado State University

SOME VARIATIONS IN THE RADIOGRAPHIC APPEARANCE OF THE NORMAL
CANINE ANCONEAL PROCESS (PROXIMAL MARGIN).
   Drs. S K Kneller & M Bischoff, University of Illinois

A SONOGRAPHIC IMAGING PROTOCOL FOR EVALUATION OF THE CANINE
ELBOW.
   Dr. V W Knox, University of Pennsylvania

DEGENERATIVE JOINT DISEASE IN FELINE HIP JOINTS: A RETROSPECTIVE
RADIOGRAPHIC SURVEY.
   Dr. H Kamishina, University of Florida
Echocardiographic findings in induced mitral regurgitation in 31 hound dogs.
M. Holland DVM, MS, J. Hudson DVM, PhD, G. H. Hankes DVM, PhD, A.R. Dillon DVM, MS, MBA, P.E. Rynders DVM, MS, J.C. Wright DVM, MS, PhD, K. Chandler BS, L. J. Dell’Italia MD

Introduction/Purpose: Standard echocardiographic protocol at Auburn University College of Veterinary Medicine include M-mode evaluation of right ventricle/left ventricle, aorta to left atrium, and e point septal separation. Longitudinal dimension of the left atrium was measured. In addition, Doppler of all valves was performed using pulsed/continuous wave Doppler +/- color Doppler. Additional echocardiographic parameters have been suggested for the evaluation of cardiac diseases. Some of these parameters include left ventricular mass, left ventricular volume, shortening area, Doppler inflow of mitral valve, isovolumetric relaxation time, Doppler of pulmonary venous flow patterns, and proximal isovelocity surface area.

Methods: Thirty-one normal hound dogs had baseline echocardiogram followed by chordal rupture under fluoroscopic guidance. The dogs were randomly allocated to 4 groups. Echocardiograms were repeated at either 2 or 4 weeks post induction of mitral regurgitation (MR). The four groups of dogs by random assignment included: 1.) 2 week post MR induction (n=8) 2.) 2 week post MR induction with toprol treatment (n=6) 3.) 4 week post MR induction (n=8) 4.) 4 week post MR induction with toprol treatment (n=9).

Results: Preliminary statistical analysis using SAS program shows significant differences in most of the standard echocardiographic parameters when comparing baseline to post induction values. Left ventricular mass, left ventricular volume, area of left ventricle in diastole, left ventricular ejection time, left ventricular ejection time index, longitudinal left atrial diameter, mitral peak E and A wave were significantly different from baseline values. Additional statistical analysis will be discussed.

Discussion/Conclusion: Preliminary results indicate many other echocardiographic parameters not included in a standard echocardiogram may be beneficial in evaluation of induced mitral regurgitation.
TISSUE HARMONIC ULTRASOUND FOR IMAGING NORMAL ABDOMINAL ORGANS IN DOGS AND CATS

J. S. Matheson DVM, R. T. O'Brien DVM, MS, F. A. Delaney RDMS. University of Wisconsin-Madison, 2015 Linden Drive, Madison, WI 53706

**Introduction:** Harmonic ultrasound has been used to image bubble contrast agents in human medicine for many years. Recently the principles of filtering the received signal to detect harmonic frequencies have been applied to non-contrast harmonic ultrasound. Tissue harmonic ultrasound has been shown to improve conspicuity of certain lesions and of normal organs in many human patients. The goal of this project was to evaluate the usefulness of tissue harmonic ultrasound for characterizing normal abdominal organs in cats and dogs.

**Methods:** Normal cats (n=38) and dogs (n=40) were imaged with fundamental ultrasound and tissue harmonic ultrasound using a General Electric Logic 700 ultrasound machine system. Images of the liver, gall bladder, spleen, left kidney, urinary bladder and jejunum were collected in all animals. Images of the left adrenal gland were collected in all dogs. Image quality was subjectively optimized by adjustments of the overall gain and the number and location of focal zones. Conspicuity was subjectively assessed by 3 readers independently as the image with the best detail, contrast and spatial resolution, and the least noise. Non-parametric statistical analyses consisted of the Wilcoxin signed rank test and a level of significance of p = 0.05.

**Results:** All cats and dogs had improved imaging with tissue harmonic ultrasound. The number of organs with improved conspicuity ranged from one to all organs imaged. The most common organ to have improved conspicuity was the jejunum (100 percent of dogs and 89 percent of cats). Significant improvement by tissue harmonic ultrasound was seen in images of gall bladder (p=0.05) and left adrenal gland (p=0.02) in dogs, and spleen, urinary bladder, and intestinal images (p=0.01) in cats. Significant improvement was seen in tissue harmonic ultrasound images of the gall bladder in dogs weighing greater than 16 kilograms (p=0.03) and in the images of the urinary bladder of dogs weighing less than 16 kilograms (p=0.02). No significant relationship between body weight and tissue harmonic image quality was noted. Subjectively, images of thin patients improved with tissue harmonic ultrasound as often as images of obese patients.

**Discussion:** Tissue harmonic ultrasound improved image quality in all cats and dogs. The improvement of the jejunum in dogs was 100%. Improved image quality over a range of organs indicates the usefulness of this modality. Sonographers should be cognizant of the potential benefits of tissue harmonic ultrasound and consider the use in all dog and cat patients. These data suggest that the improvement of the ultrasound image with tissue harmonic ultrasound is consistent but not predictable.
DOPPLER ULTRASOUND EVALUATION OF HEPATIC VEINS DURING VARIABLE HEMODYNAMIC STATES IN HEALTHY ANESTHETIZED DOGS. TS Smithenson DVM, JS Mattoon DVM, JD Bonagura DVM, MS, E Abrahamsen, DVM, WT Drost DVM. Department of Veterinary Clinical Sciences, The Ohio State University, Columbus, OH 43210.

Introduction Hepatomegaly and ascites are common clinical findings often evaluated by ultrasonography. Evaluation of hepatic venous size is often used in veterinary practice as a subjective estimate of right atrial pressure. In human patients with heart disease, deviations from normal hepatic venous flow patterns have been observed in cardiac dysfunction; however, quantitative studies of hepatic venous flow have not been published for dogs. The purpose of this study was to determine qualitative and quantitative variables of hepatic venous flow in dogs using pulsed-wave Doppler ultrasonography (PWD) during varying hemodynamic states, including one characterized by cardiac depression and elevated right atrial pressure.

Methods Ten healthy dogs were studied. Hepatic venous flow measured by (PWD) simultaneously with central hemodynamics. Dogs were sedated with butorphanol and acepromazine, induced to anesthesia with thiopental and diazepam, and maintained using graded levels of isoflurane in oxygen. Catheters were placed percutaneously for direct measurements of arterial blood pressure, right atrial pressure, pulmonary artery pressure, and cardiac output (by thermodilution). Dogs were placed in dorsal recumbency and PWD waveforms were acquired from either the right medial or quadrate hepatic vein. Hepatic venous a-, v-, S-, and D-waves were identified relative the recorded electrocardiogram and as previously described in human studies. Maximum velocities were recorded for each waveform across four discrete hemodynamic periods. Period 1 (baseline) represented a light plane of isoflurane anesthesia. Period 2 (cardiovascular depression) was obtained with a constant rate infusion of esmolol and a high-inspired concentration of isoflurane. During Period 3 (cardiac depression/volume expansion), esmolol and high-dose isoflurane were continued but cardiac filling pressures were increased 2 to 3 fold over Period 2 by the rapid infusion of lactated Ringer’s solution. Period 4 (adrenergic stimulation) represented a high cardiac output state achieved by infusion of dobutamine. Mean (or median) values for hemodynamic and PWD velocities (in cm/sec) were compared across the four treatment periods using repeated measures ANOVA. When significant differences (alpha <0.05) were identified by ANOVA, Tukey’s or Dunn’s post-test was used for multiple pairwise comparisons.

Results The four distinct waveforms identified in human patients were evident in dogs during each study period. The S- and D-waves consistently demonstrated antegrade flow and the a-wave retrograde flow in the examined veins. The v-wave was small and may be difficult to assess clinically. Except for Period 4 (adrenergic stimulation), S-wave was > D-wave was > a-wave was > v-wave (p <0.05). In period 4, S- and D-waves were not different and the amplitude of the a-wave was increased.

Conclusion Consistent hepatic venous waveforms were recorded by PWD under varying hemodynamic conditions in healthy dogs. The S-wave was of greatest amplitude and increased the most in response to volume infusion. Catecholamine infusion increased the magnitude of the a-wave, suggesting augmented atrial contractility. Clinical utility of these findings requires further study in awake dogs and in canine patients.
ULTRASONOGRAPHIC DIAGNOSIS OF PORTOSYSTEMIC SHUNTS AND OTHER PORTAL ANOMALIES IN DOGS AND CATS
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Introduction: Ultrasound (US) has become an important tool in the evaluation of portal vascular anomalies in dogs and cats. Congenital portosystemic shunts (PSS), microvascular dysplasia (MVD) and acquired PSS, secondary to cirrhotic or non-cirrhotic portal hypertension (NCPH), have been well described in the literature. The purpose of this study was to evaluate the usefulness of US in a large group of dogs and cats with different portal venous anomalies (PVA), and to evaluate new parameters that can increase diagnostic accuracy.

Material and methods: Eighty-six dogs and 17 cats presented with a clinical history suggestive of PSS between 1998 and 2002 were retrospectively and prospectively evaluated. The diagnosis was confirmed using nuclear scintigraphy, portography, surgery, necropsy, and/or sufficient clinical data. The morphology of the PSS was based on portography and/or surgery. Signalment, elevated bile acids, ammonium and liver enzymes, and liver biopsies were evaluated when available. US parameters included: liver and kidneys size, presence of portal markings, uroliths, ascites, portal vein (PV), caudal vena cava (CVC) and aorta (Ao) diameters at the porta hepatitis and PSS diameter. PV/CVC, PV/Ao and PSS/Ao ratios were calculated. Portal flow (mean velocity and variation), and presence of turbulence in the CVC were reported when possible. The PSS were subdivided in congenital extrahepatic (EH) (portocaval or portoazygos), intrahepatic (IH), and multiple acquired (MA). Sensitivity, specificity, and positive and negative predictive values of US for detecting and classifying PSS were calculated.

Results: Forty dogs and 9 cats had a congenital PSS. Six dogs had MA PSS, 4 due to non-cirrhotic portal hypertension. 6 dogs and 1 cat had MVD. 29 dogs and 8 cats had no PVA and were used as control. The signalment and biochemical changes in different groups were similar to previous reports. US was 92% sensitive, 98% specific, and had a respective positive and negative predictive value of 98% and 89% in identifying PSS. US was accurate in differentiating EH, IH and MA PSS in 53/59 of cases and could precise the subdivision in 45/53 of the cases. The combination of a small liver, large kidneys and uroliths had respective positive and negative predictive value of 100% and 51% for the presence of PSS. The correlation between PV, Ao, and CVC diameters, and body weight was significant in control dogs (r>0.709, p<0.001). A significant difference was found in PV/Aorta and PV/CVC ratios between dogs and cats without PSS and those with EH PSS (p<0.001). PV/Aorta ratio <0.65 was 100% specific in predicting an extrahepatic PSS or portal hypoplasia (NCPH), and a ratio >0.8 consistently ruled out the presence of congenital EH PSS. MVP could not be differentiated from control dogs. The EH shunt diameter was 0.60 cm (0.45-1.10) in dogs and 0.50 cm (0.4-0.66) in cats. Median diameter of IH shunts in dogs was 0.95 cm (0.6-1.8). PV/CVC ratio positively correlated with age at the time of diagnosis in dogs with EH PSS (r=0.46, p=0.025).

Conclusion: Combination of several US parameters allows a higher confidence level in evaluating dogs and cats with suspected PSS or other portal vascular anomalies.

Introduction/Purpose: In veterinary medicine one of the biggest sonographic challenges in the clinical evaluation of liver disease is the diagnosis of portosystemic shunts (PSS) in dogs and cats. Contrast harmonic ultrasound has been used to evaluate macrovascular and tissue perfusion patterns of the liver in human patients and normal dogs. The purpose of this study was to determine if combined vascular and perfusion contrast harmonic ultrasound was useful for detecting increased hepatic arterial blood flow as an indicator of PSS in dogs.

Methods: Four dogs with surgically confirmed PSS were evaluated using an ultrasound machine with contrast harmonic capabilities. Four dogs were imaged with a General Electric Logic 700 ultrasound machine system with both single pulse perfusion and coded angiographic settings, and one dog was imaged in perfusion mode only using Esaote Megas ES. Single pulse perfusion settings utilize low mechanical indexes with delayed image viewing at one frame per second on the Logic 700 and real-time image viewing on the Esaote Megas ES, while coded angiographic ultrasound on the Logic 700 utilizes a high mechanical index during real time imaging. Transverse plane images of the liver were obtained from a dorsal right intercostal window. All images were directly digitized and stored on a digital video camera. Pixel intensity was calculated using National Institute of Health image analysis of one-second frame images taken from the tissue perfusion data. A 1 cm² region of interest was used when determining pixel intensity. Time-intensity curves were generated providing the data for calculations of inflow slope and time to peak enhancement. Statistical analysis was performed using a two-way ANOVA.

Results: Coded harmonic angiographic macrovascular ultrasound displayed increased size and tortuosity of the hepatic arteries. Single pulse perfusion harmonic imaging provided contrast enhancement time-intensity curves from regions of interest in the liver. The mean (+/- standard deviation) peak perfusion time of dogs with PSS were significantly (p < 0.01) shorter (7.8 +/- 2.6 seconds) than reported in normal dogs (22.8 +/- 6.8 seconds). The mean contrast inflow slope for the dogs with PSS (18.5 +/- 10.8 pixel intensity units (PIU)/sec) was significantly (p < 0.01) greater than reported for normal dogs (3.6 +/- 1.4 PIU/sec). These results indicate that combined coded harmonic angiographic and single pulse perfusion contrast harmonic ultrasound can be used to detect increased hepatic arterial blood flow as an indicator of PSS in dogs.

Discussion/Conclusions: Increased rate of perfusion and shorter time to peak perfusion are likely a result of increased hepatic arterial blood flow in dogs with PSS. This study indicates the possible clinical utility of contrast harmonic ultrasound for the qualitative assessment of increased hepatic arterial blood flow an indicator of portosystemic shunting due to congenital extrahepatic PSS.
INTRODUCTION/PURPOSE:
Acute pancreatic necrosis (APN) is now well recognized as a feline gastrointestinal disorder of significant morbidity and mortality, although ante-mortem diagnosis continues to be a difficult challenge. The aim of the study was to review the ultrasound findings of cats with necropsy- and histology-confirmed APN, and to analyze factors contributing to the apparent inability of ultrasound to consistently diagnose pancreatic necrosis ante-mortem.

METHODS:
Cats were identified from pathology records between January 1994 and June 2001. Cats were included in the study if necropsy and histopathology confirmed APN, clinical history and laboratory data were consistent with APN, complete abdominal ultrasound examination was available for review, and less than 72 hours had elapsed between the last ultrasound exam and necropsy. Cats with suppurative and chronic, non-suppurative pancreatitis, pancreatic neoplasia, and pancreatic nodular hyperplasia were excluded from the study. Gross pathologic, histopathologic, radiographic and ultrasonographic results were reviewed. Anatomic localization of APN was determined from the gross pathology report; duration, severity, and location were determined from review of histopathologic specimens. The final ultrasound report and the ultrasonographic permanent images were reviewed, and thoracic and abdominal radiographic studies were reviewed, if available.

RESULTS:
The pancreas was considered ultrasonographically normal in 10 cats, compatible with pancreatitis in 7 cats and not observed in 3 cats. The pancreatitis in the 7 cats diagnosed using ultrasound was multifocal in all cats on gross pathology; the majority were acute or subacute (n = 5) with severe or moderate necrosis (n = 6) on histopathology. The 13 cats with a normal appearing or unobserved pancreas on ultrasound were mostly multifocal (n = 8) but others were focal (n = 2) or normal (n = 3) on gross pathology. The pancreatitis in a majority of these cats was peracute or acute (n = 11) and although most had severe or moderate necrosis (n = 8), the remaining had mild or minimal necrosis on histopathology. Thoracic and abdominal radiographic findings were non-specific. There was no significant difference in experience level between ultrasonologists who did (median, 2.5 years) or did not (median, 2.5 years) diagnose APN.

CONCLUSION:
The ultrasonographic diagnosis of feline APN using established criteria was made in only 35% of 20 cats with confirmed APN. We conclude that: (1) the low sensitivity of ultrasound in diagnosing feline APN may be due to inherent subtleties in feline pancreatic parenchymal changes and/or inappropriate ultrasound criteria, and, (2) new ultrasonographic criteria must be established if abdominal ultrasound is to be an effective diagnostic tool in cats with pancreatitis.
Diagnosis Value of Ultrasonography in Differentiating Canine Enteritis from Intestinal Neoplasia

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Introduction: Intestinal wall thickening and length of the intestinal lesion, integrity of wall layers, regional lymph node involvement, and regional motility are useful ultrasonographic (US) features in the evaluation of gastrointestinal diseases. The goals of our study were to review the US features of a large population of dogs diagnosed with intestinal inflammatory or neoplastic disorders, and to evaluate the effectiveness of separate and combined US features as predictive factors in differentiating non-specific enteritis (NSE) and intestinal neoplasia.

Material & Methods: One hundred and fifty histopathologically confirmed cases of canine intestinal disease were retrospectively evaluated. Final histopathological diagnosis was obtained via surgical biopsy, endoscopic biopsy, ultrasound-guided fine needle aspirate/biopsy, or necropsy. Signalement (breed, age, and sex), and main presenting signs were recorded for each dog. Ultrasonographic features that were recorded included: maximum wall thickness and length at the lesion site, wall layering, location of the affected bowel segment, maximum thickness of enlarged regional lymph node, and intestinal motility. The hard copies and US reports of all dogs with confirmed inflammatory or neoplastic intestinal diseases were reviewed. Statistical significance and comparisons (between NSE and tumors cases) of selected variables such as age, sex, maximum wall thickness, length of the lesion, and wall layering were performed using Mann-Whitney test (for the continuous variables, age and maximum thickness), and Chi-Squared test (for the categorical variables of sex, length of lesion, and wall layering). Sensitivity, specificity, positive and negative predictive values were calculated for several factors: age, sex, maximum wall thickness, wall layering, and lesion length.

Results: The series included 61 dogs with NSE and 89 dogs with intestinal neoplasia. The most common clinical signs reported were vomiting, diarrhea, anorexia, weight loss, lethargy, and melena. The mean intestinal wall thickness of the NSE lesions was 0.7 +/- 0.4 cm. The intestinal tumors had a mean thickness of 1.9 +/- 1.3 cm. In dogs with NSE, 26.3 % retained normal wall layering, 62.3 % had affected layering, and 11.4 % lost wall layering. In the dogs with intestinal tumor, 1.1 % had affected layering and 98.9 % had lost layering. The mean length of the NSE lesions was 30.5 +/- 15.6 cm. Intestinal tumors had a mean length of 7.0 cm +/- 5.3 cm. Lymph node mean thickness in 24/61 dogs with NSE was 1.05 +/- 0.5 cm. The mean thickness of the lymph nodes in 56/89 dogs with intestinal tumors was 2.2 +/- 1.7 cm. Multivariate analysis (stepwise logistic regression) revealed that loss of wall layering alone was the only independently predictive factor for whether an intestinal lesion was caused by neoplasia or inflammation with a positive predictive value of 0.93 and a negative predictive value of 0.98.

Conclusion: Ultrasonography is a very useful technique in distinguishing NSE from intestinal tumors. A multivariate analysis showed that loss of wall layering alone was an excellent predictive factor in determining the presence of an intestinal tumor.
Sonographic features of histiocytic neoplasias in the canine abdomen.
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Introduction
Malignant histiocytosis (MH) and malignant fibrous histiocytoma (MFH) are neoplastic transformations of histiocytes. Some tumors may present histologic features of both MH and MFH and so are defined as histiocytic sarcoma (HS). The purpose of this retrospective study is to describe the ultrasonographic features of MH, MFH and HS in abdominal organs of dogs.

Material and Methods
The medical records of 18 dogs that had undergone abdominal sonography and had a histopathologic diagnosis of abdominal MH, MFH or HS were reviewed. The ultrasound images were analyzed for the distribution, number, size, echogenicity and border definition of nodules.

Results
The organ mostly affected on histopathology was the spleen (15/18). MH was the most common (11/15) followed by HS (3/15) and MFH (1/15). Splenic sonography (11 dogs) revealed multiple hypoechoic nodules with well-defined borders (10/11). In one dog with no splenic masses, the spleen was enlarged and diffusely hypoechoic. The liver was the second most commonly affected organ (12/18). MH was the most common histiocytic neoplasia (7/12), followed by HS (4/12) and MFH (1/12). The sonography revealed (9/10) multiple hypoechoic nodules with well-defined borders. One dog had no liver mass but the liver was subjectively enlarged and diffusely hypoechoic. The diameter of the nodules seen in the spleen and liver ranged from 5 to 50 mm. Eleven abdominal lymph nodes were affected in 5/18 patients. MH was the only histological diagnosis. Sonography revealed enlarged, hypoechoic lymph nodes. Lymph node size was 15 – 75 mm (mean 39.54 mm). MFH was the only neoplastic type present in the kidneys (2/18). Sonography revealed a single heteroechoic renal mass with well-defined borders. The renal masses in the two dogs measured about 70 x 110 mm and 60 x 70 mm and they occupied most of the renal parenchyma. The stomach was affected in one patient (1/18) with MH. Sonography revealed a single well circumscribed hypoechoic mass with well defined borders. Normal layers of the wall of the stomach were not seen in the area occupied by the mass.

Discussion and conclusions
In this study it was not possible to differentiate between MH, MFH, and HS based on the ultrasonographic findings. The presence of multiple well defined hypoechoic nodules was the most common sonographic pattern in the liver and spleen regardless of the histologic classification of the type of histiocytic disorder. The lesions due to MFH in the kidneys were characterized by a single heteroechoic mass. The variation of the sonographic appearance could arise from the presence of more fibroblastic tissue with MFH. The hypoechoic nodules in the liver and spleen produced by MH and HS have the same sonographic pattern observed in other benign and malignant diseases. The diffuse enlargement of the lymph nodes is also observed with infection and neoplastic lymphadenopathy. Unfortunately, the ultrasonographic findings alone can not lead to a diagnosis of MH, MFH or HS, but must be correlated with additional information such as history, signalment, clinical, laboratory findings, and histopathology to establish an accurate diagnosis. However, abdominal MH and MFH appear to have different sonographic features but this issue needs further investigation.
Introduction/Purpose: Ultrasound evaluations of renal transplantation human patients have been by real time imaging, resistance index, acceleration time, acceleration index; pulse/continuous wave Doppler, color Doppler, and power color Doppler imaging. All these methods have been investigated to predict renal transplantation rejection. Recently grading of the power color Doppler image of the kidney vascular pattern has been used to study perfusion. These parameters were evaluated in canine renal transplantation patients to determine if signs of rejection could be determined. The gold standard for renal transplantation rejection remains a renal biopsy.

Methods: Eleven related mongrel healthy dogs had renal transplantation with or without bone marrow transplantation. After surgery each dog had a single functioning kidney from an identical, haploidentical or mismatch donor. Five mongrel dogs were evaluated on a monthly basis for changes in the renal size, renal pelvis, ureteral transplantation site, resistance index, velocity in the renal artery and vein (origin, middle, and hilus), acceleration time, and acceleration index. Power Doppler imaging was followed in each dog. Three other dogs from an earlier study were evaluated every three months. Renal biopsy was performed on the 5 dogs approximately one year post transplantation. Renal biopsy was performed approximately three years in the two surviving long-term dogs. Urinalysis +/- culture and sensitivity was collected on a monthly basis.

Results: The problems encountered in these patients were recurrent UTI, pyelonephritis, renal infarction, renal pedicle torsion, intussusception, esophageal stricture, and ureteral stenosis. Elevated renal venous flow was detected initially from the anastomosis site at the caudal vena cava and latter to the level of the hilus of the kidney. Renal artery stenosis was not detected in the 8 dogs followed over the last year. The kidneys transfixed on the midline had altered blood flow with varying degrees of urinary bladder distension as compared to those transfixed laterally to the body wall. Statistical analysis will be discussed.

Discussion/Conclusion: The problems encountered in the canine renal transplant model were similar to those described in the human literature. As seen in human medicine, sequential ultrasound evaluations were critical in evaluation of the renal transplantation patients. Renal biopsy remains the definitive method for diagnosing renal allograft rejection.
PREVALENCE OF POLYCYSTIC KIDNEY DISEASE IN PERSIAN AND PERSIAN RELATED CATS IN FRANCE.

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Introduction/Purpose : The prevalence of polycystic kidney disease (PKD) has been estimated in the USA, Australia, UK and Germany. No data are available to date in France. The purpose of this study was to determine prevalence of PKD in persian and persian related breeds of cats in France.

Materiel and Methods : Medical records of all healthy cats presented for ultrasonographic screening of PKD between December 2000 and April 2002 were analyzed from 2 centers (ENVL and ENVA). Breed, age and gender were collected. Ultrasonographic examination was performed in all cats by an ACVR or ECVDI diplomate using a VingMed CFM 810 with a 5-9 MHz mechanical transducer (ENVL) and an ATL HDI 3500 with a sectorial 5-8 MHz and a linear 7-12 MHz transducer (ENVA). Cats were classified as positive when at least one anechoic cavity was found in at least one kidney. Prevalence of PKD was compared between the 2 screening centers, between different breeds evaluated, and between male and female using Chi-square test. Hypotheses tested were accepted for P-value less than 0.05.

Results : 303 cats were examined, including 85 at ENVL (50 Persians, 22 Exotic Shorthair, 7 Chartreux, 4 Norwegian Forest Cats, and 2 Abyssins) and 218 at ENVA (163 Persians, 42 Exotic Shorthair, 4 Chartreux, 4 British Shorthair, 2 American Whirehairs, 2 Norwegian Forest Cats, and 1 American Shorthair). Prevalence of PKD was 41.8 % in Persian cats and 39.1% in Exotic Shorthair. No PKD was detected in cats from other breeds. There was no significant difference between prevalence of PKD found in ENVL and ENVA, between prevalence of PKD in Persians and in Exotic Shorthair, and prevalence of PKD in male and in female.

Conclusion : Prevalence of PKD in Persians and Exotic Shorthair cats in France is currently high but is similar to prevalence in other parts of the world. Selection based on ultrasonographic detection of cysts should decrease prevalence of PKD in the future.
Rationale and Objectives: To establish the feasibility of using contrast-enhanced interstitial US lymphography as an alternative to current sentinel node detection methods.
Methods: Aqueous US contrast microbubble suspensions of varying diameter were evaluated in vitro to characterize response to insonation. Contrast media were then injected subcutaneously into the distal extremities of 11 normal dogs to target the cervical and popliteal lymph nodes (nodes, n = 40). First order (sentinel) lymph nodes and second order sublumbar nodes were imaged intermittently from 0 to at least 120 minutes following contrast-injection using continuous power Doppler mode. Lymphoscintigraphy studies were performed on 4 dogs to verify lymphatic drainage patterns and sentinel lymph nodes.
Results: Contrast enhancement occurred in 34/40 (85%) sentinel nodes overall and in 30/32 (94%) nodes when submicron or near-micron diameter bubble formulations were used. In many instances, enhancement persisted throughout the imaging period. Contrast response was most pronounced using a high mechanical index (MI) and tissue artifact was reduced or eliminated when using a high PRF (pulse repetition frequency).
Conclusions: Contrast enhanced interstitial US lymphography could serve as an alternative to current sentinel node detection methods. Preliminary findings suggest submicron or near micron diameter bubbles may be more suitable for lymphatic imaging applications.

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EVALUATING CONTRAST ENHANCED ULTRASOUND AS A METHOD FOR CLINICAL MONITORING OF TUMOR ANGIOGENESIS IN A RAT MODEL
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PURPOSE: To monitor the vascularity of induced tumors in rats using contrast enhanced ultrasound and to compare imaging data with correlated histologic sections.
METHOD AND MATERIALS: R3230 rat mammary adenocarcinomas were implanted within the subcutaneous tissues of the thigh in 25 rats. Five rats were imaged per week starting week 2 after implantation. Sonographic evaluation was performed using a 5.0 MHz linear transducer and modified Siemens Sonoline Elegra. Measurement of maximum tumor height, width and length were obtained. A constant rate infusion of ultrasound contrast media was delivered intravenously. Contrast was diluted to 130 ul/ml and delivered at 10 ml/hour for a maximum volume of 3 ml's. A destruction re-perfusion mode was used. A destructive pulse was fired first, followed by a chain of sequential, non-destructive pulses that allowed for visualization of vascular contrast re-perfusion. All other parameters were kept constant. Colormaps of reperfusion velocity and intensity were generated. Parametric colormaps of the kidney were also produced. Contrast enhanced computed tomography was performed in the same imaging plane as ultrasound images for comparison. Rats were then euthanized and tumor tissue excised. Tissue was preserved in 10% formalin and sections obtained in the same orientation as the ultrasound images. Sections were prepared with H & E stain and Factor VIII to evaluate overall morphology and vessel distribution respectively.
RESULTS: Ultrasound-generated intensity maps showed close correlation between regional intensity, contrast enhancement demonstrated on CT images and histologic tumor viability. The mean time to 80% reperfusion within the viable portion of the tumor was 8.14 seconds with a standard deviation of 4.71 seconds. The mean time to 80% reperfusion within the renal cortex was 3.95 seconds with a standard deviation of 2.2 seconds.
CONCLUSIONS: Contrast-enhanced destruction reperfusion ultrasound imaging of implanted tumors provides an assessment of regional perfusion. Intensity maps generated through ROI analysis show agreement between intensity change, CT contrast enhancement and histologic tumor viability. Tumor blood flow appears to be markedly slower and more heterogeneous than blood flow in normal tissue (renal cortex).
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Scintigraphic, radiographic and echocardiographic evaluation of chronic valvular disease in Cavalier King Charles spaniels

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Introduction: Cavalier King Charles spaniels have a high incidence of chronic degenerative valvular disease resulting in atrio ventricular (AV) insufficiency and obligate volume overload. In humans, assessment and quantitation of mitral valvular insufficiency is commonly performed via echocardiography and nuclear scintigraphy. In veterinary medicine, radiography and echocardiography are the most commonly employed modalities. To date, scintigraphy has been reportedly used in the evaluation of regurgitation in an acute model of canine mitral insufficiency.

Objective: The purpose of this pilot study was to assess the utility of scintigraphy, radiography and echocardiography in evaluation of spontaneous mitral insufficiency in a cohort of Cavalier King Charles spaniels.

Materials and Methods: The cardiac status of 7 Cavalier King Charles spaniels was evaluated using first pass nuclear angiocardiography, gated equilibrium ventriculography, radiography, and echocardiography. All animals were ausculted and had murmurs characteristic of left AV insufficiency. Scintigraphy was used to determine the stroke volume ratio (SVR) and regurgitant fraction (RFs). Echocardiography was used to confirm the presence of left AV insufficiency and quantitatively grade volumetric insufficiency (RFe). A consensus score of categorical quantitation of left atrial enlargement and vertebral heart score (VHS) as a measure of global cardiomegaly were determined from radiographs. A Spearman Rank Order correlation was used to assess the correlation of the scintigraphic, radiographic and echocardiographic indices, p<0.05 was considered statistically significant.

Results: The age of the dogs was 10.49±2.09 years (mean ±SD) and the weight was 8.30 ± 0.60 kg (mean ± SD). There were 2 females, 4 spayed females and 1 neutered male included in this group. A significant correlation was found between RFs and Rfe (R=0.757; p=0.04). In all cases the RFs was larger than Rfe. Both of these parameters also had positive correlations with VHS (R=0.901; p=0.000 and R=0.786; p=0.03 respectively). No correlation was seen between RF, or RFs and categorical scoring of radiographic left atrial size or echocardiographically derived left atrial size. (R=0.467; p=0.255 and R=0.0603; p=0.843 respectively).

Conclusions: In this group of Cavalier King Charles spaniels, RFs correlated more closely with VHS than other traditional methods to assess left atrial size. Lack of radiographic and echocardiographic left atrial enlargement does not exclude the presence of or provide a good indication of insufficiency severity. Further studies to compare RFs and RFe against an optimum method would be necessary to assess them for accuracy.
DIAGNOSIS OF CONGENITAL CARDIAC RIGHT-TO-LEFT SHUNTS WITH $^{99m}$Tc-MAA. F. Morandi D.V.M., M.S.*, G.B. Daniel, D.V.M., M.S.*, R.E. Gompf, D.V.M., M.S.*, Anne Bahr, D.V.M., M.S. †  *University of Tennessee College of Veterinary Medicine, Knoxville, TN 37901 and †Texas A&M University, College Station, TX 77843.

Introduction: Diagnosis of right-to-left cardiac shunts can be difficult. Current techniques include echocardiography, survey radiography, angiocardiology and cardiac catheterization. Selective angiocardiology and catheterization are best for defining the underlying etiology of the shunt, but are invasive procedures. Nuclear scintigraphy using $^{99m}$Tc-MAA is a quick and easy alternative method of diagnosis. $^{99m}$Tc-MAA is the radiopharmaceutical routinely employed for pulmonary perfusion scintigraphy. The average size of the $^{99m}$Tc-MAA particles is 15 - 30 µm. When injected intravenously, the MAA particles lodge in the first capillary bed encountered, normally the pulmonary alveolar capillaries. A normal pulmonary perfusion study shows homogeneous distribution of $^{99m}$Tc-MAA throughout the lung fields. In patients with a right-to-left cardiac shunt, a portion of the radiopharmaceutical will bypass the pulmonary circulation and lodge in peripheral capillaries, with the brain, kidneys and liver showing prominent uptake.

Methods: Seven dogs presented for evaluation of a suspected right-to-left cardiac shunt underwent $^{99m}$Tc-MAA scintigraphy. 2 to 4 mCi of $^{99m}$Tc-MAA were injected in a cephalic vein and 256 x 256 x 16, static images of the whole body were acquired 1 to 5 minutes post injection. Right and left lateral, dorsal and ventral images were acquired for 60 seconds each. Shunt fraction was calculated using the following formula:

\[ \text{Shunt fraction} = \frac{\text{total body counts} - \text{lung counts}}{\text{total body counts}} \]

Results: Four studies showed distribution of the radiopharmaceutical in systemic capillaries of the whole body. Two studies showed asymmetrical systemic radiopharmaceutical distribution with lack of distribution in the head, neck and front limbs. Shunt fractions ranged from 40 to 56 %. Two of the six dogs had Tetralogy of Fallot, one had Trilogy of Fallot, two had reversed PDA and in one dog the type of shunt was not determined. Diagnoses were based upon echocardiographic findings and, when available, post mortem examination. The dogs that showed asymmetrical radiopharmaceutical distribution had reversed PDA. Lack of radiopharmaceutical in the head, neck and front limbs is likely due to shunting of blood into the aorta caudal to the bifurcation of the brachiocephalic trunk and left subclavian artery. In the one case where the radiopharmaceutical remained contained in the pulmonary capillaries, no shunt was found on echocardiography.

Conclusion: $^{99m}$Tc-MAA scintigraphy represents an accurate and quick diagnostic method to confirm or exclude the presence of a right-to-left cardiac shunt. Differentiation between reversed PDA and other right-to-left shunts may be possible based on the radiopharmaceutical distribution. Quantification of shunt fraction is easily performed.
Portal Streamlining As A Cause Of Non-Uniform Distribution Of The Radioisotope Within The Liver During Portal Scintigraphy. GB Daniel, RC DeNovo, DE Sharp. University of Tennessee,

Introduction: Non-uniform distribution of the radioisotope within the liver is a common finding during portal scintigraphy. This distribution pattern is observed in animals with no portosystemic shunt or in animals with low magnitude portosystemic shunts. We believe this is a normal variant that should not be interpreted as abnormal portal blood flow. As early as 1902, researchers recognized that portal blood enters the liver in discrete channels of streamline flow. If the radioisotope is contained within these discrete channels, it may selectively enter only one branch of the portal vein resulting in non-uniform or focal deposition within the liver.

Material and Methods: Portal scintigrams over a 1.5 year period were reviewed. Cases that had visible liver activity were classified into 4 categories: uniform distribution, focal dorsal activity, focal central activity and focal ventral activity. To document the distribution pattern of the branches of the portal vein, a mesenteric portovenogram was performed in a normal dog. The branches of the portal vein were selectively catheterized and VD and lateral images were obtained following contrast injection. These images were compared to the portal scintigrams.

Results: During the study period, 92 portal studies of diagnostic quality were obtained. Forty-five scans were interpreted as normal (median SF 4.2%) and 47 scans as diagnostic for PSS (median SF of 85.4%). There were 51 cases with sufficient liver activity to classify the distribution. The remaining cases were high magnitude portosystemic shunts with no significant liver uptake.

<table>
<thead>
<tr>
<th>% of Cases</th>
<th>Uniform</th>
<th>Dorsal</th>
<th>Central</th>
<th>Ventral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median SF</td>
<td>31.4%</td>
<td>19.6%</td>
<td>19.6%</td>
<td>29.4%</td>
</tr>
<tr>
<td>7.3%</td>
<td>5.9%</td>
<td>5.7%</td>
<td>4.1%</td>
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The mesenteric portovenogram showed the right divisional branch of the portal vein to supply the right lateral and caudate lobes (dorsal distribution), the central divisional branch supplied the right medial lobe (central distribution) and the left divisional branch supplied the quadrate, left medial and lateral lobes (ventral distribution). Shunt fraction values were not significantly different between the four distribution patterns.

Conclusion: Non-uniform distribution of the radioisotope in the liver is probably due to streamlining into one or more branches of the portal vein. Streamlining is the result of laminar blood flow. When the radioisotope is absorbed into the portal venous system, it may remain in discrete channels. This streamline flow may preferentially distribute the radioisotope to one of the branches of the portal vein resulting is focal distribution within the liver. This should not be interpreted as abnormal. Focal distribution within the liver could result in quantitative errors if not taken into account in drawing ROIs for shunt fraction calculations.
**Avian Renal Scintigraphy**  KL Marshall, L Craig, MP Jones, GB Daniel. University of Tennessee

**Introduction:** Glomerular filtration rate (GFR) is an established indicator of functional renal mass. The most common radiopharmaceutical used for measuring GFR is $^{99m}$Tc-Diethylenetriamine pentaacetic acid ($^{99m}$Tc-DTPA). The uptake of $^{99m}$Tc-DTPA within the kidney or clearance from plasma is directly related to the GFR. Dimercaptosuccinic Acid (DMSA) is also used as a renal cortical imaging agent. By determining the percent dose uptake of the left and right kidney, differential estimation of functional tubular renal mass can be made. This study was undertaken to evaluate quantitative renal scintigraphy as a method to evaluate renal function in avian species.

**Materials and Methods:** $^{99m}$Tc-DTPA and $^{99m}$Tc-DMSA studies were performed in 12 anesthetized normal pigeons. The sequence of the studies was randomized and there was at least 48 hours between the imaging studies. All image studies were repeated following induction of renal injury by injection of Gentamicin (15 mg/kg IM BID for 1 week). Renal biopsies were acquired prior to the study and complete necropsies at the end of the study.

**$^{99m}$Tc-DTPA studies:** A dynamic acquisition was acquired following injection of 1.16 mCi + 0.16 (mean + SD) through an intrasosseous catheter. The frame rate was 1 frame/2 sec for 450 frames (15 minutes). ROI analysis was used to determine the percentage of the injected dose that accumulated within the left and right kidneys. In addition time to peak renal uptake and the area of the renogram curves were determined. The percent of the injected dose that accumulated within the cloaca was also determined. **$^{99m}$Tc-DMSA studies:** Pigeons were injected with 1.12 mCi + 0.10 (mean + SD) and static images were acquired at four hours. ROI analysis was used to determine the percentage of the injected dose that accumulated within the kidneys and cloaca. **Statistical Analysis:** Pre and post gentamicin results were compared by paired t-test. The nuclear medicine test results were compared to quantitative histopathology by Pearson product moment correlations.

**Results:** There was poor renal uptake of the $^{99m}$Tc-DTPA when compared to the dog or cat. The margins of the kidney could only be identified after summing the images of the dynamic acquisition. There was activity noted within the cloaca by 2-3 minutes, indicating renal excretion. There was a significant decrease in the percent dose uptake by the kidneys and area under the renogram curve following gentamicin administration. Time to peak renal uptake significantly increased. The accumulation of activity within the cloaca showed the best corrections to histopathology. There was good uptake of the $^{99m}$Tc-DMSA by the renal parenchyma. At four hours, there was noticeable activity that remained within the soft tissues. There was activity noted within the cloaca indicating renal excretion. There was also noticeable activity within the liver. There was a significant decrease in the percent dose uptake by the kidneys following gentamicin administration but the magnitude of this difference was less than with DTPA. There was poor corrections of DMSA uptake compared to histopathology.

**Discussion:** Nuclear scintigraphy scans with both $^{99m}$Tc-DTPA and $^{99m}$Tc-DMSA showed significant differences before and after gentamicin treatment. $^{99m}$Tc-DTPA showed the best correlation to the degree of histologic damage to the kidney using the area under the renogram curve and percentage of the injected dose within the cloaca.
EXTRARENAL PLASMA CLEARANCE OF $^{99m}$Tc – MAG$_3$ IN ANEPHRIC CATS. WT Drost DVM$^1$, MA McLoughlin DVM MS$^1$, JS Mattoon DVM$^1$, P Lerche BVSc$^1$, VF Samii DVM$^1$, SP DiBartola DVM$^1$, DJ Chew DVM$^1$, SC Essman DVM$^1$; PY Barthez DVM PhD$^2$. $^1$Department of Veterinary Clinical Sciences, The Ohio State University, Columbus, OH, 43210 and $^2$Département Animaux de Companie, École Nationale Vétérinaire de Lyon, France.

Introduction: $^{99m}$Tc – mercaptoacetyltriglycine (MAG$_3$) may be suitable for evaluating renal function in cats. Hepatic uptake of $^{99m}$Tc – MAG$_3$ was reported in cats but its influence on evaluation of feline renal function is not known. The purpose of this study was to determine the extrarenal plasma clearance of $^{99m}$Tc – MAG$_3$ in anephric cats compared to the plasma clearance of $^{99m}$Tc – MAG$_3$ in normal cats.

Methods: Plasma clearance of $^{99m}$Tc – MAG$_3$ was measured before and after bilateral nephrectomy in 6 normal, female cats. Cats were pre-medicated with ketamine and acepromazine and induced and maintained on isoflurane general anesthesia for the 180-minute plasma collection period. The cats were euthanized following collection of the last plasma (anephric) sample. Nine plasma samples were collected 5, 10, 20, 30, 45, 60, 90, 120 and 180 minutes after injection with 37 MBq of $^{99m}$Tc – MAG$_3$. A double exponential curve ($y = ae^{-\alpha x} + be^{-\beta x}$) was fit to the data. Area under the curve (AUC) was calculated as $\frac{a}{\alpha} + \frac{b}{\beta}$. Plasma clearance was calculated as Dose / AUC / kg.

Results: The mean baseline plasma clearance of $^{99m}$Tc – MAG$_3$ was $5.29 \pm 0.77$ ml/min/kg (range 4.34 – 6.26). The mean extrarenal clearance of $^{99m}$Tc – MAG$_3$ was $0.84 \pm 0.47$ ml/min/kg (range 0.48 – 1.73). The mean extrarenal clearance of $^{99m}$Tc – MAG$_3$ expressed as a percentage of baseline plasma clearance of $^{99m}$Tc – MAG$_3$ was $16.06\% \pm 7.64\%$ (range 8.55 – 31.56%).

Conclusion: A variable percentage (8.55 – 31.56%) of injected $^{99m}$Tc – MAG$_3$ is cleared by extrarenal routes and consequently $^{99m}$Tc – MAG$_3$ may not be an ideal radiopharmaceutical for evaluation of renal function in cats using plasma clearance methods.
HEPATIC UPTAKE OF 99mTc – MAG3 IN ANEPHRIC CATS. WT Drost DVM1, MA McLoughlin DVM MS1, JS Mattoon DVM1, P Lerche BVSc1, VF Samii DVM1, DJ Chew DVM1, SP DiBartola DVM1, SC Essman DVM1; PY Barthez DVM PhD2. 1Department of Veterinary Clinical Sciences, The Ohio State University, Columbus, OH, 43210 and 2Département Animaux de Companie, École Nationale Vétérinaire de Lyon, France.

Introduction: 99mTc-mercaptoacetyltriglycine (MAG3) may be suitable for evaluating renal function in cats because it produces higher kidney to background ratio than 99mTc–DTPA. Hepatic uptake of 99mTc–MAG3 in cats may adversely affect its utility in estimating renal function in cats. The purpose of this study was to evaluate the hepatic uptake of 99mTc-MAG3 in anephric cats as compared to hepatic uptake of 99mTc–MAG3 in normal cats.

Methods: Eight, adult female cats were pre-medicated with ketamine and acepromazine and induced and maintained on isoflurane general anesthesia. Following intravenous injection of 37 MBq of 99mTc–MAG3, dynamic images, 6 seconds/frame, were acquired for 15 minutes. One week after baseline studies, 6 cats had bilateral nephrectomy. Dynamic images were acquired for 15 minutes immediately after surgery. The cats were euthanized without recovery from anesthesia. Time activity curves were plotted for the kidneys and liver (baseline and anephric). Data from the kidneys were background corrected. The percentage dose uptake for each region of interest was determined 1–3 minutes post-injection. Hepatic uptake in anephric cats was compared to baseline hepatic uptake.

Results: The percent dose uptake, 1–3 minutes post – injection was as follows: kidneys 20.02 ± 3.14; liver – baseline 13.63 ± 1.65; liver – anephric 21.47 ± 2.00. The percentage change from baseline for hepatic uptake was 166.89% ± 23.19%. No gallbladder activity was noted during the 15-minute acquisition period.

Conclusions: Hepatic uptake of 99mTc–MAG3 increases following bilateral nephrectomy. The main extrarenal route of 99mTc–MAG3 clearance is by the liver but biliary excretion was not seen in 15 minutes. Evaluation of renal function in cats may be more accurate using camera based vs. plasma clearance based methods since gamma camera based studies can discriminate specific organs. Hepatic uptake of 99mTc–MAG3 may interfere with drawing right kidney regions of interest. Evaluation of hepatic and renal uptake of 99mTc–MAG3 at various degrees of renal and hepatic dysfunction is warranted.
EVALUATION OF RENAL OXIDATIVE METABOLISM WITH $^{11}$C ACETATE AND POSITRON EMISSION TOMOGRAPHY (PET) IN PIGS.

L Juillard, MD, PhD, Barthez PY, DVM, PhD, M.F Janier, MD, PhD, F Bonnefoi, M Laville, MD.

From the Nephrology service1, Hôpital Edouard Herriot, Université Claude-Bernard Lyon1, Lyon, the Diagnostic Imaging service2, École Nationale Vétérinaire de Lyon, Marcy l’Etoile, the Centre d'Exploration et de Recherche Médicale par Émission de Positons (CERMEP)3,4, Lyon, and the Centre de Recherche et d'Applications en Traitement de l'Image et du Signal (CREATIS)3, Lyon, France.

Introduction/Purpose: Ischemic nephropathy is a progressing and leading cause of end stage renal disease in humans. Its evaluation, however, in research or in clinical practice, is limited by the lack of non invasive measurement of functional parameters, such as oxidative metabolism (OM). $[1-^{11}$C] acetate has been used as a tracer of tricarboxylic (TCA) cycle flux and thus as a tracer of OM. It has been demonstrated that cardiac OM could be estimated by $^{11}$C clearance kinetics as assessed by PET after a bolus IV injection of $[1-^{11}$C] acetate. The aim of this study was to compare $[1-^{11}$C] acetate renal activity detected by PET with renal oxygen consumption in various metabolic conditions in pigs, in order to validate the procedure for renal OM estimate.

Material and Methods: Right renal oxygen consumption was measured in 10 anesthetized pigs, as the product of the renal blood flow by the arterio-venous oxygen concentration difference. At the same time, acetate turnover was estimated by PET as the rate constant, $(k_{mon})$, obtained by monoexponential fitting of the first rapid clearance of $^{11}$C in the renal cortex, after a 4.5 mCi injection of $[1-^{11}$C] acetate. Renal OM was measured under various metabolic conditions induced by different combinations of interventions, either mechanical (renal artery constriction) or pharmacological (dopamine, hypertonic saline, furosemide and acetazolamide).

Results: Renal oxygen consumption varied on a wide range from 0.15 to 0.77 ml O$_2$/l (> 5 fold). There was a highly significant correlation (p < 0.0001, r = 0.82) between $k_{mon}$ and measured renal oxygen consumption ($k_{mon} = 0.228 \times ROM - 0.0065$).

Conclusion: Renal oxygen metabolism can be estimated non invasively using PET and $[1-^{11}$C] acetate in pigs.

INTRODUCTION/ PURPOSE: Tumor hypoxia is an important prognostic indicator in humans for cancer therapy outcome. EF5 \(\text{[2-(2-nitro-1[H]-imidazol-1-yl)-N-(2,2,3,3,3-pentafluoropropyl)-acetamide]}\) has been used to measure tumor hypoxia in animals and humans using immunohistochemical methods. EF5 is a lipophilic 2-nitroimidazole designed to have a very uniform biodistribution, a beneficial feature for use in PET imaging\(^1\). The present study demonstrates the capability of non-invasive PET imaging of rat tumors using \(^{18}\text{F}-\text{EF5}\)\(^2\). Validation of the PET data was performed by gamma counting of the imaged tissue.

METHODS: The tumor models studied were the Morris 7777 (Q7) hepatoma \((n=5)\) and the 9L glioma \((n=2)\) grown subcutaneously in rats. Our previous studies have demonstrated that early passage 9L tumors are not severely hypoxic. Q7 tumors are characterized by heterogeneous regions of tumor hypoxia, and they are usually more hypoxic than early passage 9L tumors. Seven rats were imaged in the HEAD Penn-PET scanner at various time points after intravenous administration of 50-100 µCi \(^{18}\text{F}-\text{EF5}\) in 30 mg/kg carrier non-radioactive EF5. The carrier was used to ensure drug biodistribution and allow analysis on the excised tissues.

RESULTS: \(^{18}\text{F}-\text{EF5}\) was excreted primarily via the urinary system. Images obtained ten minutes following drug administration demonstrated that the EF5 distributed evenly to all organ systems, including brain. Later images showed increased signal in hypoxic Q7 tumors compared to muscle. Liver uptake remained relatively constant over the same time periods. Tumor: muscle ratios ranged from 1.0 to 1.73 at 180 minutes. Gamma counts demonstrated that ratios up to 2.95 were seen in hypoxic Q7 tumors.

CONCLUSIONS: These preliminary results suggest that \(^{18}\text{F}-\text{EF5}\) is a promising agent for non-invasive assessment of tumor hypoxia. Plans are underway to initiate a research project to determine the safety and preliminary evidence for the efficacy of this preparation in patients with brain tumors.

Support: Education and Research Foundation, Society of Nuclear Medicine (LSZ), Department of Radiation Oncology, University of Pennsylvania (Gillies McKenna, Chairman), CA87645 (CJK & SME)

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\(^2\) Dolbier WR, Jr., Li AR, Koch CJ, Shiue CY, Kachur AV. \([^{18}\text{F}]\text{EF5}, a\ marker\ for\ PET detection\ of\ hypoxia: synthesis\ of\ precursor\ and\ a\ new\ fluorination\ procedure. Appl Radiat Isot 2001;54:73-80.
EVALUATION OF THE USEFULNESS OF THE DYNAMIC FLOW PHASE OF 3-PHASE OF TC99M-MDP SCINTIGRAPHY IN THE DIAGNOSIS OF NAVICULAR SYNDROME IN HORSES. J. F. Ekedahl. V.M.D., L. Neuwirth. D.V.M. M. S. University of Georgia College of Veterinary Medicine, Athens, GA 30602

Introduction/Purpose:
Navicular disease/syndrome is a common cause of lameness in horses. In addition to clinical evaluation and diagnostic nerve blocks, imaging methods used in diagnosing lameness related to the navicular bone and its associated structures include: radiography, Tc99m-MDP or HDP scintigraphy, CT, and MRI. Scintigraphic findings associated with a clinical diagnosis of navicular disease have been described for the soft tissue and bone phases of three-phase bone scintigraphy. The purpose of this study was to evaluate dynamic flow phase images of horses with clinical navicular disease to determine the usefulness of the flow phase in supporting a diagnosis of navicular syndrome.

Methods:
Medical records from May 1999 to May 2001 were reviewed to identify horses that had clinical diagnosis of navicular disease/syndrome and skeletal scintigraphy. Only those horses that had been clinically diagnosed as having lameness originating from the navicular region by perineural anesthesia were included. Duration of lameness, signalment, scintigraphic findings, radiographic findings, and degree of lameness were recorded. Nuclear scintigraphy studies of these patients were reviewed and only those cases in which serial images of the distal forelimbs were made immediately following intravenous injection of Tc99mMDP were used. These serial images were reviewed by the investigators and assessed to determine in which limb radiopharmaceutical was seen in first, and which limb had overall greater radiopharmaceutical uptake as seen on a summed image of the dynamic flow phase. Statistical analysis was performed to see if there was a significant correlation between the lame leg and the order in which flow was seen and to determine if the lame leg demonstrated relatively more or less blood flow in a pattern that was statistically significant.

Results:
Thirty horses met the criteria for inclusion in the study. Ten horses had lameness in both forelimbs, twelve in only the left forelimb and eight were lame only in the right forelimb. All horses were lame for greater than five weeks and a majority had a chronic lameness. Horses ranged in age from 3 to 20 years. In 12 out of 20 horses with lameness in only one limb, flow was first seen in the sound leg, and the sound leg had greater activity seen on summed images. The two horses with bilateral, symmetric lameness had symmetric overall blood flow.

Discussion/Conclusion:
Symmetrical flow patterns were seen in the two horses that had symmetric bilateral forelimb lameness. In horses with unilateral lameness, the majority of horses had flow seen first and greater overall flow in the sound limb.
EVALUATION OF MOTION CORRECTED AND CONVENTIONAL STATIC EQUINE SKELETAL SCINTIGRAPHIC IMAGING IN THE DETECTION OF PHANTOM LESIONS.

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Dept. of Small Animal Clinical Sciences, University of Florida, PO Box 100102, Gainesville, FL 32610.

Introduction – Equine lameness is commonly assessed by skeletal scintigraphy performed on standing, sedated horses. Movement of the patient during scanning degrades the diagnostic quality of the scintigraphic images. A currently marketed nuclear medicine system has software which automatically corrects for motion. This scintigraphy system acquires data as a dynamic study, typically at a rate of 1 frame/second for 60-90 seconds. Reference landmarks in each frame are aligned and frames are then summed to create a motion corrected static image.

The purpose of the study was to evaluate the use of motion correction software in equine skeletal scintigraphy and to determine its effect on image quality. This was performed on motion corrected and non-motion corrected images by the evaluation of spatial resolution and object contrast, using full width at half maximum (FWHM 50%) and full width at one-tenth maximum (FWHM 10%) values, respectively.

Materials & Methods – Skeletal scintigraphy was performed on 10 horses. Focal and diffuse phantom lesions were created. Lesions were placed on each horse so that they would be superimposed on the right or left iliac wing during acquisition of a dorsal image of the pelvis. A total of 230 images were acquired with a 256 x 256 image matrix and 16 bit depth at 1 frame/second for 60 seconds. Each image was filtered (Metz filter 6) and the filtered image was then stored as both a motion corrected and non-motion corrected image. This resulted in a total of 460 images for analysis. The FWHM 50% and FWHM 10% measurements were calculated with a line spread function analysis of each lesion. Data analysis using paired-comparisons of FWHM 50% and FWHM 10% (ranked data) between motion corrected and non-motion corrected for both focal and diffuse lesions were conducted by using the Wilcoxon sign rank nonparametric test. For all tests, a 2-sided P value ≤ 0.05 was considered significant.

Results – The FWHM 50% and FWHM 10% values (mm, mean ± standard error) for focal lesions were lower in the motion corrected images (55.0 ± 1.8 & 253.6 ± 10.7), compared to the non-motion corrected images (59.9 ± 1.0 & 282.8 ± 10.1). The FWHM 50% and FWHM 10% values for diffuse lesions were lower in the motion corrected images (88.2 ± 3.6 & 263.5 ± 10.4), compared to the non-motion corrected images (91.7 ± 3.5 & 293.1 ± 9.7). All four observed differences were significantly different (P < 0.01).

Discussion – Motion correction of equine skeletal scintigraphic images improves both spatial resolution and object contrast of phantom lesions. The routine use of motion correction software in equine skeletal scintigraphy may prove beneficial in overcoming the negative effects of motion and improving the detection of lesions.

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RADIOLOGY AND ULTRASONOGRAPHY OF THE EQUINE HYOID APPARATUS.
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Introduction: The objective of this study was to provide reference radiology and ultrasound images of the equine hyoid apparatus. The radiologic and ultrasonographic anatomy of the laryngeal and pharyngeal region of the horse has been reviewed, but with little emphasis on the hyoid apparatus. Few conditions affecting the hyoid apparatus are described: most clinically important and best reviewed are fractures and infection of the stylohyoid bones. Hyoid disease can be challenging to diagnose, compounded by the complicated radiologic anatomy of the region. There are a few reports of lingual abscessation in horses due to foreign bodies that include ultrasonography as an imaging modality for clinical evaluation.

Methods: Standard radiographs (DV and lateral views) of the hyoid region were made with high output and low output (portable) machines on cadaver specimens and live thoroughbred horses of various ages. Metallic markers were placed in the cadaver specimens to help define the various hyoid bones. Ultrasonographic images of the hyoid apparatus and laryngeal area were made using 5 and 7.5 MHz curvilinear array\(^1\) and multifrequency linear array 7.5 MHz\(^2\) transducers. The images were acquired from ventrally between the rami of the mandible in transverse and sagittal planes and stored on a magneto-optical diskette (MOD). Colour flow Doppler was used to identify the vascular structures. A clinical case of confirmed Actinomycotic osteomyelitis of the basihyoid bone was evaluated and treated.

Results: On DV radiographs, in addition to the stylohyoid bones, the thyrohyoid bones were seen in most horses: the basihyoid bone and lingual process was not seen. With ultrasound the basihyoid and lingual process, tongue root, linguofacial vessels, thyrohyoid bones, thyroid cartilage and laryngeal gas were easily identified. The stylohyoid bones could not be visualized with ultrasound due to the surrounding gulletal pouch gas. In the clinical case of Actinomycosis of the basihyoid, extensive mixed osteoproliferative and osteolytic changes to the lingual process were seen on radiographs. Ultrasonography showed a midline fistulous tract extending from the skin surface to the lingual process. The whole ventral surface of the basihyoid bone and lingual process showed a very irregular bone surface echo and numerous separate clean shadowing fragments. Histopathology performed on biopsy samples acquired during surgery confirmed these to be bony sequestra: PAS staining revealed clumps of branching filamentous structures within the submitted tissues, identified as \textit{Actinomyces} organisms by culture.

Conclusion: Easily recognisable anatomical landmarks and accessibility facilitate ultrasonography of the ventral hyoid apparatus and adjacent ventral laryngeal region. Ultrasonography provided superior detail of this region compared to radiography and proved indispensable in diagnosing a rare case of basihyoid Actinomycotic osteomyelitis.

\(^1\) Aloka SSD-630 Echo Camera
\(^2\) SonoSite 180 Echo Camera
Introduction: Peripheral neuropathies in horses can present a diagnostic challenge to clinicians as they sometimes resemble central nervous system diseases or musculoskeletal conditions. In humans, ultrasonography has been used to evaluate the normal and abnormal appearance of most major peripheral nerves. The goals of this study were to assess the feasibility of peripheral nerve sonography and to describe the sonographic appearance of the sciatic, tibial, peroneal, suprascapular, radial, median and ulnar nerves in normal adult horses.

Methods: Part I: The sonographic appearance and size of the sciatic, tibial, peroneal, suprascapular, radial, median/lateral palmar and ulnar nerves was studied in fresh cadavers from neurologically normal adult horses, weighing 439 to 650 kg (5 forelimbs, 5 hindlimbs). Landmarks for localization and techniques for correct nerve identification were determined. Nerve identification was confirmed by injecting new methylene blue via ultrasound guidance into the nerve. The depth and diameter of each nerve at multiple locations, and the success rate in imaging each nerve were measured. A 2-5 MHz convex, 5-8 MHz convex and/or 8-12 MHz linear transducer were used, depending upon nerve depth. Part II: The usefulness of previously determined nerve localization landmarks was evaluated in 6 live, neurologically normal horses, weighing 379-481 kg. Color Doppler and power Doppler were used to differentiate nerves from adjacent vascular structures. Measurements were repeated sonographically as described for part I and nerve appearance was assessed.

Results: Part I: Longitudinally, all nerves had two parallel, sharp linear hyperechoic borders with a relatively hypoechoic center. Only the deep peroneal nerve could be evaluated in the transverse plane and it had a hyperechoic, circular border with a hypoechoic center. Ranges for sonographically measured nerve diameter were: sciatic (n=3 sites) 0.37-1.30 cm; proximal tibial/peroneal (n=8) 0.52-1.13 cm; deep peroneal (n=6) 0.08-0.17 cm; suprascapular (n=3) 0.18-0.28 cm; mid-radial (n=4) 0.20-0.33 cm; lateral palmar (n=4) 0.10-0.25 cm. Nerve depths were: sciatic, 13.23-14.42 cm; proximal tibial/peroneal, 8.79-15.63 cm; deep peroneal, 1.15-3.07 cm; suprascapular, 3.1-5.3 cm; mid-radial, 3.82-4.50 cm; lateral palmar, 0.49-1.36. Success rate in identifying nerves in cadavers was 49%, with the proximal tibial peroneal (90%) and deep peroneal (75%) most easily identified. Part II: Nerve appearance was similar to that seen in the cadavers. An epineural color pattern was occasionally seen with power Doppler in certain nerves. Nerve diameters and depths were generally similar to those measured in the cadavers. A success rate of 70% in identifying nerves was obtained in the live horses.

Conclusions: Ultrasound of the peripheral nerves is feasible in horses. At some sites, we established preliminary diameter and depth guidelines, based on a small sample size. In some nerves, the broad range of measurements may limit the clinical application of these values. The use of Doppler techniques to differentiate nerves from vessels and improvement in examiner skill aided nerve identification in the live horses. Investigation of this technique in horses with signs of peripheral neuropathy is warranted.
EFFECT OF PERINEURAL ANESTHESIA ON THE ULTRASONOGRAPHIC APPEARANCE OF EQUINE PALMAR METACARPAL STRUCTURES. L. J. Zekas, D.V.M., L. J. Forrest, V.M.D. Department of Surgical Sciences, School of Veterinary Medicine, University of Wisconsin, Madison, WI 53706.

Introduction / Purpose: Local infiltration of anesthetics around specific nerves is a common technique utilized in equine lameness evaluations. The effect of perineural anesthesia on radiographic and scintigraphic studies has been reported, but not on ultrasonographic examinations. The purpose of this study is to describe ultrasonographic changes of the equine palmar metacarpal area attributed to infiltration of local anesthetic solution and determine if these changes are noted immediately or at 24 hours.

Methods: The palmar metacarpal region of one forelimb in each of six horses was examined ultrasonographically with a 10 MHz linear array transducer and a 7.5 MHz curvilinear transducer. Transverse and longitudinal images were recorded at 5 cm intervals distal to the accessory carpal bone. High and low palmar and palmar metacarpal nerve blocks were performed with mepivacaine hydrochloride 2%. Ultrasonographic examinations similar to the initial examination were then performed immediately, one hour and 24 hours post-injection. Cross-sectional area and mean pixel value were determined for the superficial and deep digital flexor tendons, accessory ligament of the deep digital flexor tendon, suspensory ligament and suspensory branches at each level and time period. Subjective ultrasonographic changes were also noted.

Results: No significant difference was noted in the cross-sectional area or mean pixel value of any structure at any level or time period compared to baseline. Subjective changes in the tendons and ligaments were not noted. There was mild hypoechoic swelling of surrounding soft tissues. There were also hyperechoic areas with shadowing and reverberation, interpreted as gas in the region of the injections. Gas shadowing interfered with complete evaluation of the origin of the suspensory ligament (3 horses) and the proximal portion of the accessory ligament of the deep digital flexor tendon (1 horse) within the first hour, but was not detectable ultrasonographically at 24 hours.

Discussion / Conclusions: The ultrasonographic appearance of the tendons and ligaments of the metacarpus in this study was not altered secondary to perineural injection of mepivacaine. Mild hypoechoic swelling of surrounding tissues and the introduction of gas was common. Gas may interfere with ultrasonographic examinations performed temporally close to perineural anesthesia, which may require a repeat examination at 24 hours.
THE ACOUSTIC PROPERTIES OF NORMAL AND DAMAGED EQUINE TENDON
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Ultrasound imaging uses the timing and intensity of backscattered echoes to create an image. In organized tissue with a linear structure like tendon, the conventional ultrasound transducer must be oriented nearly perpendicular to the tendon bundles or the echoes may be reflected away from the transducer and thus not be detectable. The distribution of frequencies within a broadband backscatter pulse contains considerable information about the microscopic structure of the tissue that is not displayed in the usual image presentation; information that may prove diagnostically valuable and be detectable at a wider range of beam angles. Ultrasound imaging has become the method of choice for evaluating tendon injuries in the horse. This project is a preliminary study testing this theory in a laboratory setting.

Specialized hardware and software was developed to permit acoustic sampling of small selected portions of the tendon. This was accomplished by building a device to hold and rotate the tendon suspended in a water bath. Multiple acoustic samples from normal equine tendons were then acquired in a radial fashion from different portions of each tendon. Beam angle was varied in 2° increments away from perpendicular to establish the characteristics of the backscatter frequency spectrum of normal tendon. Tendons from horses with spontaneous tendon lesions were obtained through the necropsy service and evaluated using the same methods.

Distinct differences between the backscatter frequency spectrum of normal and abnormal tendon were observed. Additionally the intensity of the backscattered energy from damaged tendon was much less sensitive to beam angle than that seen in normal tendon. Histologic correlation of acoustic properties and microscopic tendon structure are now underway.

Introduction
Magnetic resonance imaging (MRI) is highly effective in the evaluation of articular cartilage, menisci, bone, ligaments, tendons, joint capsules and muscle. The advantages of MRI include multiplanar imaging capabilities and no use of ionizing radiation. Until now, MRI in the live horse has only been possible in the anaesthetized animal, but the risks associated with anaesthesia and the expense of MRI equipment limit the use of the procedure in equine practice. The Bell Equine Veterinary Clinic in collaboration with Hallmarq Veterinary Imaging Ltd have developed and installed a low-cost dedicated MRI system for examining the distal limbs of standing sedated horses.

Methods
Horses are sedated prior to being positioned in stocks. The limb to be imaged is placed at the front of the stocks adjacent to the scanner. A solenoid coil, fashioned around a modified boot, is positioned around the foot or region of the limb to be imaged. The MRI scanner consists of a “U”-shaped 0.21T permanent magnet, mounted on a frame that is moved using electric motors. The space available between the poles of the magnet is 20cm across, and the imaging volume is approximately a sphere of 12cm diameter located at the centre. Movable elements in the floor allow the magnet to be positioned around the foot, and the height is adjustable up to the level of the carpus/tarsus. The system is supplied by Hallmarq Veterinary Imaging Ltd (Guildford, UK) and uses Windows NT based software (also used in human MRI systems) to control the scans and display the images. A full range of imaging protocols is under evaluation, with T1 weighted 3D and multislice gradient echo, and T2 weighted spin echo being the current preferred pulse sequences. The system is installed in a purpose-built building incorporating the necessary RF shielding. Motion compensation software is under evaluation.

Results
Images collected to date from normal horses and 12 clinical cases show that conventional sedation will keep the animal sufficiently immobile for a number of scans of the foot, pastern and fetlock areas, each lasting approximately four minutes. Images obtained clearly show the bone, soft tissue and joint structure of the foot. Pathological changes including deep digital flexor tendon damage, periteninous abscessation, focal articular cartilage damage, periarticular osteophyte formation, distension of synovial structures and abnormal signal in the navicular bone have been identified.

Discussion
We believe that this is the first MRI scanner to be shown capable of producing quality images in the standing horse. MRI is likely to become the imaging modality of choice for the evaluation of the bony and soft tissue structures within the equine foot, including the evaluation of caudal foot pain and navicular syndrome. Unlike radiography and ultrasonography, MRI provides 3D images. The entire foot can be imaged, and MRI provides physiological information that is anatomically specific, unlike scintigraphy. In addition to the foot, the evaluation of articular cartilage, subchondral bone and tendinous/ligamentous structures of the distal limbs are likely to be important applications of this system.
Introduction/purpose- Computed tomography (CT) is becoming more available as a diagnostic tool in the evaluation of the equine skull and brain. Previous studies have described CT as a useful technique for diagnosing intracranial disease in horses, especially pituitary adenomas. Baseline data on the CT appearance of the normal equine pituitary gland, and refining CT techniques for measuring the gland would be beneficial. An improved understanding of normal pituitary dimensions and the limitations of CT measurements will be helpful for evaluating new treatment protocols in horses with pituitary disease. Equine clinicians may be able to more accurately diagnose pituitary disease earlier, especially if clinical signs are vague or nonspecific. The purpose of this study was: to refine a computed CT protocol for measuring the equine pituitary gland, define the CT anatomy of the pituitary region, and determine a set of normal values for gross pituitary dimensions.

Methods- Twenty-five horses with no clinical evidence of pituitary disease were included in this study. These horses were euthanized for reasons unrelated to this project. Horses included 16 geldings, one stallion, and 8 mares that ranged in age from 4 years to 27 years. The weight range was from 750 pounds to 1250 pounds. Breeds included Quarter Horses, Thoroughbreds, Arabians and mixed breeds. Transverse anatomy and CT slices were compared in two horses, one with intravenous contrast and one without. Pituitary regions of 23 horses were scanned within 24 hours of euthanasia, using 10x10mm, 10x5mm, 4x4mm and 4x2mm CT slice thickness/interval combinations. Pituitary glands were removed immediately after scanning and gross dimensions measured. CT measurements were compared with gross measurements for each scanning technique, using analysis of variance (ANOVA) in a randomized block design. Accuracy percentages were also calculated for each CT technique.

Results- Intravenous contrast improved visualization of the pituitary gland. Mean dimensions of the histologically normal glands were: length 21.07mm, width 21.62mm, height 9.78mm and volume 2.66cm³. One horse had a pituitary adenoma that was not visible on CT. This was diagnosed by histopathology. Normal pituitary weights ranged from 1.7g to 3.4g. Computed tomographic length measurements were most accurate with 10mm CT slices. Width, height and volume measurements by CT were the most accurate with 4mm slices. Overlap did not affect measurement accuracy.

Conclusions- Our findings indicate that contrast-enhanced CT is an accurate technique for estimating linear dimensions of the equine pituitary. Due to problems with our software, three-dimensional CT volumetry was not an accurate method for estimating pituitary volume.
A retrospective analysis of canine brachial plexus masses seen at the University of Minnesota over a seventeen year period was conducted. The goal of the study was to characterize the computed tomographic (CT) appearance and determine the minimum mass size confidently detectable.

Twenty-three cases were found wherein both the medical records and CT images were available for evaluation. Masses were characterized based on the presence or absence of contrast enhancement, margin character, extent of local invasion, size, and presence of vertebral canal or spinal cord involvement.

Only two dogs had a palpable axillary mass on physical examination. Three dogs underwent surgery for suspected orthopedic disease prior to the diagnosis of the brachial plexus mass. Nineteen masses were noted to contrast enhance, typically with ring enhancement and a hypodense center.

Relative frequency of computed tomographic findings in 23 dogs with forelimb nerve root masses.

<table>
<thead>
<tr>
<th>Finding</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periscapular muscle atrophy</td>
<td>19/23</td>
</tr>
<tr>
<td>Well-defined mass margins</td>
<td>18/23</td>
</tr>
<tr>
<td>Contrast-enhancement (any distribution)</td>
<td>19/23</td>
</tr>
<tr>
<td>Contrast-enhancement (peripheral/rim)</td>
<td>12/23</td>
</tr>
<tr>
<td>Mass extension into vertebral canal</td>
<td>7/23</td>
</tr>
<tr>
<td>Regional invasion in thoracic cavity</td>
<td>6/23</td>
</tr>
</tbody>
</table>

As measured based on the largest dimension within a single slice, detectable masses ranged from 1.0 to 6.5 cm.

Thirteen of twenty-three dogs diagnosed with a brachial plexus mass were euthanized or sent home with palliative management. Eight dogs underwent surgical intervention to treat their masses, while two underwent medical management. Histologic confirmation was only available in nine cases, while long-term follow up was only available in seven cases.

This study has shown that CT scan is an applicable diagnostic tool to identify brachial plexus masses. Unfortunately CT scanning is not without its shortcomings. There were 4 additional dogs in which erroneous diagnoses of nerve root masses were rendered. These included three cases of fibrocartilagenous nerve root compression (lateral disk herniation) and one case of a reactive axillary lymph node.
COMPUTED TOMOGRAPHY AND TANGENTIAL VIEW RADIOGRAPHY COMPARED TO CONVENTIONAL RADIOGRAPHY IN EVALUATION OF CANINE PELVIC TRAUMA. A PILOT STUDY. J.T. Crawford, DVM, W.M. Adams DVM, P.A. Manley, DVM. University of Wisconsin-Madison School of Veterinary Medicine. Madison, WI 53706

Introduction/Purpose: Fractures of the canine pelvis are a common injury resulting from a major traumatic incident. Currently, radiographic examination of the pelvis is the standard diagnostic test for evaluation of dogs with suspected injuries of the pelvis. In the human literature, studies comparing radiographic examination of pelvic fractures to computed tomography (CT) have demonstrated that CT is not only superior in allowing more detailed description of the known fractures, but offers visualization of radiographically occult injuries. The goals of this study are (1) to describe the use of two oblique radiographic views for evaluating pelvic fractures, (2) to describe a technique for CT evaluation of pelvic fractures, (3) to document observed advantages and disadvantages of the two imaging methods, and (4) to discover if oblique radiographs and/or CT examination are warranted in evaluation of canine pelvic fractures.

Methods: Ten consecutive dogs that presented to the VMTH with pelvic trauma were evaluated with conventional radiography and computed tomography. Conventional radiography included a standard 2-view exam, plus a ventrodorsal 20° cranio-caudal oblique view (inlet), and a ventrodorsal 20° caudo-cranial oblique (outlet) view. Lateral oblique acetabular views were included when indicated. CT examination consisted of 1.5 mm contiguous transverse slices of the pelvis extending from the tuber coxae to the tuber ischii. Windowing was optimized for bone and for soft tissue examination. CT reformatting and 3-D reconstruction was performed in each case. Radiographic and CT exams were independently interpreted by the three authors and graded as: (0) = no abnormalities, (1) = possible lesion, (2) = probable lesion, or (3) = definite lesion. After independent review, a consensus opinion was made for each possible lesion. Comparisons between standard pelvic radiographs, inlet/outlet radiographs, and CT examination were made using non-parametric statistical analysis.

Results: In each case, CT identified soft tissue lesions not seen by radiographic examination, including hemorrhage and muscular trauma. In 7 of the 10 cases, bony lesions not seen radiographically were identified by CT, including ischial fractures (4), sacral fractures (3), pubic fractures (2), and acetabular fracture and sacro-iliac subluxation (1 each). In addition, CT was used to rule out lesions that were suspected based on radiographic exam including 3 suspected acetabular fractures, a suspected sacro-iliac subluxation, and a suspected ischial fracture. CT reformatting and 3D-reconstruction provided improved spatial orientation of fracture displacement. Inlet/outlet radiographic exam provided minimal additional information to the standard radiographic exam. Statistical analysis of data is in progress.

Conclusions: CT examination is useful in cases of severe canine pelvic trauma. CT examination provides information, additional to radiographic exam, that is useful in characterizing the extent of pelvic injuries and in surgical planning.
ACCURACY OF ROUTINE PATIENT SETUP USING AN IMMOBILIZATION DEVICE:
COMPARISON OF SINGLE PLANE RADIOGRAPHS AND A REMOTE CT SCANNER

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Introduction/Purpose: Radiation treatment requires a precise patient positioning procedure
for inter-fraction repositioning of the patient. The purpose of this study was to determine the
accuracy of our fixation device in treatment position and to evaluate the setup accuracy with
two different methods.

Methods: The positioning data of 19 canine patients with tumors in the head region (oral,
nasal, cerebral) treated with photon or proton irradiation were included in this study. The
patients were immobilized by means of an individualized fixation device. For tumors in the
head region of anesthetized patients, the intra-fraction displacement is negligible. Thus, focus
was set upon inter-fraction displacement with systematic and random component.
In method 1, the treatment position was evaluated by taking single plane port radiographs,
using megavoltage x-rays with the patient in treatment position. A total of 99 treatment
sessions (n=8) was analyzed. Deviations were measured with a coordinate system (x=
transverse, y= longitudinal axis) using a single lead mark within the fixation device, that
represented an external fixed mark, and anatomic landmarks on the animal. Deviations were
given. These deviations could be used in the analysis of random error only.
In method 2, two orthogonal CT-topograms were acquired to evaluate the precision of
positioning of the patient in the immobilization device. Data were obtained by comparison of
the position of predefined anatomical landmarks in the CT-topograms using an in-house (PSI)
developed software. A total of 146 treatment sessions (n=11) was analyzed. For this method,
both systematic and random displacement could be calculated.

Results: Systematic displacement: The calculated mean of systematic displacements in [mm]
with corresponding 95% confidence intervals for method 2 were as follows: x-systematic
displacement 0.158 (-0.217, 0.534), y-systematic displacement 0.307 (-0.266, 0.881) and
systematic deviation length 1.824 (1.53, 2.19). Random displacement: The calculated mean
random deviation lengths in [mm] with corresponding 95% confidence interval (CI) were
0.647 (0.55, 0.74) for method 1 and 1.127 (0.79, 1.46) for method 2. Random vector lengths
were smaller for the first method than for the second (p=0.0017).

Discussion/Conclusion: In spite of the difference between both methods, they both seem to
be accurate within the expected range. A circular margin of 3.67 mm would be enough for
both methods to take into account systematic and random position variability in the used
fixation device. Our immobilization protocol provides an accurate patient immobilization for
photon and conformal proton radiation therapy. The two methods for positioning verification
are applicable for tumors in the head region. These data can be used for the assessment of
margins for the PTV. Further studies will focus on position verification systems for tumors in
the trunk area, with expected greater inter- and intra-fraction displacement.
INTRODUCTION: The skeleton provides mechanical support for ambulation and protection of internal organs. Bone size, shape and mineral density (BMD) are important factors in determining ability of a bone to maintain its form and resist breakage under stress. There is wide variation in bone size and shape between dog breeds. The purpose of this study was to compare bone cross-sectional area and mineral density in six dog breeds of fine and heavy-boned frame types and short, medium and tall heights.

METHODS: Sixty-one healthy dogs of six breeds were examined, including (fine-boned): Italian Greyhound (IG), Saluki, Borzoi, (and heavy-boned): Cardigan Welsh Corgi, German Wirehair Pointer and Rhodesian Ridgeback (RR). Length-to-width ratios were calculated from radiographic measurements of the radius, ulna, tibia and third lumbar vertebra (L3). Bone mineral content (BMC) was estimated from radiographic optical density of the bones. Computed tomographic (pQCT) scans were performed at the radius, ulna, humerus, tibia, femur and L3. Cortical and total (cortical plus medullary) bone cross-sectional areas were measured from axial images and cortical-to-total area ratios were calculated. Bone mineral density (BMD) was estimated by computer analysis of the pQCT data. All data were analyzed by Proc mixed (SAS 8.0) to identify factors that predicted differences in bone size, area, BMC and BMD among these dogs (P ≤ 0.05).

RESULTS: Fine-boned breeds had lower width-to-length ratios than heavy-boned breeds, confirming their classification by body frame type. The three fine-boned breeds had similar bone proportions, despite great differences in body size. Total bone cross-sectional areas varied by breed in relation to body size and frame type with heavy-boned and taller dogs having the highest total bone area. However, the small, fine-boned IG had the highest ratio of cortical-to-total bone area while the RR had the lowest proportional value of cortical bone. The fine-boned breeds had lower BMC values than the heavy-boned breeds. The IG had markedly higher cortical BMD than the RR and the Saluki had similar BMD to the Pointer and Borzoi. Females had smaller bones with lower BMC but equal BMD values as compared to the males. Only one measurement revealed an age related difference, which was an increase in BMD of the ulnar cortex in older dogs. The more active dogs (athletes and active pets) tended to have smaller bones with lower BMC values as compared to the docile pets while BMD values were not significantly different.

CONCLUSION: Bone mineral density is a measurement of bone quality that is independent of bone size. The pQCT method for BMD analysis estimates density as a volumetric function (g/cm³) and allows independent measurement of cortical bone. High BMD values in the fine-boned breeds may compensate for the long, narrow shape in regards to durability. Bone size and density are multifactorial characteristics. The small body size of a fine-boned dog does not directly indicate fragility of the skeleton, nor does heavy-boned conformation equate to a more solid frame. Parameters for normal values of these bone measurements are presented for future reference.
Introduction

Arthritis of the joints is one of the more debilitating conditions as an individual ages. The onset of osteoarthritis can be insidious and multifactorial. One of the most common causes of arthritis in young individuals and dogs is acute rupture of the cranial (anterior) cruciate ligament (CCL) leading to chronic joint instability. There has been a great deal of work done on the repair of the CCL after acute rupture; however, most of these patients develop signs of early osteoarthritis regardless of the ligament repair. Recent data suggests that joint instability may not be the only factor in the development of osteoarthritis. Frequently, the cartilage within the knee and the subchondral bone is also injured when the CCL is disrupted. Bone bruise of the lateral femoral condyle is commonly seen in people and has been associated with arthritic changes. Currently, accepted medical management of an acute CCL injury is early weight bearing as tolerated, however, this may increase the inflammatory response of the knee joint and prolong healing of the subchondral bone bruise. An early non-weight-bearing status may decrease the sub-acute inflammation and thus decrease the damage to the articular surface and the likelihood of developing degenerative joint disease. The purpose of this prospective study is two-fold: to determine whether weight-bearing on the stifle increases the amount of inflammation and/or hinders healing of the subchondral bone bruise, and, to determine if the bone bruise also occurs in dogs following cranial cruciate rupture.

Methods

An experimental bone bruise was generated on the lateral femoral condyle using a mechanical impactor on 20 mixed breed dogs. Following the acute injury half of the dogs were placed in a brace that prevents weight bearing on that leg. The other half of the dogs will bear weight as tolerated. Additionally, MRI of the stifles were done prior to impact, within 1 week and at 6 months after injury to document changes of the subchondral bone bruise. Also, MRI of the stifles of canine patients following naturally occurring cranial cruciate rupture will also be performed and evaluated for evidence of a sub-chondral bone bruise.

Results

All experimental animals had normal MRI examinations of the stifles prior to mechanical impact. T1, T2, and fat saturated images were obtained in 3 planes on all stifles. A poorly defined, focal bone bruise was seen in the subchondral bone of the lateral femoral condyle of the impacted limb in all experimental dogs on the images obtained at 1 week. Results from the MRI examinations obtained at 6 months post-impact and differences (if any) between the weight bearing and non-weight bearing experimental dogs are pending. Results from the MRI examinations from the spontaneous CCL rupture patients is also pending. Final results will be presented.
RADIOGRAPHIC ASSESSMENT OF NORMAL HEALING AND COMPLICATIONS ASSOCIATED WITH TIBIAL PLATEAU LEVELING OSTEOTOMY (TPLO)

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Introduction and Purpose
Tibial plateau leveling osteotomy (TPLO) has become a commonly performed procedure to correct conformational abnormalities of the canine stifle joint which results in cranial tibial thrust and predisposes the animal to tear the cranial cruciate ligament. The TPLO procedure involves a semi-circular osteotomy and re-attachment of the proximal-caudal tibia, thus correcting the excessive caudal angulation of this portion of the proximal tibia. The purpose of this retrospective study is to describe the types and incidences of radiographically visible post-surgical TPLO complications.

Materials and Methods
Radiographs from over 1,000 TPLO cases were reviewed. All radiographs and surgical procedures were performed at Gulf Coast Veterinary Diagnostic Imaging and Gulf Coast Veterinary Surgery. All stifles had pre-operative films, immediate post-operative films and follow-up films, up to 18 months. All radiographs were compared to pre-operative films. Evaluation of normal radiographic healing as well as radiographically visible complications were assessed. Correlation of the type of complication to the animal’s breed, sex, or weight as well as the presence of clinical signs (persistent or new lameness) was performed.

Results
Complications associated with the TPLO procedure are rare, but include transverse fracture or avulsion of the tibial crest, orthopedic implant loosening and infection, patellar tendonitis, and patellar fracture. The incidence of complications, possible predisposing factors and correlations to the animal’s signalment and degree of persistent lameness will be presented.

INTRODUCTION
Degenerative lumbosacral stenosis (DLSS) is a common problem in middle-aged German Shepherd Dogs and Belgian Malinois dogs serving the U.S. Department of Defense (DOD) as Military Working Dogs (MWDs). Dogs affected with DLSS exhibit a wide spectrum of symptoms ranging from pain and intermittent rear leg lameness to muscle atrophy and severe neurologic impairment. Decompression of the cauda equina via dorsal laminectomy (+/- discectomy) has been the standard surgical therapy for affected dogs referred to the DOD MWD Veterinary Service. Although good results have been achieved in pet dogs with this regimen,1 2 a majority of MWDs that undergo this procedure (17/29 or 59%) fail to successfully return to unrestricted military duty3. Furthermore, some MWDs that initially respond favorably to this surgery have a subsequent recurrence of symptoms attributable to DLSS3. Pedicle screw stabilization of the lumbosacral vertebral motion unit (VMU) is a common procedure in people with clinical signs of spinal instability. We hypothesized that residual lumbosacral instability might be the cause of poorer success rates in treated MWDs as compared to pet dogs. The purpose of this study was to adapt pedicle screw stabilization techniques to the dog and document the outcome of pedicle screw stabilization-fusion in MWDs affected with DLSS.

MATERIALS & METHODS
All dogs underwent preoperative orthopedic and neurologic examination. Suspected extradural compression of the cauda equina was confirmed by epidurography and computed tomography of the lumbosacral region. One dog also underwent magnetic resonance imaging. Nine MWDs affected with DLSS were treated by decompression of the cauda equina via dorsal laminectomy and stabilization of the lumbosacral VMU by pedicle screw fixation. Bilateral pedicle screw and rod constructs were placed to span the lumbosacral joint. Exposure and partial debridement of the articular cartilage of the lumbosacral articular facets was combined with placement of autogenous cancellous bone grafts in order to promote fusion of the dorsal vertebral compartment in all dogs (Groups 1 & 2). Additionally, seven of the dogs (Group 2) also underwent lumbosacral discectomy and partial debridement of vertebral end-plate articular cartilage. Autogenous cortico-cancellous bone graft segments obtained from the ilial wing were wedged into the disc space in order to promote fusion of both the dorsal and ventral vertebral compartments (circumferential fusion). All dogs underwent serial, postoperative imaging studies consisting of monthly film-screen radiography and semiannual computed tomography.

RESULTS
Each dog was reevaluated by MWD training personnel to determine whether the MWD was capable of returning to either limited or unrestricted duty status. Problems attributable to screw loosening or other complications were not detected. The project is ongoing and updated results of the imaging studies and training evaluations will be discussed. Current recommendations for surgical therapy and future research will also be presented.

DISCUSSION/CONCLUSION
Working dogs perform much of their work in a hind limb (hyper) extended (lower back flexed) position. This and other activities may predispose MWDs to lumbosacral stress and contribute to instability. Lumbosacral instability is therefore a plausible inciting cause as well as a credible outcome (iatrogenic destabilization at surgery) in MWDs undergoing decompression for DLSS. Bilateral pedicle screws and connecting rods provide stabilization of the lumbosacral joint. Decompression and stabilization of the lumbosacral space using pedicle screw and rod constructs has resulted in clinical improvement in MWDs. Stabilization of the lumbosacral VMU may offer superior results in MWDs when compared to laminectomy +/- discectomy. Implant failure or disruption of the bone-implant interface may occur if fusion of the VMU is not achieved.

ACKNOWLEDGEMENT: Howmedica Osteonics Corp Allendale, NJ donated implants used in 1 dog.

3 Linn et al. Lumbosacral stenosis in 29 military working dogs: epidemiologic findings and surgical outcomes (1990-1999) IN PRESS.
MRI FINDINGS OF INFARCTION WITHIN THE CEREBELLUM OF 6 DOGS.

Introduction: Cerebrovascular disease is generally considered to be rare in dogs with few reported cases in the literature, of which only one was in the cerebellum. At our institute we are recognising an increasing number of dogs with presumed cerebrovascular accidents. This presentation will discuss the MR features of presumed cerebellar infarction.

Methods: The records and MRI findings of six cases of presumed cerebellar infarction identified between July 1999 and July 2002 were reviewed. Cases were diagnosed either on post mortem (1 case) or clinically in association with MRI, and CSF findings. The clinical diagnosis was based upon history (acute or peracute onset) and progression (static or progressive improvement). Cases were excluded if CSF analysis, clinical signs (e.g. multifocal neurolocalisation or evidence of systemic disease) or MRI findings suggested an inflammatory etiology. CSF analysis was performed in all cases. Screening for underlying causes was performed in some cases including thoracic and abdominal radiography, abdominal ultrasonography, blood pressure monitoring, adrenal and thyroid function testing and clotting profiles. Cases with possible metastatic neoplasia were excluded. All the dogs were imaged in a 1.5 T GE Signa MRI unit and an extremity coil except for 1 case scanned with a 0.5 T SMIS MRI unit. The dogs were anaesthetized and placed in dorsal recumbency for the examination. T2-weighted images were obtained in a minimum of two planes including the transverse. T1-weighted images were obtained in transverse plane prior to and following administration of gadolinium. Gradient echo sequences were performed in all cases except one. Additional studies including MR angiography were performed in some cases. All dogs were scanned within 10 days of onset of signs. One dog was rescanned seven weeks following the initial examination.

Results: Dogs with cerebellar infarcts were middle to old age (4 to 11 years). Spaniels appear predisposed with three Cavalier King Charles spaniels and one English cocker spaniel affected in the series. On T2-weighted images there was marked hyperintensity of the affected parenchyma. The lesions were solitary, homogeneous and often wedge shaped or linear and were clearly demarcated from adjacent tissue. There was no mass effect associated with the lesions. The hyperintensity was confined to the gray matter of the cerebellar hemispheres in three cases. In one case the hyperintensity was confined to the cerebellar nuclei. On T1-weighted images the lesions were isointense or hypointense and showed no or faint homogeneous enhancement. On gradient echo scans the lesions were mildly hyperintense indicating the infarctions were probably non-hemorrhagic.

Conclusion: Cerebellar infarction appears to have characteristic MRI features. The affected parenchyma is homogeneously hyperintense, usually wedge shaped and with a marked predilection for gray matter. There is no mass effect and contrast enhancement is either absent or mild and homogeneous.
Introduction: L-2 hydroxyglutaric aciduria in humans is a rare metabolic disease resulting from an inborn error of metabolism and causing a progressive encephalopathy. It has previously been undiagnosed in animals. A group of six Staffordshire bull terriers in the United Kingdom have recently been diagnosed as suffering from the condition based on MRI findings and urinary organic acid screening. The dogs were presented for progressive neurological signs, which included seizures, dementia, ataxia and head tremors.

Methods: Six Staffordshire bull terriers were presented for investigation of a variety of neurological signs. The dogs were all less than 2.5 years old except for one dog, which was 7 years old. In the older dog the signs may have been present since puppyhood in a milder form. Both entire and neutered male and female dogs were represented. The signs were localized to the brain in all cases, except for one, which has brain and neuromuscular lesions. Hematological and biochemical profiles in all the dogs were normal. MRI examination of the brain was performed in all cases. All the dogs were imaged with one of two 1.5 T MRI units (GE Signa or Phillips Gyroscan ACS-NT) and an extremity coil. The dogs were anaesthetized and placed in dorsal recumbency for the examination. T2-weighted images were obtained in a minimum of 2 planes including the transverse. T1-weighted images were obtained in transverse plane prior to and after administration of Gadolinium. FLAIR images were obtained in all cases in either transverse or sagittal planes. Additional studies were performed in selected cases. CSF analysis was performed in all cases, as was screening for organic acid metabolites in urine.

Results: T2-weighted and FLAIR images showed marked hyperintensity within the gray matter of the cerebellar and cerebral cortices, thalamus, basal ganglia, dorsal brainstem, caudal colliculi, hypothalamus and cerebellar nuclei. On T1-weighted images the affected areas were hypointense consistent with cytotoxic edema. Following administration of gadolinium no abnormal enhancement was seen. The symmetrical distribution and localization suggested a metabolic or toxic etiology. In Staffordshire bull terriers the MRI findings of symmetrical gray matter hyperintensity on T2-weighted images appears characteristic for L-2 hydroxyglutaric aciduria. Urine screening for increased levels of L-2 hydroxyglutaric acid allows confirmation of the diagnosis.
Introduction. Chiari type 1 malformation (CM1) is a developmental condition of humans characterised by inferior displacement of the cerebellar tonsils through the foramen magnum, and syringomyelia.\(^1\)\(^2\) A similar-appearing syndrome has been reported in Cavalier King Charles spaniels (CKCS).\(^3\) The aims of this study were to describe the neurologic signs and MRI findings in CKCS with CM1.

Methods. Medical records of CKCS that had MRI of the brain and cervical spine at the RVC in the period September 1999 to March 2002 were reviewed. Dogs that had evidence of intracranial space-occupying masses or other conditions considered likely to raise intracranial pressure were excluded. In each dog, MRI of the brain and cervical spine included T1- and T2-weighted transverse and sagittal images. MR images were reviewed with respect to degree of deformity of the cerebellum, degree of hydrocephalus, degree of syringohydromyelia, position of the tip of the cerebellar vermis, size of the lateral ventricles, and size of the cerebellum. Dogs were divided into two groups according to whether their neurolocalization suggested cranial or spinal lesions. The association between cranial or spinal group and categorical variables was assessed using Chi-square methods. The distribution of continuous variables in the cranial and spinal groups was compared using the Mann-Whitney U test.

Results. Forty dogs were found that satisfied the criteria for inclusion in this study. There were 22 and 17 dogs in the cranial and spinal groups, respectively. Another CKCS that was neurologically normal had MRI post mortem. The most common neurologic signs affecting dogs in the cranial group were facial nerve deficits (9/22, 41%), seizures (7/22, 32%) and vestibular syndrome (7/22, 32%). The most common neurologic sign affecting dogs in the spinal group was spinal hyperaesthesia (16/17, 94%). Three dogs showed persistent scratching of the shoulder and neck region. All dogs had herniation of the cerebellum compatible with CM1. The position of the tip of the cerebellar vermis relative to the foramen magnum ranged from \(-1.6\) to \(+5.1\) mm (median \(+1\) mm). Hydrocephalus was present in 26 (65%) dogs. Syringohydromyelia was also present in 26 (65%) dogs. There were no significant differences in age, sex, neuter status, degree of cerebellar deformity, and degree of cerebellar herniation, hydrocephalus, syringohydromyelia or size of the cerebellum between the two groups.

Conclusions. CM1 is very prevalent in CKCS. It occurs in dogs with a variety of neurologic signs and in neurologically normal CKCS; therefore, it is uncertain what signs may be attributed to this condition. Further MRI studies of clinically normal CKCS are warranted.

References
MR CHARACTERISTICS OF CHIARI-LIKE MALFORMATION IN POMERANIANS.
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Multiple scan plane images and sequences of the brain and spinal cord were performed with MR on three unrelated Pomeranians presented for acute neurological signs. The clinical histories and presentations varied from suspect head and neck trauma to cervical disc disease. A variety of neurological abnormalities were detected on MR including hydrocephalus, syringomyelia and cervical disc protrusion with cord compression. Mild bony malformations of the foramen magnum and cranial cervical vertebrae were also seen. Changes seen were consistent with Chiari malformation as described in humans. The impact of the MR imaging information on case management decisions will be discussed.
RADIOGRAPHIC, COMPUTED TOMOGRAPHIC, MAGNETIC RESONANCE AND RHINOSCOPIC FINDINGS IN DOGS WITH NASAL ASPERGILLOSIS


Introduction/Purpose: Nasal aspergillosis is a common disease of the nasal cavity and frontal sinuses and accounts for 7 to 34% of dogs with chronic nasal disease. Diagnostic imaging is an essential component for diagnosis of this disease. Radiography has been superseded by computed tomography (CT) that better demonstrates some changes that are strongly suggestive of nasal aspergillosis such as thickening of the mucosa and bony changes. Magnetic resonance (MR) is superior to CT for evaluation of soft-tissue structures and has widely been used in human medicine for the evaluation of the nasal cavity, paranasal sinuses and surrounding structures. Rhinoscopy allows a diagnosis to be made on the basis of direct visualization of fungal plaques. The aim of this study was to describe the radiographic, CT, MR and rhinoscopic findings in 15 dogs with nasal aspergillosis.

Methods: The nasal cavity and frontal sinuses of 15 dogs with nasal aspergillosis were studied. At presentation, all dogs underwent physical, serological and rhinoscopic examinations. During rhinoscopy, swabs, cytobrush and biopsies were taken for culture, cytology and histology. Final diagnosis was based on at least 3 positive diagnostic tests including direct visualization of fungal plaques at rhinoscopy in all dogs. One to three days after rhinoscopy, the imaging studies (radiography, MR and CT) were performed during the same anaesthesia. Radiography included the four standard projections. Eight MR examinations were performed on a 1T unit (Symphony, Siemens) and 7 examinations on a 1.5T unit (Signa, GE Medical Systems). Pre-contrast T1-weighted, T2-weighted, proton-density-weighted and post-contrast T1-weighted spin echo sequences were obtained in transverse and dorsal planes. CT examinations were performed on a 4th generation helical CT (Picker 6000, Picker). Pre- and post-contrast transverse images were obtained. Reformatted dorsal plane images were also obtained. The MR findings were recorded and compared to the radiographic, CT and rhinoscopic findings. One day after the imaging studies, all dogs underwent a second rhinoscopy for curretage and accurate placement of drains and, were treated with a non-invasive intranasal infusion of enilconazole 1% during 1-hour. The treatment was repeated every 3 to 4 weeks until there was no longer clinical or rhinoscopic evidence of infection.

Results: The nasal cavity and frontal sinuses were affected on at least one side in 12 dogs and were restricted to one nasal cavity in 3 dogs. Radiographic lesions were visible in 14 of the 15 dogs. Both MR and CT showed the same features suggestive of nasal aspergillosis: moderate to severe cavitary destruction of the turbinates with a variable amount of abnormal soft tissue in the nasal passages, non-specific thickening of the mucosa adjacent to the inner surface of bones and thickened reactive bone. MR was superior to CT in separating thickened mucosa, retentions cysts and retained secretions. However, definite differentiation between retained secretions and fungal colonies could not be made even with the use of MR. CT showed bony changes in more detail.

Discussion/Conclusions: MR allows better characterization of soft tissue, particularly in the frontal sinuses, than CT and radiography. However, CT and MR were even sensitive and superior to radiography for diagnosis of canine nasal aspergillosis.
Purpose: The purpose of this study is to define specific CT features associated with feline sinonasal disease, to compare these findings to a recent parallel study of radiographic findings in cats with chronic nasal disease and to determine if any correlates exist between these findings and the final diagnosis.

Method: The hospital database was searched over a 5 year period for feline patients with sinonasal disease that were evaluated using computed tomography. Sixty-two cats with a definitive histopathologic diagnosis of sinonasal disease and no history of sinonasal surgery or radiation therapy were identified. The CT images were evaluated by a single reviewer (WCS) without bias as to the diagnosis. Specific CT findings were paired with the patient data and the variables were analyzed by logistic regression. Odds ratios (OR) and 95% confidence intervals were generated for each of the variables to determine the likelihood of a diagnosis of neoplasia versus inflammatory disease based on each of the variables.

Results: The maxilloturbinates were found to be the most common epicenter in both the neoplasia (74%) and inflammatory (68%) groups. It was more common, however, for the epicenter to be undeterminable with the inflammatory cases (21%). The incidence of bilateral nasal cavity involvement was similar in both neoplasia and rhinitis, being 74% and 89% respectively. Opacification of the sinuses was a common finding in cats with both neoplasia (62%) and inflammation cases (68%). Nasal septum destruction was only present in cats with neoplasia. Destruction of the cribriform plate was relatively uncommon in both groups but was more common in the neoplasia group (18%). Lysis of the maxilloturbinates was common with both neoplasia (91%) and rhinitis (51%) but was more severe with neoplasia. Changes associated with the paranasal bones were found in 79% of the cats with neoplasia and 39% of those with rhinitis. Osteolysis was the overwhelming osseous response found with neoplasia, with lysis of the frontal, maxillary, palatine and lacrimal bones being the most common. In the cats with lymphoma, the degree of paranasal bone osteolysis ranged from nonexistent to severe.

Conclusions: Features that may be beneficial in the computed tomographic diagnosis of nasal neoplasia include osteolysis of the paranasal bones, moderate to severe turbinate destruction, lysis of the nasal septum, the presence of a homogenous space occupying mass and extension of the disease process into the orbit or facial soft tissues. The considerable overlap in the range of patient age and duration of clinical signs between the neoplasia and inflammatory groups precludes using these variables as a positive predictor for either group.

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RADIOGRAPHIC SIGNS IN CATS WITH NASAL DISEASE. C.R. Lamb MA, VetMB, S. Richbell BVetMed, P. Mantis DVM. Department of Veterinary Clinical Sciences, The Royal Veterinary College, University of London.

Introduction. There is less information about radiographic signs of nasal disease in cats compared to dogs. In a review of 29 cats, unilateral loss of turbinates, bone erosion and tooth loss were associated with nasal neoplasia.\textsuperscript{1} The prevalence of various other signs, including facial swelling, deviation/lysis of midline nasal structures, was similar in cats with neoplasia and chronic rhinitis.\textsuperscript{1} The aim of the present study was to describe the radiologic signs in a series of cats with nasal disease and to identify any signs that might be used to support a specific diagnosis.

Methods. Medical records at the Queen Mother Hospital for Animals were searched for cats that had radiography of the skull and nasal examination that included endoscopy, histopathology or cytology, and culture. In each instance skull radiographs included a dorsoventral (intra-oral) projection. Radiographs were examined without knowledge of any clinical information by two radiologists who reached a consensus about the radiographic signs in each case, and recorded their observations using a custom-designed form. The following signs were assessed: lesion location, loss of turbinate detail, soft tissue/fluid opacities, lucent foci, calcification, evidence of invasion of bones surrounding the nasal cavity, lesions affecting the frontal sinuses, and dental lesions. Prevalence of radiographic signs in cats with nasal neoplasia and rhinitis were compared using Fisher’s exact test.

Results. Fifty-two cats satisfied the criteria for inclusion, including 22 with primary nasal neoplasia, 20 with rhinitis, and 10 cats without nasal disease. Nasal structures were interpreted as abnormal radiographically in 95% cats with primary nasal neoplasia, 70% cats with rhinitis, and 0% cats without nasal disease. Signs that occurred more frequently in cats with nasal neoplasia were unilateral lesions, lesions that filled the ipsilateral frontal sinus, generalised loss of turbinate detail, displacement of midline nasal structures, and evidence of invasion of bones surrounding the nasal cavity (p<0.05). The signs with highest predictive value for nasal neoplasia were displacement of midline nasal structures (89%) and soft tissue/fluid in the ipsilateral frontal sinus (80%). The only radiographic finding that occurred more frequently in cats with rhinitis was a nasal cavity within normal limits (p<0.04), and the predictive value of this sign was only 35%. Dental abnormalities were observed frequently in all groups of cats.

Conclusions. The radiographic signs in cats with nasal neoplasia are similar to those observed in dogs.\textsuperscript{2} The relatively high predictive value of soft tissue/fluid in the ipsilateral frontal sinus suggests that it is important to make radiographs of the frontal sinuses when investigating cats with suspected nasal disease. Radiographic signs in cats with rhinitis are variable and non-specific, and may be absent.

References.
HELICAL COMPUTED TOMOGRAPHY OF NORMAL FELINE LUNG
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Introduction This study was designed to develop a protocol for computed tomography (CT) evaluation of the feline lung and to establish anatomic and densitometric values.

Methods Eight, normal, young adult female cats (2.55 – 2.90 kg) were used. Following sedation with acepromazine maleate and ketamine hydrochloride, general anesthesia was induced and maintained with isoflurane. Cats were maintained in sternal recumbency throughout the study to prevent pulmonary atelectasis.

A third generation helical CT scanner was used. Positive pressure inflation of the lungs was maintained at 15 cm H₂O for each data acquisition sequence. Two helical sequences were necessary to acquire data for the entire lung, approximately 20 seconds per sequence. Acquisition parameters were: kVp 130; mA 125; field of view 100 mm (n = 7) and 130 mm (n = 1); algorithm – sharp; collimation – 4 mm spiral. Data was reprocessed to a bone algorithm. All transverse images were viewed at a level of –700 HU and a window width of 1200 HU. Contrast medium was not administered.

Seven transverse images spaced 2 cm apart were selected for analysis of the entire lung of each cat. Circular regions of interest (ROI, 11, 29, 98 mm²) were isocentrically placed in the dorsal, middle, and ventral portions of the right and left lung lobes, unless not possible by anatomic constraints. Large pulmonary vessels were avoided with 11 mm² ROIs, but sometimes included in the 29 mm² and 98 mm² ROIs. Mean Hounsfield units (HU) and standard deviation within each ROI were recorded for each slice. The lung was removed and fixed in formalin and normalcy was confirmed histopathologically. Statistical evaluation included parametric, ANOVA and Kruskall Wallis tests.

Results Mean HU values ranged from –869 ±16 to -897 ±13.3 for cranial to caudal transverse images 1-7. Mean HU values from dorsal, middle and ventral lung were –883 ±18.5, -887 ±19.9, and –874 ±24.3, respectively. Mean HU value for the 11 mm² ROI was –885 ±20.2, for the 29 mm² ROI –882 ±20.6 and the 98 mm² ROI –877 ±22.9. Right lung mean HU was –885 ±19.3, mean left lung HU –879 ±23.1. Mean HU values for lung varied significantly when comparing cranial to caudal transverse images (images 1-7), dorsal, middle and ventral ROIs, ROI size, and right to left lung (all p < .001). There was no significant difference in HU between sharp and bone reconstruction algorithms. Primary bronchi and associated pulmonary arteries and veins were consistently visualized and allowed determination of lung lobe anatomy.

Conclusion Helical CT provides high quality feline pulmonary images in approximately one minute. The breath-hold technique allows evaluation of fully inflated lung. Normal HU values may provide a basis for evaluation of feline pulmonary diseases. Further study is needed to determine if the small yet statistically significant differences in HU values for various portions of the lung and ROI size will hinder evaluation of lung disease.
QUANTITATIVE HIGH-RESOLUTION COMPUTED TOMOGRAPHY FOR CHARACTERIZATION OF A FELINE ASTHMA MODEL
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Introduction: The objective of this investigation is to define the characteristic quantitative and qualitative CT features of an induced model of feline asthma. In the absence of concomitant bronchitis, thoracic radiographic findings of feline asthmatics include subtle airway wall thickening and evidence of air-trapping. CT morphometric analysis is expected to be sensitive and objective in identifying airway wall thickening and air-trapping in hypersensitized cats.

Methods: Five study cats underwent airway sensitization by nebulization with bermuda grass allergen over a one year period. Five control cats were also included in the investigation. High-resolution CT was performed during controlled inspiration and expiration before and immediately after methacholine nebulization in all cats. CT examinations were performed at T=0 and at 6 months after initial sensitization. Airway wall thickness, luminal diameter, thoracic volume and mean CT attenuation of the lung of control and sensitized cats was compared. Airway/arterial ratios were calculated to normalize comparisons between cats. These parameters were correlated with thoracic radiographs, airway cytology and pulmonary function testing.

Results: Immediately after initial sensitization, alveolar infiltrates and lung consolidation were identified in both sensitized and control cats. Initial evaluation of CT morphometric parameters reveals trends of airway wall thickening, increased thoracic volume and decreased parenchymal CT attenuation in affected cats. Thoracic volume reduction post-bronchoconstriction is more pronounced in the hypersensitized cats.

Conclusion: High-resolution CT assessment of induced feline asthma appears to be a sensitive tool for defining extent and severity of airway disease.

This study was supported by the Center for Companion Animal Health and the Center for Imaging Science, School of Veterinary Medicine, University of California, Davis.
USE OF CT IMAGING FOR LYMPH NODE ASSESSMENT IN DOGS WITH PRIMARY LUNG TUMORS

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INTRODUCTION:
Primary lung tumors account for 1% of newly diagnosed canine neoplasms, however the incidence is believed to be rising. Clinical signs at diagnosis, clinical stage of disease, tracheobronchial lymph node (TBLN) status and histologic score have been identified as prognostic factors for dogs with primary lung tumors. In humans, computed tomography (CT) has been utilized extensively for evaluating TBLN involvement and in the detection of occult metastatic sites. The purpose of this study is to determine if CT interpretation of tracheobronchial lymph node (TBLN) status correlates with histopathologic findings and whether CT is more sensitive than thoracic radiographs for evaluating TBLNs in dogs with primary lung tumors.

METHODS:
This retrospective analysis involved dogs presenting to the University of Wisconsin-Madison from January 1999 to June 2002. Criteria for inclusion were: 1) diagnosis of primary lung tumor, 2) thoracic CT and radiographs as part of the diagnostic workup, and 3) histopathological confirmation of TBLN status or long-term follow-up. A radiologist pre-operatively evaluated radiographs and CT scans and histopathologic samples were reviewed by one pathologist.

RESULTS:
Sixteen dogs met inclusion criteria. Fifteen had histopathologic examination of TBLN status and one dog was presumed to have negative lymph nodes due to extended disease free interval (552 days). Seven dogs had confirmed TBLN metastasis. Five of these 7 were interpreted to have lymphadenopathy on CT imaging; none were interpreted to have lymphadenopathy on thoracic radiographs. The sensitivity of CT scan evaluation for correctly assessing TBLN status was 77.7% and the specificity was 100%. The positive predictive value was 100% and the negative predictive value was 81.8%. Dogs with TBLN metastasis, lymphadenopathy on CT imaging, and clinical signs prior to diagnosis had significantly shorter survival time.

CONCLUSIONS:
CT interpretation of TBLN status appears to correlate with histopathological findings and is more sensitive than thoracic radiographs for evaluating TBLNs in dogs with primary lung tumors.
**Introduction:** Helical dual-phase computed tomography (CT) is a technique which is widely used in people to assess the hepatic and portal vasculature for degenerative and neoplastic liver diseases. Potential applications in dogs include assessment of congenital and acquired portosystemic shunts, arteriovenous fistulas, hepatic tumors and portal vein thrombosis.

**Materials and methods:** Dual-phase hepatic CT was performed in 5 normal mixed-breed dogs, aged 6 months and weighing between 12-23 kg. All dogs were free of clinical evidence of liver disease. The animals were hyperventilated immediately prior to scanning to reduce the chance of motion artifact. Initially, a test dose of iodinated contrast material (185 mg iodine/kg body weight) was administered by angiographic injector at an injection speed of 5 ml/s with a maximum pressure of 350 psi to perform a dynamic CT examination of the cranial abdominal vasculature. Contrast density was measured over time of the aorta, cranial vena cava, portal vein and hepatic artery between 5 and 45s post start injection using regions-of-interest. Time-versus-intensity graphs were drawn and the time of maximal enhancement of the vessels was noted for acquiring the arterial and portal phases. Then, the angiographic injector was reset with a calculated dose of 814 mg iodine/kg. The scan parameters were set at 5 mm collimation and a pitch of 1.4, 120 kVp and 160 mA. The hepatic arterial phase was acquired craniad from the cranial pole of the right kidney to the most cranial portion of the diaphragm, with a pre-delay that corresponded to the onset of aortic enhancement. The portal phase was acquired caudad from the most cranial portion of the diaphragm to the pelvic inlet, beginning just before peak portal enhancement or immediately following the minimum reset time between the two phases.

**Results:** All scans resulted in images of excellent quality. The arterial phase required a pre-delay of 7.3-8.9 s (mean 8.3 s). Contrast appeared in the portal vein at 10.7-16.3 s post injection (mean 14s) and reached peak density at 24.9-37.3 s (mean 31.2 s). The portal vein remained well opacified during the acquisition. Following the scans, the hepatic arteries and veins as well as the 4 main tributaries to (cranial and caudal mesenteric, splenic and gastroduodenal vein) and main branches of the portal vein were identified. Vessel location was consistent and corresponded well with the literature.

**Discussion:** Helical dual-phase CT-angiography provides excellent vascular detail of the hepatic and portal vasculature. Normal anatomy is easily and consistently identified and forms the basis for further study of potential uses for the technique. Beginning the portal phase slightly before peak enhancement avoided having contrast in the hepatic veins obscuring the portal veins. Dynamic CT is recommended for accurate scan timing especially during the arterial phase.
HELICAL CT ANGIOGRAPHY OF CANINE PORTOSYSTEMIC SHUNTS

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Introduction: The use of helical single- and dual-phase computed tomography (CT) has been reported for evaluation of the portal vein, its tributaries and branches. These techniques can be used to determine the presence and anatomy of congenital and acquired portosystemic shunts.

Materials and methods: Helical single-phase CT portography was performed in four dogs and dual-phase CT angiography in four dogs with suspected portosystemic shunts. Dynamic CT was performed to determine the optimal scan delay times for single- or dual-phase scans. Scans were performed with 3 or 5 mm collimation and a pitch of 1.4 or 1.6 appropriate to patient size. Injection of contrast medium was made through cephalic or saphenous venous catheter using iohexol (814 mg iodine/kg). The hepatic veins and the portal vein, its tributaries and branches were examined in all dogs as well as the hepatic artery in those patients receiving dual-phase scans. The origin, course and termination of portosystemic shunts were evaluated. Surgery, ultrasound and post mortem reports were used for confirmation of CT findings.

Results: CT portography identified two intrahepatic central divisional shunts, two single extrahepatic portocaval shunts, one portoazygos shunt and two cases of multiple extrahepatic shunts. In all seven cases diagnosis was confirmed ultrasonographically, surgically or by post mortem examination. In the remaining dog, the portal vasculature was normal on CT and ultrasound. The origins of seven shunts were identified and correlated with the surgical report. The terminations of the intrahepatic and portoazygos shunts were confirmed at surgery. The two extrahepatic shunts exited into the esophageal hiatus but were not seen entering the caudal vena cava on CT. At surgery they were presumed to cross the diaphragm to enter the caudal vena cava, however the precise location of anastomosis was not identified. In one case of multiple shunts, the main shunt travelled through the splenic vein. This was seen to anastomose with mesenteric veins near the bladder at surgery but could not be seen on CT. Additional multiple perirenal surgically confirmed shunts were identified on CT in this animal. The second dog with multiple shunts had a large plexus of vessels ventral to the caudal vena cava, some of which entered the large renal vein. Dogs with shunts had different degrees of decreased portal vein arborisation with only the caudate branch seen consistently. One animal with an intrahepatic shunt had increased hepatic arterial supply seen on the dual-phase study. The hepatic arteries were useful landmarks for the adjacent portal branches.

Discussion: CT angiography had good anatomic agreement with ultrasonographic and surgical findings in portosystemic shunts. Dual-phase angiography allowed additional evaluation of arterial blood supply. CT-angiography is a non-invasive, accurate method for evaluating portosystemic shunts.
COMPUTED TOMOGRAPHY OF FOCAL SPLENIC MASSES IN DOGS. WD Fife DVM¹, VF Samii DVM¹, WT Drost DVM¹, JS Mattoon DVM¹, G Kociba DVM, PhD², S Hoshaw-Woodard PhD³. ¹Department of Veterinary Clinical Sciences, ²Department of Veterinary Biosciences, and ³Center for Biostatistics, The Ohio State University, Columbus, OH 43210.

Introduction: Nodular splenic diseases in dogs may be the result of neoplastic (malignant or benign) or non-neoplastic cell proliferation. The radiographic and ultrasonographic characteristics of benign and malignant splenic masses are nonspecific. Computed tomography (CT) is commonly used in people because various splenic masses have distinguishing CT features, both pre- and post-intravenous contrast administration. The purpose of this study was to evaluate the CT imaging characteristics of focal splenic masses in dogs pre- and post-intravenous contrast administration and correlate the results with histopathologic findings.

Methods: Seventeen dogs with splenic masses measuring at least 2.5cm in diameter, as assessed with abdominal ultrasonography, were included in the study. Prior to splenectomy or euthanasia, spiral CT scans of the abdomen were performed pre- and post-intravenous administration of Iohexol 240mg/mL. Regions of interest (ROI) were drawn within the splenic head, body, and tail, and the cranial, mid, and caudal portions of the splenic mass. The mean Hounsfield unit (HU) per pixel and the standard deviation of the ROI were determined for pre- and post-contrast images. The volume of each splenic mass and the percent of the splenic volume occupied by the mass were calculated manually. The hard copy images were reviewed by 3 of the authors and each mass was evaluated according to location within the spleen, margination, homogeneity, attenuation compared to the remaining splenic parenchyma, presence or lack of internal non-enhancing hypodense areas, rim enhancement, and mineralization. Following splenectomy or euthanasia, the spleen was placed in formalin, sectioned and evaluated histologically. Specific histologic diagnoses were made for each splenic mass and each mass was classified as malignant or benign.

Results: Of the seventeen splenic masses included in the study, 12 were benign and 5 were malignant. The benign masses consisted of hematomas (n=6), lymphoid or extramedullary hyperplasia (n=5), and thrombosis (n=1). Malignant splenic masses included hemanagiosarcoma (n=3), malignant fibrous histiocytoima (n=1), and fibrosarcoma (n=1). Malignant splenic masses had significantly lower HU values (p<0.05) than benign splenic masses, both pre- and post-intravenous contrast administration, without a significant difference within the benign group between splenic hematomas and splenic hyperplasia. Ranges for HU values of the masses pre-contrast were: malignant (22.7-38.0) and benign (36.3-64.2; hematomas: 36.3-61.4, hyperplasia: 38.0-64.2). Post-contrast HU ranges were: malignant (35.0-62.8) and benign (41.5-112.3; hematomas: 41.5-84.7, hyperplasia: 47.2-112.3). Splenic hematomas were significantly larger (207cm³-8221 cm³) than splenic hyperplasia (4cm³-174cm³) (p=0.0184) and occupied a greater percentage of the splenic volume (32-89%) than splenic hyperplasia (3-60%) (p=0.0279). No differences were noted between malignant and benign masses for the categorical data.

Conclusion: HU values of malignant and benign splenic masses differ significantly, with malignant masses having lower HU values pre and post-contrast administration. Intravenous contrast administration does not change the relative attenuation characteristics of benign vs. malignant lesions. Subjective categorical measurements are less useful than are objective attenuation values in differentiating malignant from benign canine splenic masses.
COMPARISON OF SEVEN DIGITAL CAMERAS FOR DIGITIZING IMAGES  
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Introduction/Purpose: Teleradiology is an emerging tool available to practicing veterinarians who wish to take advantages of the skills and equipment of radiologists at far distances. It is therefore important to identify relatively low-cost, easily accessible methods for digitizing radiographs. The purpose of this study was to evaluate seven different digital cameras of various costs and capabilities for their ability to adequately resolve and capture radiographic images for evaluation by an experienced radiologist.

Materials and Methods: The digital cameras used in this experiment included a 2.1 Megapixel (MP) Kodak DC3800, a 3.1MP Kodak DC4800, a 2.14MP Nikon Coolpix 775, a 3.34MP Nikon Coolpix 995, a 3.34MP Ricoh i500, a 5.0MP Sony Cybershot DSC-F707, and a 3.25MP Canon EOS-D30 fitted with a Canon EF 50mm f/2.5 compact macro lens. Radiographs of three phantoms were made using two line pair (LP) phantoms with ranges of 0.6-3.4 LP/mm and 3.15-16.6 LP/mm and one 20-step gray-scale contrast phantom. The phantom images were captured on a stand light box at both a close distance of 30 cm from the film and a far distance, defined as the distance needed by the camera to completely capture a 14x17 inch film. The images captured were transferred to a desktop computer and read by two radiologists using Adobe Photoshop® 6.0 on a 21” color monitor with 1024x768 resolution and 32-bit color. The captured images were evaluated for the number of LP/mm (0.6-16.6) that each camera could resolve and the range of contrast latitude (1-20). Significance was established at p ≤ 0.05.

Results: The Canon EOS-D30, equipped with a Canon EF 50 mm f/2.5 Compact Macro lens, consistently performed the best in LP/mm resolved (7.7 at close distance, 1.4 at far distance) and in range of contrast latitude (all 20 steps at both close and far distances). The Nikon 995 and Sony DSC-F707 also performed well, with the 995 scoring significantly lower in the number of LPs resolved at close distance (5.0) and the 707 scoring significantly lower in the number of LPs resolved at far distance (1.0). The Kodak DC3800 was consistently the lowest-scoring camera in all categories. Other than the DC3800, all cameras did not differ significantly in their range of contrast latitude.

Discussion: The Canon EOS-D30, which was determined to be the best camera used in this study for photographing radiographic images, is also the most expensive camera that was used ($3500 list, $440 for the lens). However, two cameras, the 995 and the 707, were very close to the Canon in quality of performance with considerably less cost, at $800 and $1100 respectively. It was established, though, that certain cameras, such as the relatively inexpensive 3800 ($350), are not acceptable choices for the intended use of teleradiology. Although none of the cameras met the American College of Radiology teleradiology standards for LP/mm resolution at the far distance, studies have yet to be done that define an adequate line pair resolution in veterinary medicine. This study demonstrates that digital cameras can be effectively used in teleradiology, providing a relatively low-cost, user-friendly method for digitizing plain film radiographs for subsequent transfer by computer.

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USE OF WEB COURSE TOOLS (WEB CT) IN TEACHING RADIOGRAPHY AND ULTRASOUND.  J.A. Hudson D.V.M., Ph.D., M. Holland D.V.M., M.S.  Auburn University College of Veterinary Medicine, Auburn, AL 36849.

Introduction:
Web Course Tools, commonly known as Web CT, is one of several educational packages available to design an interface and facilitate the development of a web based instructional setting. Web CT has been used for both distance learning and to supplement classroom instruction. Access to the electronic “classroom” is password-protected. Using packaged administrative tools, the instructor can manage class lists, allow students access to their examination and grade results, give and grade tests, and post information pertinent to the entire class. Communication facilities include an instructor monitored forum for discussions, chat rooms, whiteboards, and presentation areas. Areas are included for the posting of lessons and course information.

Methods:
Web CT is being used to teach ultrasonography as an elective to second and third year veterinary students at Auburn University. The class consists of weekly laboratories to allow the students hands-on scanning. Weekly lessons including images are posted for the students to read and print if desired. Discussions take place on line. Examinations using a multiple choice and short answer format are posted for the students to take during a designated time interval. Grading is largely automated.

Results:
Our early experience has been largely encouraging. Writing the course material was relatively simple. No major problems were encountered. The students expressed an appreciation for the use of the format. We anticipate extending the use of Web CT to the Imaging class taught to first year students.

Discussion:
Although we used Web CT to supplement a classroom based course, Web CT also holds promise for distance education. Although computer based teaching cannot replace “hands on” teaching, it can serve as a useful adjunct and communication tool.
An integrated picture archiving and communication system or PAC system can offer many potential benefits including:

- Direct cost savings associated with decreased consumption of radiographic film and chemistry, decreased processor workload/maintenance, less requirement for radiograph storage space, and decreased labor cost associated with reduced film handling and distribution.
- Increased connectivity and integration between facilities and departments.
- Productivity improvements (less time spent looking for misplaced radiographs or prior images, less time spent hanging/removing films, less time distributing films to referrers).
- Increased revenues through eliminating lost examinations and increasing effective capacity.
- Fewer repeated studies due to poor radiographic techniques.
- Decreased time to interpret and communicate diagnoses.
- A more progressive image in the veterinary community.

In addition, a digital imaging environment allows the use of PC-based diagnostic tools to manipulate and annotate images, perform precise image measurements, as well as export images for inclusion in digital presentations or publications.

To achieve optimum functionality, a PAC system should not exist as a stand-alone technology. A radiology information system (RIS), ideally integrated into the hospital information system (HIS) is needed which to achieve this. Functionality should include at least patient registration, order entry/scheduling, report generation and report distribution.

A key component to the exam record table within the RIS is the accession number field. The accession number is a unique, sequential auto-number assigned to each study (not necessarily each image) ordered in the system. When entered into the digital imaging modality or source, either manually or via a worklist populated form the RIS, the accession number creates a permanent link between the images that comprise the study and the associated study data/patient demographics. A RIS generated worklist significantly reduces the possibility of data entry errors.

As college administrators considered purchase and customization of a ‘turnkey’ commercially available RIS/PACS systems too expensive, and our HIS does not support the required functionality, a site specific RIS was built (using access and SQL 2000) and this was interfaced with a commercially available medical PACS (AMICAS). The PACS supports both dicom workstations and a web-viewer. The RIS also has a web component that allows users outside of the radiology department to register patients, enter exam orders, quickly access radiology history and reports. As part of the web functionality, an extensive search engine was implemented to allow comprehensive searches of radiology reports based on the clinician, study date, species, examination, assessment and/or key words, providing a valuable tool to find images for teaching or investigational purposes.

The selection of workstation software, computer and monitor specifications, PACS software and issues associated with introduction and implementation of this technology will be discussed.
INTRODUCTION

Thoracic radiographic assessment of feline hypertrophic cardiomyopathy (HCM) may be of limited use because myocardial hypertrophy may not manifest itself as external enlargement of the heart. This study assessed the relationship of thoracic radiographs to echocardiography in evaluation of normal cats and cats with HCM based on 4 questions: 1. What is the relationship between specific radiographic findings and determination of HCM? 2. What is the relationship between the radiographic findings and ultrasound measurements? 3. What is the difference between the true normal and HCM for ultrasound variables? 4 What is the difference in the demographic characteristics among the normal cats and cats with HCM?

METHODS

4 veterinary radiologists, 2 veterinary cardiologists, 1 radiology resident and 1 cardiology resident independently reviewed thoracic radiographs of 120 cats. Confirmed cases of HCM (n=89) came from Veterinary Teaching Hospital files. Normal cats (n=31) were prospectively studied. All cats had a comprehensive cardiac examination by the Cardiology Service (KM, MK, AS), including echocardiography. Radiograph from normal and HCM cats were co-mingled and randomly placed into one of six groups to aid in independent review. Normal cats placed into each group were matched to HCM cats with respect to radiographic positioning. One lateral radiograph and one DV or VD radiograph were evaluated for each cat. Observers were blinded to diagnosis. A score sheet asked Yes or No responses for the following categories: right atrium enlarged, left atrium enlarged, left ventricle enlarged, generalized cardiomegaly, pleural fluid, pulmonary edema, enlarged pulmonary vessels, enlarged caudal vena cava (CVC), normal CVC position, significant pericardial fat, congestive heart failure, normal heart. The relationship between radiographic categories and echocardiographic normality was tested using logistic regression models, accounting for the fact the same radiographs were observed by multiple reviewers. A multivariable logistic regression model was used to find the best set of variables to predict whether the heart was deemed abnormal and to assess whether the radiographic variables (generalized cardiomegaly, left ventricular enlargement, left atrium) were significant predictors of the ultrasound measurements (interventricular septal thickness, [IVS], left ventricular posterior wall [LVPW], left ventricular internal diameter [LVID], all at systole [s] and diastole [d] and left atrial to aortic root ratio [LA/Ao]). Ultrasound and demographic variables from normal HCM cats were compared using a Wilcoxon Rank Sum test.

RESULTS

The univariable relationship between each of the radiographic measurements and the determination of HCM showed that all radiographic variables (except pericardial fat) are highly significant predictors of HCM. Multivariable logistic regression analysis showed the radiographic variables of left ventricular enlargement, generalized cardiomegaly, pleural fluid and pulmonary edema were found to be the best subset of predictors of HCM. Ultrasound and corresponding radiographic measurements were all significantly related except left ventricular enlargement was not significantly related to LVIDd/s and left atrial enlargement was not significantly related to LA/Ao. Significant differences for normal and HCM cats in the ultrasound variables (except aortic root) were found. No significant differences in age, body weight or gender were found for normal and HCM cats.

CONCLUSIONS

The presence of left ventricular enlargement or generalized cardiomegaly, pleural fluid and pulmonary edema are the best predictors of HCM and all cats with both pleural fluid and pulmonary edema had HCM. Radiographically determined left ventricular enlargement is not related to LVID. Demographics were similar for normal and HCM cats.
DETERMINATION OF NORMAL VS. HYPERTOPHIC CARDIOMYOPATHY IN CATS USING VERTEBRAL HEART SCORE. JS Mattoon DVM1, WT Drost DVM1, KM Meurs DVM PhD1, S Hoshaw-Woodard PhD2, A Spier DVM1, M Kraus DVM1, VF Samii DVM1, F Morandi DVM1, MD Halliday DVM1. 1Department of Veterinary Clinical Sciences, 2College of Medicine and Public Health, The Ohio State University, Columbus, OH 43210

Introduction Thoracic radiographs, alone or with echocardiography, are used to evaluate cats with hypertrophic cardiomyopathy (HCM). Use of vertebral heart score (normal 7.5 ± 0.3) is advocated for discrimination of normal from abnormal feline cardiac silhouettes. This study determines the usefulness of VHS in discriminating normal from HCM feline cardiac silhouettes.

Methods 4 veterinary radiologists, 2 veterinary cardiologists, 1 radiology resident and 1 cardiology resident independently reviewed thoracic radiographs of 121 cats. Confirmed cases of HCM (n=90) came from Veterinary Teaching Hospital files. Normal cats (n=31) were prospectively studied. All cats had a comprehensive cardiac examination by the Cardiology Service (KM, MK, AS), including echocardiography. Radiograph from normal and HCM cats were co-mingled and randomly placed into one of six groups and radiographs were matched to HCM cats with respect to radiographic positioning. One lateral radiograph and one DV or VD radiograph were evaluated for each cat. Observers were blinded to diagnosis. Observers determined VHS and other qualitative radiographic categories, including whether or not the heart was normal. Normal VHS was 7.5 ± 0.3. Overall observer differences for each of the questions were assessed using cross-tabulations and statistical tests (F-test) because all observers evaluated the same 121 cases. The 8 observers were categorized into Grouping 1 (radiologists, cardiologists, and residents), and Grouping 2 (radiologists + radiology resident and cardiologists + cardiology resident). Kappa statistics assessed interobserver reliability. Since normal or HCM was known, the percentage of correct diagnoses was compared between observers, and Sensitivity, Specificity, Positive Predicted values (PPV) and Negative Predicted values (NPV).

Results The 8 observers and Grouping 1 had significantly different VHS (p<0.001). Grouping 2 did not differ significantly (p=0.127). There was no significant difference in the percentage of normal VHS scores recorded by the 8 observers nor Grouping 2, but there was a difference in Grouping 1 due to the residents. Significant relationships between normal VHS and ultrasound measurements of normal left atrial size, interventricular septal thickness (IVS), left ventricular posterior wall (LVPW) at systole (s) and diastole (d), but not left ventricular internal diameter (LVIDs/d) were noted. Interobserver reliability was poor between all observers, radiologists, cardiologists, residents and Groupings 1 and 2. There was a significant difference p<0.001 in mean VHS of normal cats, 7.61 ± 0.56 (5.5 min-9.5 max) and HCM cats, 8.17 ± 0.90 (6.6- 12.5). Sensitivity, specificity, PPV, NPV of using VHS to predict normal cats hearts was 53.3, 68.8, 37.6 and 80.7. If the VHS was > 7.8, the probability of HCM was 0.85. However, when the VHS was < 7.2, the probability of HCM was 0.61 and the probability of HCM was 0.62 even when the VHS was in the normal range. The probability of VHS of < 7.2 in normal cats was 0.17. After controlling for radiographic diagnoses of left ventricular enlargement, generalized cardiomegaly, pulmonary edema and pleural fluid, VHS does not further enhance the prediction of HCM hearts.

Conclusions There is significant variability between observers in determination of VHS. VHS is a good predictor of HCM when values are >7.8. However, there are a large percentage of HCM cats with normal and low VHS.
Introduction: The purpose of this study was to investigate a transvenous coil embolization (TCE) technique for attenuation of a single congenital PSS in dogs. Methods: Ten dogs presented to the VTH at The Ohio State University with a clinical diagnosis of single congenital PSS confirmed by sonographic and scintigraphic studies were included in the study. The TCE was performed in a similar manner in all dogs. Under general anesthesia, an angiographic catheter with a guide wire was passed into the caudal vena cava via a jugular or femoral vein approach. Retrograde portography was then performed. The catheter was placed into the mid-portion of the shunt vessel, and an occluding embolization coil was delivered. Embolization coils were added until the diameter of the shunting vessel was reduced by 75-80%. Abdominal sonography, per rectal portal scintigraphy, and serum bile acid concentrations were evaluated at 1 week, 1 and 6 months, and 1 and 2 years after transvenous coil embolization.

Results: The transvenous coil embolization procedure resulted in complete resolution of clinical signs in 4 dogs with extrahepatic shunts, and 3 dogs with intrahepatic shunts. Dogs #3 and #4 required a second embolization to achieve further occlusion of the shunting vessel. At the one-month scintigraphic reevaluation of dog #5 there was persistent shunting. An exploratory laparotomy was performed and there was shunting through a second, presumably acquired, shunt. During the transvenous coil embolization procedure of dogs #5, #7, and #8, one coil migrated to the right ventricle, and lodged within the pulmonary artery. Attempts to retrieve the coil using a microsnare were unsuccessful in dog #7 and #8 where it was lodged at the bifurcation of the main pulmonary trunk, and the dogs arrested during anesthesia. These 2 dogs weighted less than 3.0 kg. In dog #5 and #9, the coil migrated distally within the pulmonary artery, without causing any clinical problems. After the transvenous coil embolization procedure, the dog #9 developed acute portal hypertension, and was euthanatized 2 hours after the procedure due to poor prognosis.

Discussion: In 2 of the intrahepatic shunts, a second embolization was necessary to adequately close the shunting vessel; the reduction of flow through the shunting vessel after the first embolization was less than 75% on the retrospective review of the venographic study. Death of 2 dogs was related to migration of coils to the level of the main pulmonary artery. If the coils had migrated further distally within the pulmonary vasculature, complications would have been unlikely as collateral vascularization would have been recruited (as in 2 other dogs). An embolization coil with a diameter exceeding the shunt vessel diameter by 3 to 4 mm appears adequate. The length of the coil was chosen so it would make 2 turns on itself within the vessel.

Conclusion: Transvenous coil embolization resulted in improvement of clinical signs in seven of ten dogs. Since surgical occlusion of an extrahepatic shunt with an ameroid constrictor is a safe and effective method of treatment, it is unlikely that transvenous coil embolization will replace this surgery unless the issue of coil migration can be resolved. On the other hand, transvenous coil embolization appears to be a less invasive alternative to surgical ligation in dogs with single intrahepatic PSS.
THE NORMAL LEFT LIMB OF THE PANCREAS IS VISIBLE ON SURVEY RADIOGRAPHS OF FAT CATS. W.E. Blevins, DVM, MS., K. M. Kooreman, DVM, PhD., School of Veterinary Medicine, Purdue University, W. Lafayette, IN 47907

Introduction: Conventional wisdom supported by multiple veterinary textbooks suggests that the normal pancreas is not visible on survey radiographs. It has been discovered that this is not true in over half the cases of abdominal radiographs of cats.

Methods: Because it is our policy to make survey radiographs before performing an abdominal ultrasound study, a data search for all abdominal ultrasound studies of cats was done. The abdominal radiographs of 100 consecutive cases were review by the first author. The cases were separated into two groups: 1) those with limited abdominal contrast due to lack of fat or other factors which obscured visualization of the pancreas and 2) those whereby the pancreas could be seen. The diameter of the left limb of the pancreas was measured in those cases where the pancreas was visible. In all cases where possible, the thickness of the falciform fat was also recorded.

Results: There were 57 cases (57%) where the pancreas was visualized and could be measured. Of the 43 cases (43%) where the pancreas could not be seen, 8 had overt peritoneal disease including ascites, pancreatitis, hemorrhage or lymphoma. There were 16 cases where the falciform fat measured 0.5 cm or less. These cases were considered to have poor abdominal contrast due to lack of fat. There were 3 cases where the abdominal contrast was considered to be marginal (falciform fat measures 0.6-0.7). An additional 5 cases had feces, bowel gas or poor radiographic positioning which obscured the region of the left limb of the pancreas. There were 11 cases with a non-visualized pancreas that had a similar fat load to those cats whose pancreas could be visualized.

Of the 57 cases with a visible left limb of the pancreas, the average falciform thickness was 2.6 cm with a range of 0.8-5.3 cm. The falciform fat could not be measured in one case that had a peritoneal-pericardial hernia. The average width of the left limb of the pancreas was 0.9 cm with a range of 0.5-1.2.

Discussion: When interpreting abdominal radiographs, it is important to be able to accurately identify abdominal organs. In cases where a normal left limb of the pancreas can be observed, diseased involvement of this region of the organ is less likely. Non-inflammatory enlargements of the left limb of the pancreas (tumors or infiltrative disease) can be recognized by knowing the location and size of the normal organ.
HELICAL COMPUTED TOMOGRAPHY OF NORMAL FELINE PANCREAS
JS Mattoon DVM¹, WT Drost DVM¹, VF Samii DVM¹, S Hoshaw-Woodard PhD², SE Weisbrode VMD PhD³, ¹Department of Veterinary Clinical Sciences, ²College of Medicine and Public Health, ³Department of Veterinary Biosciences, The Ohio State University, Columbus, OH 43210

Introduction The purpose of this study was to develop a clinical computed tomography (CT) protocol and establish anatomic and densitometric values of the normal feline pancreas.

Methods Eight, normal, young adult female cats (2.55 – 2.90 kg) were used for this study. The normal health of each cat was determined by complete blood count, serum biochemistries, serum T₄ concentration, urinalysis and histologic evaluation. Each cat was sedated using acepromazine and ketamine. Anesthesia was induced and maintained using isoflurane in oxygen. The cats were positioned in sternal recumbency. An esophageal tube was placed into the stomach and room air was introduced until the stomach was visibly distended. All data were collected using a third generation helical CT scanner. The acquisition parameters were: kVp - 130; mA - 125; field of view - 120 mm; algorithm – standard. For the first phase, 5 mm helical slices of the abdomen were made from the cranial aspect of the liver to the level of the acetabulae. These were reviewed to locate the pancreas and plan for the second phase of data acquisition. For the second phase, 3 mm spiral slices of the pancreas (and surrounding structures) were obtained. For the third phase, 3 mm spiral sequences were repeated immediately following intravenous iohexol administration (240 mg/lb). Images were viewed at a window level of 30 HU and a window width of 250 HU.

Circular regions of interest (ROI) were drawn on the pancreas (10 mm²) and portal vein (3 mm²). The time of acquisition for each slice was recorded. The mean Hounsfield unit (HU) and standard deviation within each region of interest was recorded for each slice. Comparisons between the factors were conducted using analysis of variance. Linear regression models were used to estimate the change in HU over time from acquisition.

Results The body of the pancreas was located directly ventral to the portal vein. The right lobe could be followed caudally along the duodenum. The left lobe followed the greater curvature of the stomach and was closely associated with the transverse colon and splenic vein. The length of each pancreatic lobe that could be seen varied among the 8 cats but in general the left lobe could be followed further caudally than the right. Pre-contrast (HU 57.4 ±6.1) and post-contrast (HU 96.5 ±10.6) HU values were significantly different (p <.001). No statistical difference was found between the body, left, or right lobes of the pancreas nor between various slice locations either pre- or post-contrast. There was no difference in post-contrast HU values from the beginning to the completion of data acquisition (< 1 minute). The mean portal vein HU was 36.6 ± 5.0 pre-contrast and 213.6 ± 50.3 HU post-contrast. The mean portal vein HU declined significantly over the post-contrast acquisition time from 247.3 ± 37.5 to 193.9 ± 22.3.

Conclusions The normal feline pancreas can be imaged using CT and may be a useful imaging technique in assessment of pancreatic disease. Helical CT allows rapid data collection, an important consideration for clinical use. The portal vein is an important anatomic landmark used to locate the pancreas, further aided by distension of the stomach and duodenum with air.
Evaluation of the Feline Pancreas using Computed Tomography and Radiolabeled Leukocytes. LL Head, GB Daniel, K Tobias, F Morandi, R DeNovo, R Donnell, University of Tennessee.

Introduction/Purpose: Current imaging studies, as well as laboratory results are unreliable for diagnosing feline pancreatitis. The goal of this study is to evaluate the usefulness of computed tomography and granulocyte labeling in evaluating the feline pancreas. Since there are no published reports of labeling feline granulocytes, methodology and feasibility of this procedure is also investigated.

Materials and Methods: Six young male adult cats were deemed to be healthy based on physical exam, blood values, abdominal radiographs and ultrasound. Autologous granulocytes were labeled with $^{99m}$Tc-HMPAO and injected into each cat. Whole body images were acquired at 1, 5, 15, 30 minutes, 1, 2, and 4 hours. The following day, the cat was anesthetized, computed tomographic images of the abdomen were acquired both pre and post contrast. Following CT, a surgical pancreatic biopsy was performed.

Results: Feline granulocytes are easily separated by sedimentation and can be successfully labeled with $^{99m}$Tc-HMPAO. Labeling efficiency ranged from 15-42% with an average of 27%. An average of 5.42 x 10^7 cells in a 2 ml volume were injected into each cat. Image acquisition was based on the capture of 500,000 counts per image and this required less than one minute. Granulocytes distribute predominantly to the lung, spleen and liver in order of decreasing activity. Very little activity can be identified in the region of the pancreas. The pancreas is easily identified using CT images of the abdomen. An ANOVA was utilized to compare liver, spleen and pancreas (P<0.05). The pancreas is hypodense to both the spleen and liver. The liver and spleen are not statistically different from each other. The pancreas enhances with the administration of contrast medium, peaking immediately, and gradually clearing over the 30 minute test period. All post-contrast values are significantly different than the pre-contrast density of the pancreas. All biopsies revealed normal pancreas and no adverse effects were recognized as a result of pancreatic biopsy.

Discussion/Conclusion: Despite the poor labeling efficiency associated with feline granulocytes in this study, there was a large number of granulocytes injected into each cat allowing for good image acquisition in less than one minute. Given the relative ease with which feline granulocytes can be labeled, and the void of activity in the region of the pancreas in normal cats, this may be a promising imaging procedure for the detection of feline pancreatitis. The pancreas was easily identified on CT images allowing for establishment of its normal appearance and contrast enhancement pattern. We predict that these parameters may be altered in the face of inflammation, allowing detection of feline pancreatitis. Data from cases of suspect feline pancreatitis are needed to evaluate these methods for clinical utility.
OSTEOPETROSIS IN CATS: CLARIFICATION OF A COMMON MISNOMER.
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Introduction: In the veterinary literature, a rare, diffuse, osteosclerosing disorder of cats is commonly referred to as osteopetrosis. Radiographically, these osseous lesions are characterized by a diffuse increase in medullary opacity and are generally identified incidentally. The etiology and significance of the osseous lesions are unknown. The purpose of this abstract is to compare and contrast the disorder to human osteopetrosis, identify potential etiologies for this disorder, and ascribe significance to this radiographic finding.

Methods: The case histories of three cats with a radiographically identified diffuse increase in medullary opacity were reviewed. Additionally, radiologist responses and case histories of an additional 11 cats identified in an ACVR list-serv poll were reviewed.

Results: In all of the cats in this series, osseous abnormalities were identified incidentally. In three of the cats, the radiographic lesions were confirmed with an increase in bone mineral density by dual energy x-ray absorptiometry. In these three cats, the extremely hard bone could not be penetrated with a bone marrow biopsy needle. Cats ultimately died of lymphoblastic leukemia(1), SLE related illness(1), lymphoma (2), C-cell tumor (1), myeloproliferative disorders (8). One cat was alive with chronic renal failure six months after diagnosis. Multiple radiologists responding to the poll stated that they consider the lesions incidental findings and did not recommend further investigation.

Discussion: Dorland’s Medical Dictionary defines osteopetrosis as “a rare genetic disease characterized by abnormally dense bone due to defective resorption of immature bone.” In humans, the disease is characterized by fragile bones that easily fracture, mental retardation, blood dyscrasias, and fetal death in the autosomal recessive form. In veterinary medicine, a similar disease is found in dogs, horses, and cows. However, the syndrome in cats is characterized by abnormally hard bones, no neurologic deficits, and appears to be an acquired disorder. Due to these dissimilarities it is recommended that the term osteopetrosis be replaced with a descriptive term such as diffuse osteosclerosis.

Numerous causes of diffuse sclerosis are found in the human literature. Notably, renal failure, leukemia, myeloproliferative disorders, and SLE are known to cause osteosclerosis. These are the same diseases identified in the cats in these series. Further studies are needed to identify the relationship between the osseous lesions and these associated disorders. Nonetheless, at the present time, it appears prudent to recommend further diagnostics when these lesions are detected radiographically. A bone aspirate, however, is not recommended as the sclerotic bone precludes acquisition of a bone marrow sample.

Conclusions: It is concluded that the term osteopetrosis is a misnomer. It is proposed that the descriptive term diffuse skeletal osteosclerosis be used to describe this radiographic finding in cats. If identified incidentally a search for an underlying cause is warranted. The sclerotic bone is too hard to penetrate for a bone marrow aspirate.
POSITIVE AND NEGATIVE PREDICTIVE VALUES FOR DIAGNOSING CANINE URETERAL ECTOPIA USING THREE DIFFERENT IMAGING TECHNIQUES.
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Introduction: The purpose of this study was to determine the positive and negative predictive values for diagnosing canine ureteral ectopia using excretory urography, urethrography, or contrast-enhanced computed tomography (CT). We hypothesize that CT would be superior to other imaging methods in the determination of ectopia.

Methods: Sixteen female and four male dogs, each with a history of urinary incontinence despite normal voiding patterns, were evaluated. Described protocols for radiographic, CT and cystoscopic evaluation of the urinary tract were followed. Excretory urography was performed on day one of imaging. Urethrography, contrast-enhanced CT, and cystoscopy were performed on day two of imaging. The presence or absence of ureteral ectopia was determined on cystoscopic evaluation. Surgery or necropsy was performed in all cases where ureteral ectopia was determined cystoscopically. Two board certified radiologists and four radiology residents, all blinded to cytoscopic and surgical or necropsy findings, independently reviewed all studies for the presence of ureteral ectopia. All examinations were randomized such that imaging procedures for the same dog could not be viewed simultaneously. The overall differences between the studies were assessed using cross-tabulations and F-tests. Sensitivity, specificity, positive predictive value and negative predictive value were determined using both cystoscopy and surgery or necropsy, when available, as gold standards. Kappa statistics were calculated to estimate the inter- interpreter reliability between tests and overall. Interpreters were evaluated in three groupings: Board certified radiologists, residents, and all interpreters.

Results: Thirteen of 20 dogs had ectopic ureters (65%). Ectopia was bilateral in 9/13 dogs (69.2%). There was no significant difference between the studies with respect to judging percent positive for ectopia (p=0.178). There was no significant difference between the studies with respect to judging unilateral versus bilateral ectopia (p=0.548). A significant difference was found between board certified radiologists and residents in the correct interpretation of CT exams (p=0.017) and for all three studies combined (p=0.021) as compared to cystoscopy. A significant difference was not found between board certified radiologists and residents in the correct interpretation of any or all studies as compared to surgery. Poor agreement (κ<0.4) was present between board certified radiologists (κ =0.138), residents (κ =0.379), and all interpreters (κ =0.343) in diagnosing ureteral ectopia with CT. Fair to good agreement (κ =0.4-0.75) was seen in the other studies and groupings. Poor agreement was present between board certified radiologists (κ =0.243) and all interpreters (κ =0.203) in determining bilateral ectopia with CT. Poor agreement was present between all interpreters (κ =0.362) in determining bilateral ectopia with urethrography and overall. Fair to good agreement was seen in the other studies and groupings.

Conclusion: CT was not determined to be superior to either excretory urography or urethrography for diagnosing canine ureteral ectopia. It is speculated that interpreter inexperience at reading CT examinations may have been a factor. Board certified radiologists were better than residents at identifying dogs negative for ureteral ectopia via CT and overall.
Introduction

Thoracic radiology is routinely used in crias with known or suspected cardiac or respiratory disease and as a screening procedure for non-specific clinical signs or abnormal blood work. With scant thoracic radiology literature available, the purpose of this study was to collect quantitative and qualitative information of the normal alpaca thorax.

Methods

Twenty-one normal alpaca crias (14 females, 7 males; 2-238 days of age, 18-56 lbs) were radiographed in right, left, ventrodorsal (VD) and dorsoventral (DV) recumbency in a small animal radiology suite. A 400-speed rare earth film screen combination was used. A standard canine thoracic technique chart utilizing relatively high, patient thickness dependent kVp and low mAs was used. Sedation was not necessary and only minimal manual restraint was required. Exposures were made during inspiration.

The radiographs were viewed on a patient by patient basis as well as collectively relative to recumbency. Quantitative assessment of the radiographs included cardiac height/length, cardiac width, thoracic height and width, cardiosternal contact, T3-5 length, T4 vertebral height, cranial pulmonary artery and vein at the level of the third rib, tracheal (@ T3) and mainstem bronchial height, tracheal angle, CVC height, and pulmonary vasculature size. The lumbodiaphragmatic recess, cranial extent of the lung lobes, clarity of pulmonary vessel visualization, bronchial mineralization, carina location, cranial mediastinal width, direction and visualization of the caudal vena cava (CVC) were recorded.

Results

On lateral radiographs, the ratio of cardiac length + cardiac width to T3-5 was 3.12 ± 0.21. The ratio of mean cardiac height to thoracic height was 0.75 ± 0.03. Mean intercostals space (ICS) of the heart was 2.75 ± 0.32. Cardiosternal contact was 2.83 ± 0.31 sternabrae. Right cranial pulmonary artery to third rib width was 0.42 ± 0.11, right cranial pulmonary vein to third rib width 0.45 ± 0.11. Tracheal height to T4 ratio was 0.78 ± 0.12, trachea to mainstem bronchi ratio 1.29 ± 0.22 and tracheal angle 13.72° ± 3.52. The lumbodiaphragmatic recess ranged from T10 to L1, the cranial lung lobes always extended to the first rib, the carina was located at the 4th rib or 4th ICS, the was either parallel to the thoracic spine or slightly divergent from it, mineralization of larger airways was always seen, and pulmonary vessels could be clearly seen into the peripheral-most extent of the lung. There was no statistical difference in quantitative values or qualitative assessment between right and left lateral radiographic views.

The mean cardiac length + cardiac width to T3-5 ratio was 2.52 ± 0.25 for DV radiographs, 2.88 ± 0.21 for VD views. Cardiac width to thoracic width ratio was 0.80 ± 0.06 on the DV views, 0.86. ± 0.08 on the VD views. The cranial mediastinum was always confined to the width of the cranial thoracic vertebrae. Caudal lobar pulmonary vessels were difficult to quantitatively assess in the majority of cases, as was the caudal vena cava, independent of DV or VD positioning.

Conclusions

Establishment of quantitative and qualitative thoracic radiographic parameters for alpaca crias may prove useful in assessment neonatal and juvenile cardiac and non-cardiac thoracic disease. No differences were found between right and left lateral radiographs and there was little quantitative or qualitative difference between DV and VD radiographs.
HELICAL COMPUTED TOMOGRAPHY OF NORMAL FELINE THYROID
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Introduction The purpose of this study was to develop a clinical computed tomography (CT) protocol and establish anatomic and densitometric values of the normal feline thyroid.

Methods Eight normal, young adult female cats (2.55 – 2.90 kg) were used for this study. The normal health of each cat was determined by complete blood count, serum biochemistries, serum T4 concentration, urinalysis and histologic evaluation. Each cat was sedated using acepromazine and ketamine given intramuscularly. Anesthesia was induced and maintained using isoflurane. The cats were positioned in sternal recumbency. Using a third generation CT scanner the following acquisition parameters were: kVp - 120 (n = 7) or 130 (n = 1); mA - 125 (n = 8); field of view - 80 mm; algorithm – standard; slice thickness – 2 mm spiral. A scout image of the neck was made for image planning. Slices were acquired from the cranial aspect of second cervical vertebrae through the caudal aspect of the fourth cervical vertebrae. Data were acquired before intravenous iohexol (240 mg/lb) administration in seven cats. Because these cats were part of another study, delayed contrast enhanced images of the neck were acquired prior to a second contrast medium injection, with immediate images made (n = 8). Circular regions of interest (ROI, 1 mm²) were drawn on the right and left thyroid lobes on each slice that included thyroid tissue. The ROI were applied to the pre-, delayed, and immediate post-contrast medium enhanced transverse images. The mean Hounsfield unit (HU) and standard deviation within each region of interest was recorded for each slice. Data was evaluated using ANOVA. Dorsal and parasagittal plane reconstructions were made using software included with the CT scanner. From precontrast transverse, dorsal and sagittal images, height, width and length of each thyroid gland were measured in 7 cats. Thyroid measurements were averaged over the left and right thyroids, and the average sagittal and dorsal lengths were used for CT length measurements. Mean CT derived thyroid measurements were compared (Pearson’s correlations) with gross measurements obtained at necropsy with electronic calipers.

Results Thyroid lobes were identified in transverse images in all pre-contrast cats as relatively hyperattenuating round to oval structures consistently located directly adjacent to the trachea and medial to the common carotid arteries. Post-contrast the thyroid glands uniformly opacified and identification was enhanced by opacification of adjacent common carotid arteries. Significant differences were found between pre-contrast HU (117 ± 21.1), delayed contrast HU (126.9 ± 26.4) and post-contrast HU (161.3 ± 31.5). Mean CT measurements were length 16.9 ± 2.2 mm, height 4.1 ± 0.8 mm, and width 2.6 ± 0.9 mm. Mean caliper measurements were length 16.5 ± 2.1 mm, height 5.4 ± 1.05 mm and width 3.05 ± 0.07. Correlations between CT and caliper measurements were length 0.68, height 0.50 and width -0.13.

Conclusions Feline thyroid glands are easily assessed with CT pre- and post-intravenous contrast administration. While nuclear medicine and ultrasound are current imaging modalities of choice, CT may be valuable in assessment of thyroid size (length and height), shape and relationship to adjacent structures in certain disease states.
QUANTITATIVE EVALUATION OF PERFUSION AND PERMEABILITY USING CONTRAST ENHANCED COMPUTED TOMOGRAPHY IN AN INDUCED RAT TUMOR MODEL

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PURPOSE: To quantitate the perfusion and permeability of induced tumors in rats using Patlak analysis of contrast enhanced computed tomography images and to compare imaging data with correlated histologic sections.

METHOD AND MATERIALS: R3230 rat mammary adenocarcinomas were implanted within the subcutaneous tissues of the thigh in 25 rats. Five rats were imaged per week starting 14 days after implantation. CT images were obtained pre contrast and tumor volume was determined. Serial, stationary CT images were obtained at 2-second intervals for 1 minute following bolus injection of 1 ml of iodinated contrast media into the tail vein. Tumor permeability and perfusion were measured by applying Patlak analysis to time-density data from tumor and femoral artery. Rats were then euthanized and tumor tissue excised. Tissue was preserved in 10% formalin and sections obtained in the same orientation as the CT images. Sections were prepared with H & E stain to evaluate overall morphology.

RESULTS: Contrast-enhanced computed tomography generated images revealed progressive change from a uniform contrast enhancement in smaller tumors to a peripheral distribution in larger tumors. Contrast enhancing areas approximated histologically viable tumor. Perfusion and permeability tended to diminish with increasing tumor volume. The mean perfusion of tumors with a volume less than 1000 mm³ was 0.0555 ml/min/ml, 1000-3000 mm³ was 0.0520 ml/min/ml, 3000-5000 mm³ was 0.0299 ml/min/ml, and greater than 5000 mm³ was 0.0370 ml/min/ml. The mean permeability value for tumors with a volume less than 1000 mm³ was 0.0228 ml/min/ml, 1000-3000 mm³ was 0.0194 ml/min/ml, 3000-5000 mm³ was 0.0124 ml/min/ml, and greater than 5000 mm³ was 0.0100 ml/min/ml.

CONCLUSIONS: Patlak analysis of contrast-enhanced computed tomography imaging of implanted tumors provides a quantitative assessment of regional perfusion and permeability. Overall tumor perfusion and permeability tended to decrease with increasing tumor volume. The assistance of Rich Larson, Jason Peters, and Betty Hu is gratefully appreciated. The authors acknowledge the support of NIH CA76062.
MAGNETIC RESONANCE IMAGING (MRI) FINDINGS OF PRIMARY BRAIN TUMORS IN DOGS: A RETROSPECTIVE STUDY (1998-2001)


PURPOSE: The purpose of this study was to establish the incidence of primary brain tumors in dogs in the MRI service at León University School of Veterinary Medicine and their MRI appearance.

MATERIAL AND METHODS: A retrospective study was performed to evaluate the MRI features of primary brain tumors in dogs by reviewing the log book of MRI examinations performed between 1998 and 2001. Patients were included in the evaluation only if primary brain tumor was confirmed by surgery or necropsy.

Were examined by MRI 50 animals with suspect of encephalon disease; of this dogs were primary brain tumors 15.

All animals were received at our service after completed physical, neurological and laboratorial examination, dogs were put under general anesthesia and MRI was performed. We used a 0.2 Tesla magnetic (Signa Profile, GE Medical Systems) unit. In all the cases a “head coil” was used.

The technical data of this study were: matrix: 256X192; slice thickness: 4mm; TR (repetition time): 300 and TE (echo time): 20 for the T1 sequence (pre and post contrast); TR: 2500 and TE: 124 for the T2 sequence.

RESULTS: The dogs were between five and twelve years of age. There were eight males and seven females. Breeds included Boxer (7), Cocker Spaniel (1), Yorkshire Terrier (1), Rottweiler (1), Schnauzer (1), Daschaund (1), Spanish Water Dog (1), Mixed Breed (2).

Principal MRI characteristics were mass effect, moderate to intense hydrochephalus, mild to severe edema, high signal intensity on T2 weighted magnetic resonance images and post contras enhancement on T1W in 12 cases (meningioma was the brain tumor with more intense contrast enhancement, in this cases in addition dural tail sing was present).

The presence of brain tumor was confirmed by surgery in two cases and by necropsy in the others. There were 6 meningiomas and 9 gliomas (5 astrocytomats, 3 oligodendrogiomas and one ependymoma).

CONCLUSIONS: In this review, Boxer was the breed most affected by primary brain tumors. The mass was detected in all dogs on precontrast image, principally T2W and, except in three cases, all tumors had some degree of enhancement with gadolinium-DTPA. Contrast enhancement was very important in characterizing the exact position and extension of the tumor and in differentiating tumor of edema.

DISCUSSION: Although MRI is not specific technique in predicting the type of brain tumor, in our opinion, is a useful technique to evaluate dogs with primary brain tumor and to estimate if the mass is probably a meningioma or a glioma. MRI allows veterinary surgeons to determine the exact position of the tumor and the possibility of removing.
MAGNETIC RESONANCE ANATOMY OF THE NORMAL CANINE NASAL CAVITY
AND FRONTAL SINUSES

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Introduction/Purpose: The radiographic evaluation of a pathologic canine nasal cavity is difficult
due to the superimposition of many complex structures of different physical densities. Computed
tomography (CT) may overcome tissue superimposition but shows often considerable overlap of
the attenuation values of abnormal soft tissues. Magnetic resonance (MR) offers a new
technological approach with a high soft tissue resolution that may allow better differentiation of
abnormal nasal soft tissues.

Purpose: The aim of this study was to provide a description of the normal canine nasal cavity and
frontal sinuses using MR imaging.

Methods: Two Belgian Shepherd dogs weighing 25 and 35 kg, respectively, were used in this
study. Both dogs had no history of nasal disease, were free of nasal symptoms at physical
examination and had normal radiographs of the nasal cavity and frontal sinuses. MR
examinations were performed on a 1T superconducting magnet (Signa, GE Medical Systems).
T1-weighted, T2-weighted, proton density and post-contrast T1-weighted (2 mL/kg of a solution
of 2mmol gadolinium meglumine/L) sequences were obtained. Contiguous 5mm-thick slices
were performed in transverse (from the caudal level of the frontal sinuses to the nostrils) and
dorsal (from the dorsal level of the frontal sinuses to the hard palate) planes. At the end of the
MR examination, heparine was injected intravenously (IV) (cephalic vein) in both dogs. The
dogs were euthanatized for reasons unrelated to nasal disease. Immediately after death, IV
(jugular vein) perfusion with formaldehyde 4% was performed. The heads were severed at the
atlanto-occipital joints and, the cranial skin, mandibles and temporal muscles were removed. The
skull was placed in a solution based on nitric acid for decalcification during 2 weeks and then
embedded with gelatine. The skull was sectioned into 10 mm thick sections using a stainless
steel knife. Each anatomical section was photographed and compared with the corresponding
MR images.

Results: The results of the study are shown in sequential matched photographs of the anatomical
sections with their corresponding MR images. Clinical relevant anatomic structures are
identified. T2-weighted images provided better soft tissue contrast while anatomic details,
particularly the turbinates of the ventral nasal concha, were better identified on T1-weighted
images.

Discussion/Conclusions: MR provided excellent anatomical detail of the nasal cavity and frontal
sinuses. The images of this study may serve as reference for clinical MR imaging studies of the
canine nasal cavity and frontal sinuses.
OBSERVER DIFFERENCES IN THORACIC RADIOGRAPHIC ASSESSMENT OF NORMAL CATS AND CATS WITH HYPERTROPHIC CARDIOMYOPATHY. JS Mattoon DVM¹, S Hoshaw-Woodard PhD², KM Meurs DVM PhD¹, WT Drost DVM¹, A Spier DVM¹, VF Samii DVM¹, F Morandi DVM¹, M Kraus DVM¹, MD Halliday DVM¹. ¹Department of Veterinary Clinical Sciences, ²College of Medicine and Public Health, The Ohio State University, Columbus, OH 43210

Introduction The hypothesis that significant interobserver differences exist for interpretation of feline thoracic radiographs, particularly for cardiac silhouette evaluation, was tested using normal cats and cats with hypertrophic cardiomyopathy (HCM).

Methods 4 veterinary radiologists, 2 veterinary cardiologists, 1 radiology resident and 1 cardiology resident independently reviewed thoracic radiographs of 120 cats. Confirmed cases of HCM (n=89) came from Veterinary Teaching Hospital files. Normal cats (n=31) were prospectively studied. All cats had a comprehensive cardiac examination by the Cardiology Service (KM, MK, AS), including echocardiography. Radiograph from normal and HCM cats were co-mingled and randomly placed into one of six groups and radiographs were matched to HCM cats with respect to radiographic positioning. One lateral radiograph and one DV or VD radiograph were evaluated for each cat. Observers were blinded to diagnosis. A score sheet asked Yes or No responses for the following categories: right atrium enlarged, left atrium enlarged, left ventricle enlarged, generalized cardiomegaly, pleural fluid, pulmonary edema, enlarged pulmonary vessels, enlarged caudal vena cava (CVC), normal CVC position, significant pericardial fat, congestive heart failure, normal heart. Observers determined vertebral heart score (VHS). Overall observer differences for each question were assessed using cross-tabulations and statistical tests (F-test) that account observers all evaluating the same 121 cases. The 8 observers were categorized into Grouping 1 (radiologists, cardiologists, and residents), and Grouping 2 (radiologists + radiology resident and cardiologists + cardiology resident). Kappa statistics assessed interobserver reliability. Since normal or HCM was known, the percentage of correct diagnoses was compared between observers, and Sensitivity, Specificity, Positive Predicted values (PPV) and Negative Predicted values (NPV) were calculated.

Results Significant differences (p<0.008) amongst all 8 observers were found in all categories. Comparing Grouping 1, significant differences were found in assessment of the left atrium (p<0.001), left ventricle (p=0.01), generalized cardiomegaly (p=0.004), pulmonary edema (p<0.001), pulmonary vessels (p<0.001), CVC size (p=0.004) and CVC position (p<0.001). Comparing Grouping 2 significant differences were found in assessment of the left atrium (p=0.021), left ventricle (p<0.001), generalized cardiomegaly (p<0.001), and CVC position (p<0.001). Interobserver reliability was fair to good or poor in most categories, excellent for cardiologists and residents for pleural fluid. Amongst all observers Sensitivity was 51.6-83.9%, Specificity 50-76.4%, PPV 35.4-53.3%, NPV 80.8%-90.7%. Comparing Grouping 1, there was significant difference in sensitivity of the residents (58.1%), but not between radiologists and cardiologists (74.2% and 71.76%, respectively). Specificity was 59.8-64.8%, PPV 36.7-40.53%, and NPV 81.4-87.3%. Between Grouping 2 there were no differences, with sensitivity from 69.2-69.7%, specificity 59.4%-63.7%, PPV 37.3-40.1%, and NPV 84.7-85.8%.

Conclusions Significant differences exist amongst observers in evaluation of thoracic radiographs of normal and HCM cats. Although differences between radiologists and cardiologists were not found, residents as an independent group were significantly different from radiologists and cardiologists suggesting experience has a role in radiographic interpretation.
SONOGRAPHIC FEATURES OF CANINE EMBRYONIC AND FETAL DEATH
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Introduction
Sonography is a useful imaging diagnostic tool for early diagnosis of pregnancy, estimation of the litter size, and determination of fetal viability. The goal of this report is describe the sonographic features of canine embryonic and fetal death.

Material and methods
Thirty-seven bitches presenting with a history or clinical signs suggestive of probable embryo/or fetal death were evaluated, of which twenty-one were selected prospectively at the Veterinary Policlinic of the College of Veterinary Sciences, University of Zulia, Venezuela. The remaining of the data was obtained from retrospective review of the medical records of sixteen bitches with ultrasonographic diagnosis of fetal death at the Veterinary Teaching Hospital, College of Veterinary Medicine and Biomedical Sciences, Colorado State University. Nine bitches were evaluated at 25 - 35 days of gestation (Group I) and 28 bitches at 35 days or more to parturition (Group II). Images were evaluated for cardiac activity and fetal motion, fetal mineralization and differentiation of thoracic and abdominal organs.

Results
Group I: No heart beats were detected in one or more embryos in all nine bitches. The gestational sacs contained either echogenic amniotic fluid with hyperechoic particles (2/9), hyperechoic or hypoechoic amorphous masses represented by remnant embryos(4/9), or a normal looking embryo surrounded by fluid (2/9). Echogenic amniotic fluid with hyperechoic particles and hyperechoic or hypoechoic amorphous masses were identified in the gestational sacs of one pregnancy. Group II: No heart beats or fetal motion were detected in one or more fetuses. The fetuses in 6 bitches showed poorly defined thoracic and abdominal organs as well as disorganization of the bony structures, which still generated acoustic shadowing. Irregular shaped gestational sacs containing amorphous irregular shaped fetal remnants were identified in two more bitches. The dead fetuses in 11 bitches had normal thoracic and abdominal organ anatomy. This feature was mainly seen ≥ 50 - 55 days of gestation. Fluid filled fetal abdomens with loss of visualization of abdominal organs was noted in 3 fetuses of one bitch; after cesarean surgery this was found to be purulent exudate within the abdominal cavity. Fetuses in 5 bitches had no visible normal anatomic structures and gas was present within the thorax, abdomen and within the subcutaneous tissues. Gas within the gestational sac, surrounding a fetus was seen in another bitch. Fetuses of remaining 5 pregnancies presented complete disorganization of the anatomic and bony structures. Dead and alive fetuses were identified at the same time in 10/28 bitches. The alive fetuses were born normally.

Discussion and Conclusions
Absence of cardiac activity and fetal motion were the most important sonographic evidence of embryonic and fetal death. The presence of an amorphous, hyperechoic or hypoechoic remnant (dead embryo) was the most common sonographic feature of death 25 - 35 days of gestation. Poorly defined thoracic and abdominal anatomy as well as disorganization of the bony structures was one of the most common finding at 35 - 45 days after mating in group II. During the last trimester, when no heart beat was detected more than 50 % of the fetuses still had normal sonographic appearance of thoracic and abdominal organs. This study confirms the importance of the sonographic visualization of cardiac activity in every normal looking fetus. The presence of gas in the uterus and fetuses or abnormal presence of fluid within the fetuses were good indicator of fetal death.
INTRODUCTION AND JUSTIFICATION
Bone production on the proximal margin of the anconeal process has been recognized as an early sign of Fragmented Coronoid Process (FCP) in the dog. Presence of bone production in this location has been used as the only radiographic sign in diagnosing FCP. Because of the difficulty in detecting radiographic signs of FCP, computed tomography (CT) has been used to investigate patients with suspected FCP. We believe bone production on the proximal margin of the anconeal process may be easily confused with normal variation.

MATERIAL AND METHODS
The Imaging/Radiation Therapy Section of the University of Illinois Department of Veterinary Clinical Medicine received elbow radiographs as a second opinion because of discrepancy in a report from the Orthopedic Foundation for Animals (OFA). The patient was a 26 month old Labrador Retriever. As the OFA readers disagreed, we were asked to offer our opinion. The only abnormality we detected on the radiographs was well defined, organized bone on the proximal margin of one anconeal process which was not discernable on the other. In past years there had been discussion among our group as to the possibility of Rottweiler ulnas normally bearing a normal bony prominence at this site. Because of the apparent asymmetry, we suggested studying the elbows with CT. On CT examination, there was no discernable difference between the elbows.

In review of the radiographs to determine why asymmetry was “present” on radiographs but not on CT images, bones (specimens) were compared with the radiographs. A ridge was detected which matched the “bone production” in the “abnormal” ulna and could be “imagined” on the opposite flexed lateral views. A group of bones used for anatomy classes were then studied. On approximately half of these bones, a similar ridge could be detected.

CONCLUSIONS
While bone production on the proximal margin of the anconeal process of the dog is a useful sign in early diagnosis of FCP, care must be taken to not interpret apparent radiographic asymmetry as bone production.
A SONOGRAPHIC IMAGING PROTOCOL FOR EVALUATION OF THE CANINE ELBOW
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Introduction
Regarding the canine elbow joint, there is currently no detailed investigation into the use of sonography, either to define its normal sonographic appearance or to investigate its diseases. This project establishes a sonographic imaging protocol to evaluate all regions of the canine elbow in standard anatomic planes.

Methods
Sonographic observations were made of 22 elbows from 11 normal, mature, mixed-breed dog cadavers (12-17 kg body weight). A high frequency, compact linear array probe (5-10 MHz; 3 x 1 cm footprint; ATL 5000 or ATL Ultramark 9, ATL Laboratories, Bothell, WA) was used. The sonographic images were recorded with a multi-image camera on single-emulsion ultrasound film, Super-VHS videotape, and/or on a computer hard drive. Anatomic landmarks were identified by palpation and via sonography. For each image, the anatomic plane of the sonographic beam and position of the probe on the elbow were recorded and the data were used to establish a sonographic imaging protocol.

Results
The following sonographic imaging protocol was established. The sonographic probe was initially placed in the dorsal anatomic plane on the medial aspect of the extended elbow, at the level of the medial epicondyle of the humerus. The epicondyle and humeroulnar joint spaces were seen. The medial coronoid process was also demonstrated in these dorsal plane images and could also be seen as the probe was rotated into a transverse anatomic plane. The medial collateral ligament, including its origin, could best be seen in the transverse plane. The elbow was then flexed and the probe was moved onto the caudomedial aspect of the medial humeral epicondyle in order to image the olecranon, anconeal process, and caudal part of the humeroulnar joint. To demonstrate the M. triceps brachii and its tendon, the probe was relocated to the caudal aspect of the elbow and images were made in the dorsal and transverse anatomic planes.

The sonographic probe was repositioned on the lateral aspect of the extended elbow in the dorsal anatomic plane, and the lateral humeral epicondyle was demonstrated. The humeroradial joint space was also seen in the dorsal plane and again as the probe was rotated into the transverse anatomic plane. The head of the radius and its cartilage were also imaged in the transverse anatomic plane as were the lateral collateral ligament and M. supinator and tendon. The sonographic examination was completed as the elbow was flexed and transverse images were made of the olecranon and anconeal process.

Conclusions
In the sonographic examination of the canine elbow, it is important to use a complete, routine imaging protocol, made in standard anatomic planes, to ensure that all regions of the joint are examined. The protocol enables a diagnosis of either a normal or pathologic elbow. The use of such a protocol will also clearly define the extent and nature of any elbow pathologic features.

Introduction/Purpose: Helical tomotherapy is intensity-modulated radiation therapy where the goal is to precisely target the tumor and avoid critical normal tissues. Tomotherapy combines a helical CT unit with a linear accelerator and MVCT images can identify patient anatomy to ensure accurate set-up during treatment. The purpose of this study was to evaluate the diagnostic quality of low-dose megavoltage computed tomography (MVCT) images and perform treatment optimization for helical tomotherapy. Kilovoltage CT (kVCT), MVCT images and a helical tomotherapy plan of a pet dog with a spontaneously arising nasal tumor are presented.

Methods: 5mm cross sectional kVCT images were obtained on a Siemens Hi-Q scanner in a Golden Retriever dog with a nasopharyngeal sarcoma. 4 mm MVCT slices were then obtained with the dog in the same position on a helical tomotherapy unit, consisting of a 6 MV linear accelerator and xenon CT detector system. A filtered backprojection reconstruction algorithm was used. Both the kVCT and MVCT images were obtained at a dose level of 2 cGy. Tumor and critical structures were contoured on the kVCT and treatment optimization for helical tomotherapy was done.

Results: On MVCT images the tumor can be identified in the nasal cavity and bony destruction is seen. At a dose of 2 cGy the MVCT images are of sufficient quality for verification of treatment set-up, but soft tissue contrast is inferior to conventional kVCT. The MVCT and kVCT images were successfully fused. A treatment plan was devised using helical tomotherapy that spares critical normal tissues and effectively covers the tumor volume.

Discussion/Conclusions: MVCT image quality is sufficient for 3-D set-up verification in a tumor-bearing dog. MVCT images obtained just prior to therapy with the patient in treatment position can be fused with the planning kVCT to ensure accurate delivery. Image fusion was successful in this canine patient despite no rigorous attempt to maintain exact positioning between the two scans. Xenon detectors in the helical tomotherapy system can provide data for dose reconstruction during treatment ensuring accurate dose delivery and allowing adaptive radiotherapy, if corrections are necessary. Despite being a large tumor and extending to the level of the rostral brain, a treatment plan was devised using helical tomotherapy that spares critical normal tissues and effectively covers tumor volume. This plan was far superior to the conventional paired wedged fields using Cobalt-60 irradiation that was used to treat this dog.

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It has been known for many years that hypoxia, i.e. low tissue oxygen concentration, limits the response of tumor cells and rodent tumors to radiation therapy. Hypoxic cells are resistant to chemotherapy because of their relative isolation from the blood supply and/or the mechanism of the drug action. The importance of hypoxia as a prognostic and predictive factor for human tumors, however, was controversial for many years. This debate was supported by the relatively modest success of trials designed to sensitize hypoxic cells by hyperbaric oxygen or nitroimidazole drugs. In the 1980s, studies performed using polarographic needle electrodes documented the presence of hypoxic heterogeneity in human tumors. Measurements in cervix cancer and squamous cell carcinoma of the head and neck confirmed that humans with hypoxic tumors were more likely to experience recurrence following radiation therapy than those with oxic tumors. Additional studies unexpectedly found that hypoxic cervix tumors were more likely to recur following surgical therapy and that human patients with hypoxic soft tissue sarcomas were more likely to experience lung metastasis even when their primary tumor was successfully controlled. It is now generally acknowledged that genetic changes, including selection of cells resistant to apoptosis can be a consequence of cellular hypoxia providing a mechanism for these clinical findings.

In order to measure hypoxia, we have developed and tested the ability of the 2-nitroimidazole hypoxia detection agent, EF5 to measure hypoxia using fluorescence immunohistochemistry. Nitroimidazoles are a class of compounds that are selectively reduced and bound in hypoxic, viable cells at a rate that is inversely proportional to cellular pO₂. This binding and the consequent formation of adducts can be quantitated using a monoclonal antibody to EF5, conjugated to a fluorescent dye. Tissue and/or cells so treated can be analyzed in a quantitative fashion for the formation of EF5 adducts as a surrogate for tissue pO₂. We will report that EF5 binding can be used to predict radiation response in rodent tumor models and clinical outcome in human tumors. The possibility of performing such studies in spontaneous canine and feline tumors will be discussed.

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OXYGEN MEASUREMENTS USING POLAROGRAPHIC NEEDLE ELECTRODES IN SPONTANEOUS CANINE TUMORS DURING FRACTIONATED RADIATION THERAPY

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Introduction: Tumor oxygenation is a major predictor of radiotherapy outcome and the process of reoxygenation is an important factor in the efficacy of fractionated radiation therapy. Furthermore, information on the oxygenation status may play an important role when adjuvant antiangiogenesis treatments are considered. Therefore we investigated the change of the oxygenation status during a course of fractionated radiation therapy.

Methods: Twenty-one dogs with spontaneously arising tumors were included in the study. Several potentially important predictors, such as tumor volume and red blood parameters, were recorded. Tumor oxygen partial pressure (pO2) measurements were performed with the Eppendorf-pO2-Histograph. Measurements were performed under anesthesia and oxygen needle positioning was guided with ultrasound. PO2 measurements in the palliative patients were done before each fraction of radiotherapy (5x6 Gy or 3x8 Gy). The curative group had oxygen measurements before fraction 1, 3, 6, 8, 10, 12, 14 and 16 (14-16x3.5 Gy or 15x3 Gy). For statistical analyses differences to baseline measurements (pre-treatment) were calculated.

Results: Sixteen of the twenty-one dogs had repeated oxygenation measurements during fractionated radiation therapy. The analysis showed a decrease of hypoxia during the initial part of radiation therapy followed by an increase and again a decrease to baseline levels of tumor oxygenation at the end of therapy. Mean of median difference to baseline were 0.05 mmHg between 6-9 Gy, -9.00 mmHg (12-15 Gy), -3.78 mmHg (16-21 Gy), -8.46 mmHg (24-27 Gy), 0.32 mmHg (30-33 Gy), 7.7 mmHg (38.5-39 Gy) and -11.38 mmHg (45-45.5 Gy). Mean of difference of the hypoxic fraction ≤ 5 mmHg to baseline were -9.69 %, 9.45 %, 5.53 %, 11.71 %, -3.27 %, -0.03 % and 20.65% at the same dose intervals as above. However, neither the curative nor the palliative group showed significant changes with repeated measures analyses. Correlations among the oxygen parameters at the time of pre-treatment measurements (0 Gy), end of palliative treatment or mid of curative therapy (24-27 Gy) and end of curative treatment (45-45.5 Gy) were highly significant (p<0.001). Comparison of the tumor volume to oxygenation at the end of palliative, respectively curative treatment was significant. Tumors with a large pre-treatment volume had a higher decrease in oxygenation (difference of mean and median to baseline) when treated palliatively. In addition, the hypoxic fraction (difference of hypoxic fraction ≤ 10 mmHg to baseline) increased more in the palliative versus curative treatment. This was statistically significant.

Conclusion: In this study there were obvious changes of the oxygenation status during fractionated radiation therapy. The response of tumor hypoxia to fractionated radiation may differ depending on curative or palliative treatment regimens. Pre-treatment volume may play a more important role than previously assumed. In summary, tumor oxygenation appears to be much more complex when studied in a spontaneous clinical model. To further support our data larger study groups have to be acquired.
EXPRESSION OF CYCLOOXYGENASE-2 IN NATURALLY OCCURING EPITHELIAL NASAL TUMORS IN DOGS.
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Introduction: Cyclooxygenase 2 (COX-2), inducible in some epithelial tumors by various stimuli, catalyzes conversion of arachadonic acid to prostaglandins. These prostaglandins have antiapoptotic, proangiogenic and proinvasive properties. Thus, in tumors expressing COX-2, selective inhibitors may be useful. Also, COX-2 inhibitors have been shown to enhance tumor cell radiosensitivity. Considering the poor response of canine nasal tumors to irradiation, the combination of radiotherapy and selective COX-2 inhibitors might improve tumor control. It is not known if canine nasal tumors express COX-2. The objective of this study was to determine whether COX-2 is expressed in naturally occurring epithelial nasal tumors.

Methods: Twenty-two formalin fixed, paraffin embedded biopsy samples from canine epithelial nasal tumors were analyzed for COX-2 expression using immunohistochemistry. The specimens were collected from dogs prior to radiation therapy. Briefly, sections were dewaxed, rehydrated and prepared with peroxide, PBS and blocking serum. Polyclonal rabbit antihuman antiserum to COX-2 was used as primary antibody. Immunoreactive complexes were detected by the avidin-biotin-peroxidase complex method, visualized with diaminobenzidine and counterstained with hematoxylin. The intensity and distribution of COX-2 staining was evaluated using light microscopy.

Results: Immunohistochemical analysis revealed that COX-2 was expressed in 18 of 22 (82%) tumor specimens. COX-2 staining was predominantly cytoplasmic and of moderate intensity and found in 10% to 100% of tumor cells in each specimen. Variability in expression levels, with foci of very high intensity, was found in many neoplasms. COX-2 expression was also found occasionally in neighbouring, non-neoplastic nasal epithelium. Control tissues stained as expected.

Discussion: Our data indicate that COX-2 is expressed at varying levels in the majority of canine epithelial nasal tumors. Combining selective COX-2 inhibitors with radiation may be a beneficial therapeutic approach. Further investigations are planned to assess whether 1.) COX-2 expression could be used as a prognostic marker to predict response to radiation therapy. 2.) there is a relationship between COX-2 upregulation in canine nasal tumors and other tumor factors, and 3.) if COX-2 inhibitors are beneficial in the treatment of canine nasal tumors.
ASSESSMENT OF VASCULARITY IN SPONTANEOUS CANINE TUMORS WITH CONTRAST-ENHANCED DOPPLER ULTRASOUND AND COMPARISON TO TISSUE OXYGEN MEASUREMENTS USING THE EPPENDORF METHOD

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Introduction/Purpose: Vascularity and hypoxia play a crucial role in tumor therapy and prognosis. Polarographic electrodes such as the Eppendorf histograph, are the method of choice to measure oxygen tension (pO2) in tumors. However, due to the invasiveness and the restricted accessibility of many tumors, applicability of this technique is limited. Therefore, the purpose of this study was to non-invasively investigate vascularity in spontaneous canine tumors with contrast-enhanced color (CD) and power Doppler (PD) ultrasound (US) and to compare results to invasive pO2 measurements.

Methods: Pre-radiation sonographic evaluation of vascularity and pO2 measurements were assessed in 9 soft tissue sarcomas, 4 bone sarcomas, 2 squamous cell carcinomas and 1 oral melanoma. Tumors were sonographically examined with gray-scale, CD and PD US before and after intravenous injection of an US contrast agent (Levovist®, Schering AG, Switzerland). Vessel density of digitized US images was evaluated with a subjective score (low, moderate, high). For objective assessment, a ROI was drawn around the tumor boundary and three computerized parameters were obtained for CD and PD images pre- and post-contrast administration. The mean color level (MCL) was obtained by dividing the sum of the color values by the number of the colored pixels. The fractional tumor area bearing flow (FA) was the ratio of colored pixels to the total number of pixels in the ROI multiplied by 100. The product of the first two parameters divided by 100 determined overall tumor perfusion (CWFA). In the same tumor area where the Doppler images were taken, invasive tissue pO2 measurements were obtained with the Eppendorf histograph. The following oxygenation parameters were determined: hypoxic fraction (percentage of pO2 values < 2.5 mmHg or < 5 mmHg), median or mean pO2 and the hypoxic subvolume (HSV). HSV was defined as the percentage of pO2 values < 5 mmHg multiplied by the total tumor volume. Correlations and linear regression analyses between US and pO2 parameters were calculated.

Results: In general, correlations were higher for post-contrast US parameters than for pre-contrast parameters. In regard of the Eppendorf parameters, mean pO2, median pO2 and percentage of pO2 values < 2.5 mmHg showed best correlations to US parameters. High correlations were found between all computerized PD US parameters and Eppendorf measurements, with post-contrast MCL and CWFA revealing the best results (r = 0.84 to 0.9 (mean pO2), 0.84 to 0.88 (median pO2) and -0.79 to -0.87 (percentage of pO2 values < 2.5 mmHg)). For CD US parameters, correlations were also high for FA and CWFA (r = 0.79 to 0.88). PD and CD FA and CWFA significantly decreased with increasing total tumor volume. Correlations of the subjective vessel density score with mean pO2, median pO2 and percentage of pO2 values < 2.5 mmHg were only moderate (r = 0.66, 0.65 and -0.62).

Conclusions: To our knowledge, for the first time a highly significant correlation between invasive pO2 measurements and non-invasive Doppler US was demonstrated in spontaneous tumors. Doppler US appears an excellent non-invasive tool in assessing tumor vascularity and hypoxia in clinical research with contrast enhanced PD being the most valuable US technique.
IN-VIVO MONITORING OF REAL TIME TISSUE PHARMACOKINETICS OF LIPOSOME/DRUG CONCENTRATION USING MRI. B.L. Viglianti1MSBME, S.A. Abraham4,5, J.R. MacFall1, M.B. Bally4,5, M.W. Dewhirst1,2. Departments of 1Biomedical Engineering, 2Radiation Oncology, 3Radiology, Duke University Medical Center. Durham, NC 27710; Departments of 4Advanced Therapeutics -Medical Oncology and 5Pathology-Laboratory Medicine, University of British Columbia, Vancouver, BC Canada.

Purpose: The objective of this work was to determine if a novel liposome formulation containing a MR imageble contrast agent, MnSO4, and doxorubicin (DOX) can be used to determine real time tissue pharmacokinetics and drug release during administration of local hyperthermia to rats with transplanted fibrosarcomas.

Methods: The MnSO4 based procedure for doxorubicin loading was accomplished using a salt gradient loading method. Solutions containing a range of concentrations of free MnSO4 and liposomally encapsulated MnSO4+DOX were placed into tubes and imaged in 2-T 30-cm bore diameter magnet (Signa, G.E. Medical Systems, Milwaukee, WI). A series of T1 images were taken in the axial plane with a field of view of 5 cm at Te of 8 ms and Tr of 20, 33.3, 66.6, 150, 316, 633, and 1266 ms. In vivo studies were performed in the same magnet, using Fischer-344 rats bearing transplanted fibrosarcomas that were grown in the flank. The tumors were heated using a single 16g catheter placed axially through the tumor, through which heated water (55°C; doped with MnSO4 to remove flow artifacts) was pumped.

Results: In vitro studies. With free MnSO4, T1 shortening was linearly dependent upon MnSO4 concentration. The relaxivity (1/T1 vs concentration) was in the range for GdDTPA (4-4.5 (mM*sec*°C)-1. Relaxivity was inversely proportional to temperature, in the range between 37 and 55°C. This effect is likely the result of increased thermal motion leading to decreased interaction between Mn and H2O at higher temperatures. When MnSO4+DOX was encapsulated into non-thermally sensitive liposomes, baseline relaxivity was much lower and it was directly proportional to temperature, presumably due to increased passage of H2O across the lipid bilayer at higher temperatures. When MnSO4+DOX was encapsulated into thermally sensitive liposomes, the formulation behaved like the non-thermally sensitive liposome until it reached the transition temperature, at which point the contents were released and the relaxivity increased dramatically to parallel the behavior of free MnSO4. In vivo studies These studies demonstrate that accumulation of MnSO4 signal enhancement occurs selectively in heated tumor and the pattern of signal intensity change is different for non-thermally sensitive and thermally sensitive formulations.

Conclusions: The results of this ongoing study have demonstrated the feasibility of using this type of liposome for monitoring tumor liposomal drug uptake and release from thermally sensitive liposomes in real time. Further work will determine whether this method is sensitive enough to measure drug concentration distributions. The safety of this type of formulation needs to be established before it can be used clinically. Work supported by a grant from the NCI (CA42745).
Co administration of Non-Radiolabeled Liposomes Has No Effect on the Intratumoral Distribution Of $^{99m}$Tc-Liposomes in Rats

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Introduction:
As a non-invasive way to estimate the distribution of therapeutic liposomes, concurrent administration of a tracer amount of radiolabeled liposomes has been considered. At Duke University Medical Center, a Phase I trial evaluating the effect of local hyperthermia on intratumoral extravasation of Doxil (ALZA Pharmaceuticals, Palo Alto, CA), a liposome-encapsulated doxorubicin formulation, is proposed in patients with locally advanced breast cancer. In this study, a small number of empty $^{99m}$Tc-labeled liposomes (tracer dose) would be used to estimate the distribution of the Doxil liposomes (therapeutic dose). On Day 1, a tracer dose would be given to estimate intratumoral Doxil accumulation under normothermic conditions. On Day 2, Doxil liposomes would be co-administered with a tracer dose of liposomes, in combination with local hyperthermia. The change in distribution of the radiolabeled liposomes under normothermic versus hyperthermia conditions would then be an indication of the effect of hyperthermia on the distribution of Doxil. For this hypothesis to be valid, the assumption is made that the much larger number of Doxil liposomes dose not interfere with the biodistribution of the radiolabeled tracer dose of liposomes. With no defined receptor uptake system for liposomes it appears reasonable to assume this independence, but we considered it necessary to evaluate this in a rodent model before initiating the study in humans.

Methods:
Fifty-six rats with transplanted subcutaneous mammary adenocarcinomas (R3230Ac) were randomized into treatment and control groups. The rats in the treatment group received a tracer dose of $^{99m}$Tc- radiolabeled liposomes on Day 1 and a therapeutic equivalent of empty liposomes concurrently with a radiolabeled tracer dose of liposomes on Day 2. The rats in the control group received only tracer doses of labeled liposomes on both days of the study. Liposome distribution was evaluated with a gamma camera at times 0, 2, 5 and 16 hours following liposome administration. Regions of interest were drawn around the tumor and around the rat, and tumor uptake was evaluated as percent tumor to body uptake at each time point on each day of the study.

Results:
Based on preliminary analysis of the 56 rats, there appears to be no difference in radiolabeled liposome distribution between treatment and control rats on either Day 1 or Day 2 of the study, however final statistical analysis of the results is pending. The preliminary results suggest that incorporation of a small tracer dose of radiolabeled liposomes can be used to describe the distribution of co-administered therapeutic liposomes. The final results will be available for the presentation.
**In Vivo Dosimetry Using An Implanted Telemetric Dosimetric Device In Tumor Bearing Dogs.**

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**Introduction:**
A reliable method for measuring the actual dose of radiation delivered to a patient does not exist. An implantable telemetric has been developed to monitor the daily dose delivered at the target site. This study was designed to compare the dose registered by the device to the dose estimated by treatment planning software and determine the \textit{in vivo} location of the device during and post-radiation treatment.

**Methods:**
The device, a product of Sicel Technologies Inc. (STI, Morrisville, NC), consists of a radiation dosimeter microchip and antenna enclosed in a glass capsule measuring 3mm x 25mm. Following insertion of the device in client owned dogs with spontaneous malignancies undergoing radiation therapy, CT based isodose distributions were obtained and the isodose line most closely associated with the device identified. Daily cumulative dose measurements were obtained with the reader, which provides inductive power to obtain the radiation dose, in real time, from the implanted device. Serial CT scans and/or diagnostic radiographs were obtained to determine dosimeter location \textit{in vivo}. Clinical evaluation of the implantation site was performed weekly and any excised tissue was examined histopathologically.

**Results:**
Eight dogs were entered as of 6/01/02. Five dogs were implanted post resection (in the tumor bed) and 3 at the periphery of gross tumor (within treated volume). Devices have been in place from 1 to 10 months with no adverse effects. Location of the device differed from its original location in 1 dog. Two dogs received preoperative radiation and at the time resection the device was retrieved and fibrous encapsulation was noted around the device in both dogs. Variation between expected and observed dose ranged from 0.6%-17%, the high end of the range being the dog whose dosimeter location changed.

**Discussion:**
The implantable telemetric device is the first dosimetry system with the capability to provide accurate \textit{in vivo} measurements of radiation dose. Dosimetry information can be obtained daily and in real time. The device does not appear to create any adverse side effects within the body. It has the potential to provide the clinician with information on the variation of daily delivered radiation dose.

Introduction: Osteosarcoma often occurs in skeletally immature individuals. Previous studies have reported that the radiopharmaceutical 153Samarium-EDTMP, is an effective component of multi-modality therapy for treatment of primary bone tumors. Therefore, 153Sm-EDTMP may prove to be an integral component of therapy for treatment of juvenile osteosarcoma. After injection, this radiopharmaceutical localizes in areas of high osteoblastic activity; however, the effects on developing cartilage have not been reported. The purpose of this study was to determine the effects of intravenous injection of 153Sm-EDTMP on the developing physeal and articular cartilage of healthy, juvenile rabbits.

Methods: Sixteen, 8-week-old New Zealand White rabbits were randomly assigned to one of two groups: treatment (n=12) or control (n=4). Rabbits in the treatment group were given 1 mCi/kg of 153Sm-EDTMP intravenously (anti-neoplastic dose). Rabbits in the control group received a sham injection. Forty-eight hours after injection, whole body scans were acquired using a gamma camera to assess radiopharmaceutical uptake. Lateral and craniocaudal radiographs of the tibias, radii, ulnas, and humeri were cut and stained with hematoxylin and eosin, and toluidine blue. All sections were subjectively evaluated for physeal and articular cartilage morphology and extracellular matrix staining by two blinded investigators (ST, JC). Immunohistochemical staining for collagen type X and matrix metalloproteinases (MMP-1 and MMP-13) reactivity was performed and subjectively evaluated by one blinded investigator (JC). Measurement data were combined for each group and means (±SEM) were determined. Statistical analyses (t-test) were performed using a computer software program with significance set at P<0.05).

Results: One rabbit in the treatment group died due to anesthetic complications. Rabbits in the treatment group had significant (p=0.014) reduction in total bone growth of the radius compared to controls over the 8-week period. Eight of the 11 rabbits (73%) in the treatment group exhibited pronounced abnormalities in the histologic morphology of the physeal cartilage in all bones. The columnar arrangement of the physeal chondrocytes was disrupted and disorganized, clone clusters were noted in various zones of the physis, and retained hypertrophic cells and matrix were present. Rabbits in the control group had significant increases in positive collagen X expression (p=0.023) and MMP-13 (p=0.018) expression associated with hypertrophic chondrocytes in the growth plate. There were no significant differences in MMP-1 expression in treatment versus controls.

Discussion: These data suggest that clinically significant damage to developing physeal cartilage may occur as the result of intravenous administration of 153Samarium-EDTMP at the dosage studied. The effects on radial bone growth and the consistent and widespread disturbances to the developing physeal tissues have immediate clinical implication for the use of 153Samarium-EDTMP in the treatment of juvenile osteosarcoma. Further investigation regarding the effects of radiopharmaceutical on developing physeal cartilage in warranted.
Objective: To compare the accuracy of radiographs and magnetic resonance imaging for estimating appendicular osteosarcoma margins. Accuracy of CT and bone scintigraphy were also assessed when these studies were available.

Methods: Eight dogs with appendicular osteosarcoma underwent radiographic and MR imaging of affected limbs. In addition, bone scintigraphy was performed in 6 dogs and computed tomography examination was performed in 5 dogs. Two observers jointly measured tumor length on all imaging studies. Correlative gross and histologic evaluation of all affected limbs was performed to determine tumor extent as measured from the nearest articular surface. Results from imaging studies were compared to gross and microscopic morphometry findings to determine accuracy of each modality for determining tumor boundaries.

Results: MR images were accurate with a mean overestimation of actual tumor length of 3±13%. T1 weighted non-contrast images were superior for identifying intramedullary tumor margins in most instances while contrast enhanced images provided supplemental information in two dogs. Lateromedial and craniocaudal radiographs overestimated tumor length by 17±28% and 4±26%, respectively. Scintigraphy and CT overestimated tumor margins by 14±28% and 27±36%, respectively.

Conclusions: MRI appears to be an accurate diagnostic imaging modality for determining intramedullary osteosarcoma boundaries. MR imaging should be considered as part of a pre-operative assessment of appendicular osteosarcoma, particularly when a limb-sparing procedure is contemplated.

This study was supported by the Center for Companion Animal Health and the Center for Imaging Science, School of Veterinary Medicine, University of California, Davis.
EFFICACY OF RADIATION THERAPY FOR INCOMPLETELY EXCISED GRADE II MAST CELL TUMORS. VJ Poirier, DVM, LJ Forrest, VMD, WM Adams, DVM, EG Green, DVM, C Bohling, J Capelle, and DM Vail, DVM. School of Veterinary Medicine, University of Wisconsin-Madison

Introduction/purpose
Mast cell tumor (MCT) is the most common cutaneous tumor in dogs. Histologic grade of MCT is predictive of metastatic behavior. Grade I and II MCT have a low metastatic potential. Complete excision of the MCT should be curative in 70-90% of grade II MCT. When incompletely excised, local control can be obtain with radiation therapy. The purpose of this retrospective study was to evaluate the efficacy and toxicity of daily radiation therapy (15 fractions to 48 Gy) for the local control of incompletely excised grade II mast cell tumor.

Methods
To be included in the study, the dogs had histologically confirmed incompletely excised grade II mast cell tumor and were stage 0a (tumor incompletely excised without regional lymph node involvement). Tumor staging included a complete blood count, chemistry profile, urinalysis, thoracic radiographs, abdominal ultrasound, bone marrow and regional lymph node aspirate or biopsy when possible. Dogs were treated with 15 fractions of 3.2 Gy for a total dose of 48 Gy to the primary site and regional lymph node on a Monday-Friday schedule using cobalt external beam or orthovoltage irradiation.

Results
Forty-seven dogs (47) fit the criteria for entry. Forty-five (45) dogs had only 1 surgery prior to radiation therapy, 1 dog had 2 and 1 dog had 4. The range of time from the last surgery to RT was 12 to 99 days with median of 31.5 days. All dogs completed the radiation therapy treatment (cobalt, n=41; orthovoltage n=6). The acute effects were mild to moderate and self limiting in 42 dogs and severe in 5 dogs (sloughing pads in 2 dogs; severe and confluent moist desquamation with edema in 3 dogs). Late effects were severe in 1 dog (osteonecrosis) and 2 dogs suffered from muscle spasm. Two dogs treated with orthovoltage therapy had sarcoma in the RT field (4 and 5 years post treatment) and one dog had a pathological fracture (3 years post RT). Three dogs (6.3%) had tumor recurrence within the radiation field at 39, 130 and 203 days. The median DFI was not reached and the media follow-up was 904 days (39-2412 days). The median survival was not reached with a median follow-up of 975 days (94-2414 days). Eighteen dogs (38%) developed a second tumor during follow-up. Twelve of those dogs developed a second mast cell tumor (25%).

Conclusion
This radiation protocol is well tolerated and efficacious for the local control of incompletely excised grade II mast cell tumor. Dogs treated with megavoltage irradiation were less likely to exhibit late normal tissue effects (1/41, 2%) as compared to dogs treated with orthovoltage irradiation (3/6, 50%). As confirmed in this study, mast cell tumors can arise de nova; a second mast cell tumor was diagnosed in 25% of the dogs during their lifetime and treated as new primary tumor.
VINBLASTINE, PREDNISONE AND COARSE FRACTION RADIOTHERAPY FOR HIGH-RISK, CUTANEOUS MAST CELL TUMORS IN 24 DOGS. M.M. Turek, D.M. Vail, D.H. Thamm, W.M. Adams, L.J. Forrest. School of Veterinary Medicine, University of Wisconsin-Madison and Animal Emergency Center, Glendale, WI

**Introduction:** Dogs with poorly differentiated (Patnaik grade III) mast cell tumors (MCT) have a high likelihood of death due to disease with short historical median survival times (ST) with surgery alone. Treatment with vinblastine (VBL) and prednisone (PRED) can result in a median ST of 331 days. Regional lymph node (LN) metastasis, an indication of high-risk biological behavior, is also associated with a poor prognosis, irrespective of histologic grade of the primary tumor. The objective of this retrospective analysis was to evaluate efficacy, predictors of outcome and toxicity of combination cobalt-60 radiotherapy (RT), VBL and PRED in 24 dogs with high-risk (i.e. grade II with regional LN metastasis or grade III with or without regional metastasis) MCT.

**Methods:** Dogs were treated after surgical resection of the primary MCT. All dogs received 4 weekly 8-Gy-fractions of RT to the primary tumor site, including the regional LN in 18 dogs. Concurrent with radiotherapy, all dogs received VBL at 2 mg/m2 weekly for 4 weeks, then every other week for 4 additional treatments. Prednisone was initiated at 1-2 mg/kg daily, then tapered and discontinued over 1-6.5 months in all cases. Data was analyzed on an intent-to-treat basis.

**Results:** Fifteen dogs had grade III MCT; among the 6 evaluated, 4 were positive for regional LN metastasis. Eight dogs had grade II MCT and were positive for regional LN metastasis. One dog had primary, single-site lymph node disease.

Among the 18 dogs receiving LN irradiation, 3 were treated in the gross-disease setting, 2 were treated prophylactically and 3 were treated without cytologic evaluation. The remaining ten underwent surgical removal of the metastatic LN prior to irradiation of the extirpation site.

Median follow-up was 441 days. Median time to tumor progression (TTP) for all patients was 421 days. Tumor recurrence occurred with the radiation field in 3 dogs, systemically in 1 dog and 7 dogs developed new cutaneous MCT at distant sites. Median ST was 1055 days. Median ST was significantly longer ($p=0.01$) for tumors located on the limb (1281 days) over tumors located elsewhere (427 days). Median ST was also significantly longer ($p=0.04$) for dogs that experienced VBL-related side effects (1055 days) over those that did not (427 days). Outcome was not significantly influenced by tumor grade or LN irradiation.

Overall, VBL treatments were well tolerated with dose reduction and/or treatment delay required in 5 dogs. Gastrointestinal complications requiring treatment occurred in 4 dogs. No dogs were hospitalized for chemotherapy-associate complications. Eleven dogs experienced acute, self-limiting local radiation effects. One dog, irradiated in the sublumbar region, developed a colonic stricture that was successfully treated with surgical resection.

**Conclusions:** Combination VBL, PRED and coarse fraction RT was well tolerated and appears to be an effective treatment for high-risk canine MCT. Location of the primary tumor was a significant predictor of survival. In this case series, tumor grade was not a significant prognostic TTP and median ST observed compare favorably to cases of high-grade MCT in the literature treated with surgery and/or chemotherapy. Randomized prospective trials would ultimately be necessary to determine the relative importance of RT versus VBL and PRED in the protocol.
Dose-response Relationship for Fractionated High Dose Rate Brachytherapy in Canine Cutaneous Tumors

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Introduction: High-dose-rate brachytherapy (HDRB) has been increasingly used alone or in combination with external beam irradiation without consensus on fractionation guidelines. The primary potential disadvantage of HDRB is toxicity because large doses per fraction are used.

Objective: To investigate feasibility, tumor control and toxicity of HDRB using different dose/fractionation schedules.

Methods: Dogs with incompletely resected soft-tissue sarcomas were randomized to 7 fractionation schemes including 4 weekly treatments of 7.5, 9, 10 or 11 Gy and 5 weekly treatments of 6, 6.5, and 7 Gy. Dogs were treated after skin healing (14 to 33 days after surgery) with a GammaMed IIIi HDR remote afterloading unit (Sauerwein GMBH, Haas, Germany) using a high-activity ¹⁹²Iridium source (3-10 Ci, RTS Technology, Inc. North Andover, MA). Source position and dwell times were calculated using standard volume optimization techniques (Gammadot, RTS Technology, Inc., North Andover, MA). Applicators were removed after each treatment and dogs were discharged the same day. Dogs were given antibiotics to reduce the risk of iatrogenic infections. The RTOG/EORTC late radiation morbidity scoring scheme was used to grade toxicity >90 days after RT.

Results: Thirty seven dogs with cutaneous tumors including mast cell tumor (N=15), soft tissue sarcoma (7 fibrosarcomas, 7 spindle cell sarcomas, 2 hemangiopericytomas and 1 myxosarcoma) and squamous cell carcinoma (n=5) were treated. In order to analyze a dose response relationship for tumor control and complications, the biologically effective dose (BED) was calculated for both the tumor (\(\alpha/\beta=10\) Gy) and the late responding tissues (\(\alpha/\beta=3\) Gy) using the linear quadratic model. BED for tumor ranged from 48 to 92 Gy and BED for late effects ranged from 90 to 205 Gy. Treatment fields in each group were similar and ranged from 15 to 66 cm². Acute tolerance of the brachytherapy catheters and HDRB was excellent; no cases of infection or wound complication occurred. Late effects included skin atrophy, alopecia, loss of pigmentation and fibrosis. A dose response relationship was identified for complications but not for tumor control. Higher BED’s calculated for late effects were associated with increased risk of complications.

Conclusions: HDRB offers several significant and well-known technical advantages, including reliable source positioning over the duration of the procedure, individually programmable dwell times, and treatment as an outpatient procedure. The use of a small number of high-dose fractions, however, may be associated with an increased risk of skin complications and potentially other normal tissues. The therapeutic benefit of HDRB for cutaneous tumors in small animals, compared to teletherapy, has yet to be determined.
RADIATION THERAPY AS AN ADJUVANT TO CHEMOTHERAPY IN THE TREATMENT OF CANINE LYMPHOMA
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Introduction/Purpose: Lymphoma, one of the most common canine neoplasias, has a wide variety of chemotherapeutic treatment options. New chemotherapy protocols have only improved remission times by a few months. With over $10^{10}$ tumor cells present in multi-centric lymphoma, a cycle of chemotherapy, which is estimated to kill 90% of tumor cells, would still leave $10^9$ cells. Additionally, multiple cycles will not eliminate the tumor prior to development of drug resistance or dose-limiting toxicities. Lymphoid tumors are exquisitely sensitive to irradiation and 8 Gy reduces the surviving fraction of lymphoma cells to 0.005 suggesting the addition of radiation to aggressive chemotherapy protocols would be warranted if it can be safely administered. We hypothesized that delivering radiation following chemotherapeutic induction could improve duration of remission, and that toxicity would be acceptable if each body treatment were delivered in 2 fractions on consecutive days.

The purpose of this pilot study was to assess the toxicities and remission times associated with sandwiching radiation within an aggressive 25 week chemotherapy protocol.

Methods: Eight dogs with completely staged III-V lymphoma were studied. Diagnostics included CBC, serum chemistry, urinalysis, thoracic and abdominal radiographs, lymph node biopsy, bone marrow aspirate and PCR. Radiation therapy was administered in two 4 Gy consecutive-day fractions to each body using a 6MV linear accelerator. The cranial body was treated in week 11 and the caudal body in week 15 of a 25-week U of Wisconsin-Madison normal dose chemotherapy protocol. Toxicities were recorded at each treatment visit. Follow-up was via contact with owner or recheck appointments at CSU.

Results: The stages of disease consisted of IIIa B-cell (2), IIIa T-cell (2), V PCR negative (2), V B-cell (1), and V PCR unknown (1). Two dogs were euthanized prior to receiving cranial body RT due to progressive disease. The other dogs were in complete remission (4) or had stable disease (2) at the cranial body radiation treatment. Five dogs that received RT were in CR after completing RT while the other was in partial remission. Chemotherapy-related toxicities (myelosuppression, diarrhea, lethargy, posterior paresis and tachycardia) were mild (grade I or II) except for one dog that was briefly hospitalized for dehydration associated with vomiting and diarrhea. All dogs had treatment delays of 1-2 week duration after chemotherapy treatments due to myelosuppression. Four dogs required dose reduction of doxorubicin (3) or vincristine (1). RT-related toxicities were also mild and included post caudal body diarrhea (6), myelosuppression (2) and alopecia of the irradiated site (3). All dogs had a decrease (average of 50%) in neutrophil count two weeks after each RT. Mean time to completion of protocol was 34 weeks. Five dogs are in CR and 1 dog is in PR at the time of abstract submission. Updated mean remission times will be presented.

Conclusions: Acute effects associated with radiation sandwiched in an aggressive chemotherapy protocol are acceptable. Further clinical trials are essential to optimizing the therapeutic gain of this combination therapy.
Introduction: Hypofractionated radiation therapy has been successfully used to control local and regional oral malignant melanoma. Although complete response of local disease is often achievable, the high metastatic potential of this disease predicts that radiotherapy will be only palliative.

Purpose: To determine duration of progression-free survival (PFS) time in dogs with oral malignant melanoma after hypofractionated radiation therapy, and to identify prognostic factors for PFS time and survival, and patterns of failure in canine patients treated at Tufts University.

Methods: Retrospectively, the medical records were reviewed for 62 dogs with oral malignant melanoma with or without evidence of metastasis treated from August 1994 to May 2002. 38 patients received orthovoltage irradiation between August 1994 and January 1998 and 24 dogs received megavoltage irradiation between May 1998 and May 2002 at Tufts University School of Veterinary Medicine. Three different hypofractionated therapy schemes were identified 1) 30 Gy in 3 fractions at 0, 7, and 21 days by orthovoltage irradiation (n=38), 2) 24 Gy in 3 fractions at 0,7, and 21 days by megavoltage irradiation (n=16), and 3) 36 Gy in 6 fractions over 3 weeks by megavoltage irradiation (n=8). Follow up information was available in all dogs. Four dogs did not complete their course of radiation therapy due to tumor progression and death. Follow up information include treatment response, side effects of radiation therapy, progression of disease and survival through regular oncology rechecks and telephone calls to the referral veterinarian and the owners. Multivariate analysis was done by use of Cox's regression model to determine significant prognostic factors and by use of a competing risk model to determine prognostic factors influencing on local control and survival.

Results are presently being analyzed. The result will have potential to provide prognostic factors, which may enhance the predictability for outcome and response to therapy.
USE OF A SOFT TISSUE EQUIVALENT MATERIAL INSIDE THE CANINE NASAL CAVITY TO MAXIMIZE MEGAVOLTAGE DOSE DISTRIBUTION TO THE FLOOR
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Introduction/Purpose
Despite 3 decades of trials, advances in the treatment of canine nasal tumors have been slow. It is well established that orthovoltage irradiation plus surgery yields longer survivals than orthovoltage alone, but similar results do not occur with megavoltage irradiation plus surgery. This is believed to occur because orthovoltage Dmax (maximum dose) occurs at the surface and floor of the exenterated nasal cavity where tumor cells are viable, while megavoltage radiation requires tissue depths of >0.5 cm to reach Dmax, thereby suffering a lack of dose build-up in air. Soft-tissue equivalent material can be applied to the surface of the nasal cavity to maximize Dmax at the dorsal aspect of the nasal cavity. We hypothesized that placing soft-tissue equivalent material inside the nasal cavity would improve dose distribution to the floor of the nasal cavity.

Methods
Rhinotomy was performed on six frozen canine heads. Lithium fluoride thermoluminescent dosimeters (TLDs) were attached to the following locations in the nasal cavity using tissue glue: 1)rostral floor 2) caudal floor 3)rostral bone flap 4)caudal bone flap 5) medial wall of maxilla. CT scans were performed. 150 cGy was prescribed to the floor of the nasal cavity using a 6MV photon beam with a single dorsal portal (Dmax = 1.5cm). Measurements were made with the nasal cavity empty, completely filled with gel (Lubrivet®), and filled to 1.5 cm. A paired t-test was used to compare dose distribution between the air- and gel-filled nasal cavities.

Results
Mean dose to the dorsal surface of the air-filled nasal cavities was significantly greater than dose to the ventral surface at the cranial (192.5 cGy vs 180.66 cGy, p<0.001) and caudal (188.7 cGy vs 171.7 cGy, p=0.031) TLDs. Dose to the dorsal surface of the gel-filled nasal cavities was significantly greater than dose to the ventral surface, at both cranial (189.3 vs 172.0, p<0.001) and caudal (189.4 vs 161.2, p<0.001) TLDs. Dose was significantly greater in the air-filled than the gel-filled nasal cavities at the floor at both the cranial (p=0.023) and caudal (p=0.031) TLDs. Dose to the floor in the 1.5 cm gel-filled nasal cavities was greater than the dose at the floor of the air-filled nasal cavities (173.8 cGy vs 170.8 cGy, p=0.020).

Discussion/Conclusions
Large loss of dose did not occur at the floor of the air-filled nasal cavity. This refutes the commonly accepted theory that the “air-cavity phenomenon” causes significant loss of dose in the nasal cavity. Completely filling the nasal cavity decreases dose to the floor. Filling the nasal cavity to 1.5 cm causes minimal (1.1%) increase in dose, which is unlikely to benefit the clinical patient.
Introduction/Purpose: An accelerated protocol using 10 fractions of 4.2 Gy of $^{60}$Co radiation delivered in 11 days has been used at the UW-VMTH for the treatment of canine nasal neoplasia. A review of all cases treated with this protocol was undertaken to determine the incidence of acute and late effects and the effectiveness of tumor control.

Methods: Records were evaluated for the following parameters: signalment; presenting signs; survival time; time to return of clinical signs; tumor histology and stage; features of radiation fields; duration and severity of acute and late effects; and reason for death or euthanasia.

Results: Fifty-three cases were available for review. Twenty-one of these cases have been previously reported. Tumor histology was as follows: 17 anaplastic carcinomas, 14 adenocarcinomas, 10 carcinomas, 4 chondrosarcomas, 2 squamous cell carcinomas, 2 osteosarcomas, 2 fibrosarcomas, 1 lymphoma, and 1 nerve sheath tumor. Tumor staging was as follows: T1 (8), T2 (17), T3 (6) and T4 (22). Forty-three dogs were treated with 2 orthogonal fields and 10 were treated with 3 fields. The median equivalent square was 8.2 cm². Dogs died or were euthanized due to the following causes: local failure (32), metastases (5), and other (11). Five dogs are still alive. Median censored survival time for all dogs was 570 days (19 months). Dogs with Stage 1, 2, or 3 tumors had a median censored survival time of 25 months. Dogs with Stage 4 tumors had a median censored survival time of 13 months. Thirty-three dogs had recurrence of clinical signs with a median time to recurrence of 120 days (range 24 to 876 days). Four dogs experienced severe mucositis. Four dogs experienced osteoradionecrosis and fistula formation and four dogs experienced seizures as late effects. 28 of 41 dogs surviving longer than 6 months experienced chronic KCS, cataracts, or retinopathy which led to unilateral blindness in 13 dogs and bilateral blindness in 8 dogs.

Conclusions: This report describes the longest median censored survival time (19 months) to date for nasal tumors treated with megavoltage radiation. Tumor stage is predictive of outcome in patients treated with this protocol. Late ocular effects were frequent in patients with durable tumor control.
PRESURGICAL ACCELERATED RADIOTHERAPY FOR CANINE NASAL TUMORS.
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Introduction: Median survival of dogs treated with megavoltage radiotherapy for nasal tumors has been reported in the range of 8 – 14 months. In a recent study using an accelerated protocol of cobalt teletherapy, median survival time was increased to greater than 18 months, however, more than 60% of dogs treated eventually had recurrence of clinical signs suggesting local tumor regrowth. Historically, the longest median survival reported for canine nasal tumors was attained using orthovoltage radiotherapy in the immediate post-operative setting (23 months). Attempts to repeat that success with megavoltage protocols post-operatively have been unsuccessful. In this prospective study, we report the results following exenteration of residual or recurrent malignant nasal tumors identified by CT exam after accelerated cobalt teletherapy.

Methods: Owners of dogs with malignant nasal neoplasia were offered subsidized CT examination as early as 6 weeks after accelerated radiotherapy, if they agreed to surgical removal of tumor discovered on followup CT. Therapy protocol was 4.2 Gy x 10 daily fractions on consecutive weekdays, beginning on Mondays. Radiotherapy was planned from CT images, using a 2D computer planning system. Six weeks after completion of radiotherapy, dogs were scheduled for nasal CT examination. If gross tumor was noted, aggressive nasal exenteration was performed and tissue biopsied. If no tumor was noted, owners were encouraged to have an additional CT examinations 12 weeks post-radiotherapy. Followup continued at 2-3 month intervals until 1 year, then at 6 month intervals until death. Radiotherapy and/or surgical complications were recorded.

Results: Nine dogs had aggressive surgery performed at a median of 10 weeks following nasal radiotherapy (range; 6 – 73 weeks). Surgery was indicated based on an initial CT scan 6 – 8 weeks after radiotherapy in six dogs. One dog had 3 post-radiotherapy CT scans and another had 8 CT scans before surgery was clearly indicated. All tumor stages were represented (Stage I – 1; II –3; III – 3; IV – 2). Seven dogs had carcinomas; 2 had sarcomas and age range was 6.5 – 12 (median – 9 years). Biopsy obtained at time of nasal exenteration was positive for tumor in 7 dogs. One dog with brain involvement was euthanized due to complications 8 days post-op, and 2 dogs succumbed to local recurrence at 140 days and 4 years post-operatively. Post-operative complications included subcutaneous emphysema (2 dogs) and recurrent epistaxis (1 dog) in the immediate post-op period and osteomyelitis (2 dogs – within a month of surgery) and rhinitis (1 dog – 10 months after surgery). Additional nasal surgery was necessary for the cases of osteomyelitis. Six dogs lived 1.5 – 4.8 years following radiotherapy; 4 of which are alive at this writing (1.5, 2, 2.6 and 4.8 years).

Conclusion: Aggressive rhinotomy following radiotherapy may extend patient survival when recurrent or residual nasal tumor is suspected on post-radiotherapy CT scans. Post-operative complications may be serious, requiring additional surgery.
What is a Radiosensitizer (?): Update on Gemcitabine for Canine Sinonasal Carcinoma and Feline Oral Squamous Cell Carcinoma

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INTRODUCTION
Local tumor failure continues to be the predominant cause of death in dogs with nasal carcinoma and cats with oral carcinomas. Radiation therapy alone significantly improves survival times in dogs; however, reported average survival times are more often than not less than one year. Radiation therapy for feline oral squamous cell carcinoma has not been proven to substantially improve survival times. The combination of radiation and drugs is appealing to veterinary and human oncologists interested in improving poor locoregional tumor control. The goal of this combination is to improve therapeutic results. These results depend not only on tumor response but also on normal tissue response. The objective of this VRTOG supported trial is to evaluate therapeutic results of gemcitabine as a radiosensitizer in canine sinonasal carcinoma and feline oral squamous cell carcinoma.

METHODS
This VRTOG approved trial is designed to enroll dogs with regionally localized sinonasal carcinoma and cats with regionally localized oral squamous cell carcinoma treated with definitive external beam radiation. Details of the study design will be presented. Eli Lilly Corporation has graciously supplied drug.

RESULTS
Fifteen dogs have been entered into the trial from two radiation facilities. Average radiation dose was 50 Gray in M-F fractions. Eight dogs received 3Gy/fx. Seven dogs received 3.2Gy/fx. All dogs fit inclusion criteria. Average number of gemcitabine doses was 5 per patient. Average dose was 40 mg/M². Twelve of fifteen dogs required chemotherapy postponement/dose reduction due to bone marrow and/or normal tissue toxicity. Median local control is 8.6 months (mean 8 months). Nine dogs died due to progressive disease. Two dogs died due to unrelated disease with no evidence of local progression at 0.5 months and 20 months. Three dogs are alive with no evidence of local progression at 2, 8, and 29 months. One dog had no evidence of local progression when lost to follow-up at 18 months. Seven grade three and twelve grade two normal tissue toxicities were documented.

Ten cats have been entered into the trial from three radiation facilities. Average radiation dose was 54 Gray in M-F fractions. Nine cats received 3 Gy/fx and one cat received 3.2 Gy/fx. Two cats did not fit inclusion criteria due to tumor metastasis. Average number of gemcitabine doses was 5. Average dose was 21 mg/M². Five cats required chemotherapy postponement/dose reduction due to bone marrow and/or normal tissue toxicity. Median local control is 3 months (mean 6 months). Six cats died due to progressive local disease. Two cats died due to metastasis without progressive local disease. Two cats are alive with no evidence of local progression at 1 and 32 months. Four grade three and nine grade two normal tissue toxicities were documented.

DISCUSSION
While data herein does not support the routine use of gemcitabine to enhance local control of head and neck carcinoma, it is important to remember that the absence of promising results does not negate the scientific premise. The inclusion of pharmacological data will be critical to our ability to make appropriate recommendations and conclusions.
Irradiation and Carboplatin Chemotherapy for Treatment of Advanced Canine Intranasal Carcinomas
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Introduction: Although it is generally agreed that radiotherapy is an integral component in the treatment of dogs with nasal/paranasal neoplasms, the results of radiotherapy alone have been very disappointing.

Objectives: To investigate feasibility, toxicity and efficacy of carboplatin as a radiosensitizer for T2 nasal carcinomas

Methods: Dogs with histologically confirmed carcinomas derived from the nasal passages and/or paranasal sinuses, with no evidence of systemic dissemination of tumor and no extension into the frontal sinuses or cribriform plate. Dogs were irradiated with a telecobalt-60 unit (AECL Eldorado 8, Canada). Treatment dose was 40 Gy administered in 10 fractions of 4 Gy over 3 and 1/2 weeks on a Monday-Wednesday-Friday schedule. Computer-based treatment planning (Prowess 3000, Small Systems, Chico CA) was performed in all cases. Carboplatin (30 or 45 mg/m²) was given as an intravenous bolus 30 minutes prior to each radiation dose fraction. A group of dogs (n=28) with T2 intranasal carcinomas treated with irradiation alone (48 Gy in 12 fractions of 4 Gy given on alternate-day schedule) was used as an historical control group. Blood samples were obtained prior to carboplatin administration and each radiation fraction, to determine plasma levels of platinum using electrothermal flameless atomic absorption spectroscopy. In addition, weekly complete blood counts and serum biochemistry profiles were obtained during the course of treatment and 1 month following treatment. The RTOG/EORTC acute and late radiation morbidity scoring scheme was used to grade local toxicity.

Results: Ten dogs with newly diagnosed carcinomas including adenocarcinoma (n=4), squamous cell carcinoma (n=4), transitional carcinoma (n=1) and undifferentiated carcinoma (n=1) received carboplatin (30 mg/m², n=8, and 45 mg/m², n=2) as a radiosensitizer. Three dogs that died early after treatment because of widespread metastasis were not included in the late toxicity analysis. Discrete effects of carboplatin chemotherapy on hematology and serum biochemistry were not found. Carboplatin-related nausea and vomiting were not observed. Analysis of serial plasma levels of platinum did not reveal a cumulative effect. After drug administration, plasma levels were consistent for each dog but varied widely from dog to dog irrespective of drug-dosage. Low-dose carboplatin in combination with irradiation was safe. When compared to radiotherapy alone (48Gy) the rate of acute and late complications was lower. Although survival rate at 12 months were twice as high when compared to historical patients treated with radiotherapy alone, the difference was not significant (p=0.1).

Conclusions: Low-dose carboplatin appeared to selectively enhance the effectiveness of a moderate dose of radiation without increasing toxicity. A dose-escalation study with 3-D radiation treatment planning may provide the basis for an optimum treatment of canine nasal carcinomas.