American College of Veterinary Radiology

2007

ANNUAL SCIENTIFIC MEETING

November 27 – December 1, 2007

CHICAGO MARRIOTT O’HARE HOTEL
CHICAGO, ILLINOIS

PROGRAM COMMITTEE
Kari L. Anderson, Program Chair
Brian Poteet, Program Co-Chair (ACVR)
William R. Brawner, Jr., Program Co-Chair (Radiation Oncology)
Daniel A. Feeney, Coordinator of Resident Seminar Series
Lisa Zekas, Coordinator of Image Interpretation Session
Jonathan Shiroma, President Ultrasound Society
Wm. Tod Drost, President Society of Veterinary Nuclear Medicine
Victor Rendano, Jr., President CT/MRI Society
Jessica Winger, Administration
Tuesday, November 27, 2007

7:00 am  Registration Opens

8:00 am  Resident Seminar Series – Clinical Approach to Abdominal Radiography – Introductory Comments

8:05 am  Abdominal distention/masses

9:00 am  Acute abdomen/collapse

10:00 am  Break

10:30 am  Contrast media

11:00 am  Special procedures

12:30 pm  Lunch

1:30 pm  Vomiting/diarrhea

2:30 pm  Hematuria/dysuria

3:30 pm  Break

4:00 pm  Jaundice/azotemia

5:00 pm  Question and Answer session with speakers

Wednesday, November 28, 2007

7:00 am  Ultrasound Society Meeting

8:00 am  Conference Welcome – Dr. Kari L. Anderson, 2007 Program Chair

8:05 am  Resident Authored Paper and Grant Awards

8:10 am  ACVR Presidential Address – Dr. William Hornof
8:30 am  ACVR Keynote Address
“Beyond Anatomy: Imaging Molecules, Function, and Disease Using Advanced Magnetic Resonance Methodologies”
Michael Garwood, PhD

10:00 am  Break with exhibitors

10:30 am  Ultrasound Society Keynote Address
“Animal Models for Ultrasound Contrast Imaging Research”
Flemming Forsberg, PhD, FAIUM, FAIMBE

11:30 am  Scientific Session 1: Diagnostic Ultrasound

12:00 pm  Lunch

2:00 pm  Scientific Session 2: Diagnostic Ultrasound

3:30 pm  Break with exhibitors

4:00 pm  Scientific Session 3: Diagnostic Ultrasound

6:30pm  Reception supported by Universal Medical Systems of Ohio

Thursday, November 29, 2007

7:00 am  Society of Veterinary Nuclear Medicine Meeting

8:00 am  Scientific Session 4: Nuclear Medicine

9:00 am  Scientific Session 5: General Radiology

10:00 am  Break with exhibitors

10:30 am  Scientific Session 6: General Radiology

11:00 am  General Radiology Special Session
“I.R. or the O.R.? Veterinary Interventional Radiology”
Dr. Chick Weisse

12:00 pm  Lunch

1:30 pm  ACVR Business Meeting

3:30 pm  Break with exhibitors
Friday, November 30, 2007

7:00 am  CT/MRI Society Meeting
8:00 am  Scientific Session 7: CT/MRI
9:00 am  CT/MRI Keynote Address
        “MRI: Where We Are At and Where We Are Going”
        Joseph P. Hornak, PhD
10:00 am  Break with exhibitors
10:30 am  Scientific Session 8: CT/MRI
12:00 pm  Lunch
1:30 pm  Poster Session with Authors
2:30 pm  Scientific Session 9: CT/MRI
3:30 pm  Break with exhibitors
4:00 pm  Scientific Session 10: CT/MRI

Saturday, December 1, 2007

7:00 am  VRTOG Meeting
8:00 am  Welcome by Dr. Deborah Prescott, ACVR-RO President
8:05 am  ACVR-RO Keynote Address
        “Radiation Therapy: A look at the Past, the Present, and Maybe a Glimpse of the Future”
        Wendell Lutz, PhD
9:30 am  Scientific Session 11: RO
10:00 am  Break
10:30 am  Scientific Session 12: RO
11:00 am  ACVR-RO Business Meeting
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3:00 pm  Radiation Oncology Forum
         “Treatment planning for brain and nasal tumors in dogs”
2007 ACVR Scientific Conference

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Introductory comments
Dr. Daniel Feeney, University of Minnesota

8:05 am Abdominal distention/masses
Dr. Charles Root, Animal Medical Imaging, PLLC, Kirkland, WA

9:00 am Acute abdomen/collapse
Dr. Daniel Feeney, University of Minnesota

10:00 am Break

10:30 am Contrast media
Dr. Seth T. Wallack, Veterinary Imaging Center of San Diego

11:00 am Special procedures
Dr. Seth T. Wallack, Veterinary Imaging Center of San Diego

12:30 pm Lunch

1:30 pm Vomiting/diarrhea
Dr. Elizabeth Riedesel, Iowa State University

2:30 pm Hematuria/dysuria
Dr. Gary R. Johnston, Western University of Health Sciences

3:30 pm Break

4:00 pm Jaundice/azotemia
Dr. Kathy Beck, Angell Animal Medical Center – Boston

5:00 pm Question and Answer session with the speakers
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11:36 am  Scientific Session 1: Diagnostic Ultrasound
Moderator: Dr. Jonathan Shiroma

11:36 am  Noninvasive estimation of central venous pressure by measurement of hepatic venous bloodflow velocity and abdominal venous diameter.
N.C. Nelson, The Ohio State University

11:48 am  Freehand ultrasound-guided femoral arterial catheterization in dogs.
S.A. Ringold, University of Missouri

12:00 pm  Lunch

2:00 pm  Scientific Session 2: Diagnostic Ultrasound
Moderator: Dr. Kate Alexander

2:00 pm  Contrast harmonic ultrasound of splenic hemangiosarcoma and associated liver nodules in dogs.
M. Ivančić-Arndt, University of Pennsylvania

2:12 pm  Quantitative perfusion analysis of the normal canine pancreas and duodenum using contrast-enhanced harmonic ultrasound.
J.L. Johnson-Neitman, Kansas State University
2:24 pm Contrast harmonic ultrasound imaging of the normal pancreas and pancreatitis in dogs.  
L. Gaschen, Louisiana State University

2:36 pm Pattern recognition of thickened muscularis layer in diffuse feline small intestinal lymphoma and inflammatory bowel disease.  
A.L. Zwingenberger, University of California, Davis

2:48 pm Quantitative comparison of the ultrasonographic signal intensity of the renal cortex and liver parenchyma in healthy dogs.  
M. Ivančić-Arndt, University of Pennsylvania

3:10 pm Ultrasonographic measurement of gallbladder volume in healthy, adult cats.  
J.L. O’Sullivan, Tufts University

3:22 pm Ultrasonographic evaluation of gall bladder disease.  
L.J. Crews, University of Minnesota

3:30 pm Break with exhibitors

4:00 pm Scientific Session 3: Diagnostic Ultrasound  
Moderator: Dr. Marc-André d’Anjou

4:00 pm Association between ultrasonographically-determined adrenal gland size and results of the ACTH stimulation test in dogs.  
S.M. Lillis, University of Pennsylvania

4:12 pm Correlations between age, body weight and ultrasound measures of medial retropharyngeal lymph node size in apparently healthy dogs.  
G.O. Burns, Cornell University

4:24 pm The prevalence of lymphosarcoma in dogs with sublumbar lymphadenopathy.  
T.M. Axam, University of Georgia

4:36 pm Evaluation of left ventricular function using pulsed tissue Doppler imaging in normal dogs.  
J.Y. Kim, Seoul National University

4:48 pm Coelomic ultrasonography of the normal green iguana.  
M.F. Holland, University of Georgia

6:30 pm Reception supported by Universal Medical Systems of Ohio
## 2007 ACVR Scientific Conference

**Thursday, November 29, 2007**

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<th>Time</th>
<th>Session</th>
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<tr>
<td>7:00 am</td>
<td><em>Society of Veterinary Nuclear Medicine Meeting</em></td>
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<td>8:00 am</td>
<td><strong>Scientific Session 4: Nuclear Medicine</strong></td>
<td>Effect of sedation protocol on glomerular filtration in cats as determined by quantitative renal scintigraphy.</td>
<td>M.D. Winter, University of Florida</td>
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<tr>
<td>8:00 am</td>
<td><strong>Scientific Session 4: Nuclear Medicine</strong></td>
<td>Comparison of $^{99m}$TC-MIBI biliary excretion in dogs with ABCB1 gene mutation versus normal dogs.</td>
<td>J.C. Coelho, Washington State University</td>
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<tr>
<td>8:24 am</td>
<td><strong>Scientific Session 4: Nuclear Medicine</strong></td>
<td>Evaluation of $^{99m}$technetium-labeled biotin as a soft tissue inflammation seeking agent in horses.</td>
<td>M. Solano, Tufts University</td>
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<tr>
<td>8:36 am</td>
<td><strong>Scientific Session 4: Nuclear Medicine</strong></td>
<td>Correlation of the scintigraphic assessment and radiographic appearance of the equine sacroiliac region.</td>
<td>D. Gorgas, University of Bern, Switzerland</td>
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<td>8:48 am</td>
<td><strong>Scientific Session 4: Nuclear Medicine</strong></td>
<td>Thyroid to background ratio in predicting I-131 therapy failure at 4 mCi dosing.</td>
<td>S.T. Wallack, Veterinary Imaging Center of San Diego</td>
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<td>9:00 am</td>
<td><strong>Scientific Session 5: General Radiology</strong></td>
<td>The relationship of radiographic hilar lymphadenopathy to serologic titers for <em>Coccidioides sp.</em> in dogs in an endemic region.</td>
<td>A.C. Crabtree, Auburn University</td>
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<tr>
<td>9:12 am</td>
<td><strong>Scientific Session 5: General Radiology</strong></td>
<td>Examining the reliability of cervical vertebral radiography for the assessment of equine cervical articular process joint osteoarthritis.</td>
<td>V. Unt, University of London, England</td>
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<tr>
<td>9:24 am</td>
<td><strong>Scientific Session 5: General Radiology</strong></td>
<td>Factors affecting width of the canine femorotibial joint space in non-weight-bearing radiographs.</td>
<td>C.R. Lamb, University of London, England</td>
</tr>
</tbody>
</table>
9:36 am  **Accuracy of veterinary diagnostic imaging: a systematic review.**  
C.R. Lamb, University of London, England

9:48 am  **Artifacts in digital radiography.**  
D.A. Jimenez, Kansas State University

10:00 am  **Break with exhibitors**

10:00 am  **Scientific Session 6: General Radiology**  
Moderator: Dr. Rob McLear

10:30 am  **Objective radiographic evaluation of proventriculus size in psittacines (parrots).**  
S.E. Dennison, University of Wisconsin

10:42 am  **Results of portography help predict outcome in cats having surgical treatment for congenital portosystemic shunt.**  
C.R. Lamb, University of London, England

11:00 am  **General Radiology Special Session**  
“I.R. or the O.R.? Veterinary Interventional Radiology”  
Dr. Chick Weisse

12:00 pm  **Lunch**

1:30 pm  **ACVR Business Meeting (Diplomates only)**

3:30 pm  **Break with exhibitors**

4:00 pm  **ACVR Image Interpretation Session**

6:30 pm  **Reception supported by Orthopedic Foundation for Animals**
2007 ACVR Scientific Conference

Friday, November 30, 2007

7:00 am  
**CT/MRI Society Meeting**

8:00 am  
**Scientific Session 7: CT/MRI**
Moderator: Dr. Victor Rendano

8:00 am  
**Bone mineral density (BMD) assessed by computed tomography in an *in vivo* rabbit model of stifle osteoarthritis.**
M. Bouchgua, University of Montreal, Canada

8:12 am  
**In vivo multimodality imaging of temporal changes in stifle osteoarthritis (OA) lesions in a rabbit model.**
M. Bouchgua, University of Montreal, Canada

8:24 am  
**Computed tomography arthrography of the stifle for detection of caudal cruciate, cranial cruciate and meniscal ligament tears in dogs.**
V.F. Samii, The Ohio State University

8:36 am  
**What is the diagnostic impact of computed tomography in dogs with suspected elbow arthritis?**
C.R. Lamb, University of London, England

8:48 am  
**Comparison of ultrasound, CT, and MRI in detection of acute wooden foreign bodies in the canine manus.**
C.P. Ober, Virginia Tech

9:00 am  
**CT/MRI Keynote Address**
“MRI: Where We Are At and Where We Are Going”
Joseph P. Hornak, PhD

10:00 am  
**Break with exhibitors**

10:30 am  
**Scientific Session 8: CT/MRI**
Moderator: Dr. Travis Saveraid

10:30 am  
**Establishment of a computed tomographic protocol for the canine dentition.**
T. Schwarz, University of Wisconsin

10:42 am  
**Virtual endoscopy imaging of the middle ear cavity and ossicles in dogs.**
S.H. Park, Chonbuk National University, South Korea
10:54 am  Osteophytosis, subchondral sclerosis, joint effusion and synovial thickening in canine experimental stifle osteoarthritis: a comparison between 1.5 T MRI and computed radiography.
M.-A. d’Anjou, University of Montreal

11:06 am  Temporal assessment of bone marrow lesions in a canine model of stifle osteoarthritis: impact of sequence selection on MRI.
M.-A. d’Anjou, University of Montreal

11:18 am  Percutaneous ultrasound guided popliteal lymphography for computed tomographic imaging of canine thoracic ducts.
H. Cho, Chungbuk National University, Republic of Korea

11:30 am  Assessment of airway disease in 5 dogs using multidetector row computed tomography and radiography under sedation and bronchoscopy.
L. Jesse, North Carolina State University

11:42 am  Comparison of different helical CT protocols for the detection of soft tissue pulmonary nodules in the dog.
H. Joly, University of Montreal

12:00 pm  Lunch

1:30 pm  Poster Session with Authors

Poster 1  Dynamics of acute phase proteins and ultrasonographic mensurations of conceptus during gestation in boxers.
F.A. Sterman

Poster 2  Diagnostic value of free hand ultrasound-guided fine needle sampling of gastrointestinal tract lesions in dogs and cats.
C.A. Robert

Poster 3  Evaluation of lateral ventricle using computed tomography in the normal Shih-tzu dog.
H.J. Choi

Poster 4  Magnetic resonance imaging in the investigation of canine heads.
M.C.F.N.S. Hage

Poster 5  MR imaging diagnosis of congenital hydrocephalus in the rat.
B.H. Lee
Poster 6  Evaluation of position’s effects related to gravitational pulmonary dependent densities in dogs (Canis familiaris) by computed tomography. A.C.B.C. Fonseca Pinto

Poster 7  Comparison of human and canine sandwich Elisa development kit from R&D systems for the detection of canine VEGF. I. Sekis

2:30 pm  **Scientific Session 9: CT/MRI**  
Moderator: Dr. Allison Zwingenberger

2:30 pm  The clinical application of three-dimensional computed tomographic imaging in head and neck lesions. 
H.W. Kang, Chonbuk National University, South Korea

2:42 pm  Positional CT of the L7-S1 intervertebral foramina in dogs with lumbosacral syndrome (81 cases, 1995-2006). 
S. Davies, Virginia Tech

2:54 pm  Establishment of a computed tomographic protocol for the canine cervical and lumbar spine. 
R. Drees, University of Wisconsin

3:06 pm  Quantitative MR investigation of microvascular dysplasia (MVD) following Feridex® contrast enhancement of the liver. 
S.P. Holmes, Washington State University

3:18 pm  Coronal radiation hyperintensity in magnetic resonance (MR) images of cases with presumed hepatic encephalopathy (HE). 
S.P. Holmes, Washington State University

3:30 pm  **Break with exhibitors**

4:00 pm  **Scientific Session 10: CT/MRI**  
Moderator: Dr. Constance DeHaan

4:00 pm  Magnetic resonance angiography (3D time of flight) of the arterial blood supply to the canine brain. 
J.D. Rodriguez, University of Wisconsin

4:12 pm  Magnetic resonance imaging of the stifle in anesthetized horses. 
T.C. Saveraid, University of Minnesota

4:24 pm  Distension of the navicular bursa to determine the presence of adhesions using magnetic resonance imaging. 
B. Eichelberger, Colorado State University
4:36 pm  **Computed tomographic evaluation of otitis in the alpaca.**
T.I. Silver, Colorado State University

4:48 pm  **Calvarial hyperostosis in two acromegalic cats.**
K.M. Gisselman, The Animal Medical Center, New York

5:00 pm  **Magnetic resonance and computed tomographic anatomy of the normal green iguana.**
M.F. Holland, University of Georgia

5:12 pm  **Comparison of pre and post contrast computed tomography and magnetic resonance imaging for the evaluation of canine nasal neoplasia.**
R. Drees, University of Wisconsin

5:24 pm  **Does dynamic contrast enhanced MRI predict percent tumor necrosis in spontaneous canine osteosarcomas?**
B.M. Eichelberger, Colorado State University
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8:05 am   ACVR-RO Keynote Address
“Radiation Therapy: A look at the Past, the Present, and Maybe a Glimpse of the Future”
Wendell Lutz, PhD

9:30 am   Scientific Session 11: Radiation Oncology
Moderator: Dr. William Brawner

9:30 am   Expression of epidermal growth factor (EGFR) in malignant canine epithelial nasal tumors.
K. Shiomitsu, North Carolina State University

9:42 am   In vivo radiosensitization in drug sensitive and -resistant tumor cells by epothilone B.
C. Rohrer Bley, University of Zurich, Switzerland

10:00 am  Break

10:30 am  Scientific Session 12: Radiation Oncology
Moderator: Dr. Monique Mayer

10:30 am   Correlations between pain scores and acute radiation scores in dogs undergoing curative intent radiation therapy.
S.M. LaRue, Colorado State University

10:42 am   Developmental deceleration with repeat general anesthesia and radiation therapy on growing mini pigs in pediatric radiation oncology research.
L.E. Weisssfloh, Max Planck Institute for Biological Cybernetics, Tuebingen, Germany

11:00 am  ACVR-RO business meeting (Diplomates only)

12:00 pm  Lunch

1:30 pm   Scientific Session 13: Radiation Oncology
Moderator: Dr. Chess Adams
1:30 pm  
**Accelerated radiation therapy in equines.**
J. Fidel, Washington State University

1:42 pm  
**Abstract withdrawn**

Efficacy of radiation therapy for the treatment of canine sialocele.
V.J. Poirier, University of Zurich

1:54 pm  
**Dosimetric impact of daily setup variations during treatment of canine nasal tumors using intensity-modulated radiation therapy.**
M.A. Deveau, University of Wisconsin

2:06 pm  
**A dosimetric comparison of intensity modulated radiation therapy versus 3-D conformal radiation therapy for canine nasal tumor patients.**
T.N. Tuchak, Colorado State University.

2:30 pm  
Break

3:00 pm  
Radiation Oncology Forum
“Treatment planning for brain and nasal tumors in dogs”
Moderator: Dr. William Brawner

4:30 pm  
Conference adjourned
NONINVASIVE ESTIMATION OF CENTRAL VENOUS PRESSURE BY MEASUREMENT OF HEPATIC VENOUS BLOODFLOW VELOCITY AND ABDOMINAL VENOUS DIAMETER
N.C. Nelson, W.T. Drost, J.D. Bonagura, P. Lerche
The Ohio State University, College of Veterinary Medicine
Columbus, OH 43210

Introduction/Purpose  Determination of central venous pressure (CVP) is relevant to patients with right heart disease, pericardial disease, and to situations of volume depletion or intravenous fluid therapy. Noninvasive determination of CVP would lend itself well to serial determination of right heart filling pressures. Ultrasound measurements of hepatic vein diameter and blood flow velocity have been used in human patients to estimate CVP. Previously we reported consistent patterns of hepatic venous blood flow measured by pulsed-wave Doppler ultrasonography (PWD) in healthy dogs (a-, S-, v-, and D-waves). In the current study, we addressed the hypothesis that changes in CVP in dogs can be predicted by measurement of hepatic vein diameter, caudal vena caval diameter, and hepatic venous flow velocities.

Methods  Seven healthy American Foxhounds were anesthetized and maintained on isoflurane. Catheters were placed in the cephalic vein, jugular vein, and dorsal pedal artery. The tip of the jugular catheter was advanced into the right atrium using fluoroscopy. Following baseline recordings, physiologic saline (0.9%) and hetastarch were administered to progressively increase CVP. Abdominal venous structures were evaluated by B-mode ultrasonography and hepatic venous flow by PWD. Volume administration created the following treatment periods beyond the baseline: CVP of 5-, 10-, 15-, 20-, and 25-mm Hg. The a-, S-, v-, and D-wave velocities were recorded from the right medial hepatic vein using PWD. The diameters of the right medial hepatic vein, caudal vena cava, and aorta and the thickness of the gallbladder wall were determined. All measurements were guided by a simultaneous ECG and collected at end-expiration. After the final treatment period, furosemide was administered and the dogs recovered. The aforementioned variables were compared across the six treatment periods by repeated measures ANOVA (or a Friedman’s ANOVA where data were not normally distributed). When the ANOVA was significant (p<0.05), post-hoc tests (Holm-Sidak or Dunn’s) were used to identify differences between treatment periods. Additionally, simple and multivariate linear regression was used to predict the relationships between CVP and variables demonstrating significant changes with increasing CVP.

Results  The a-, S-, and v-wave velocities increased significantly with volume loading, but D-wave velocity did not. Diameters of the vena cava and right medial hepatic vein increased with higher CVP. The variables with best univariate correlation to measured CVP were vena cava diameter (r=0.732), hepatic vein diameter (r=0.578), v-wave velocity (r=0.654), S-wave velocity (r=0.519), and gallbladder wall thickness (r=0.783).

Discussion/Conclusion  Increases in CVP lead to progressive dilation of the caudal vena cava and to a lesser extent the right medial hepatic vein. S-wave and v-wave velocities also increase as CVP rises. These findings may be applicable in the assessment of volume status, dogs with right sided heart disease, and during serial monitoring of dogs receiving fluid or diuretic therapy. Edema of the gall bladder wall correlates directly with increases in CVP, and likely represents a hypervolemic state.

1) Introduction/Purpose: Vascular access is fundamental in diagnosing and treating a multitude of conditions and diseases. Arterial catheters are used to obtain blood samples and direct arterial blood pressure measurements or to facilitate access for interventional radiology techniques. The purpose of this investigation was to demonstrate that ultrasound-guided femoral artery catheterization is feasible and practical in dogs.

2) Methods: The study was designed as a prospective case series. The subjects, four sexually intact female mixed breed dogs weighing 14-23 kg, were used immediately following an ultimately terminal junior surgery laboratory and had been anesthetized prior to this ultrasound study. Dogs were positioned in lateral recumbency with the upper limb abducted and immobilized. The dependent limb was extended and shaved and isopropyl alcohol was applied. An ultrasound transducer was oriented transverse to the axis of the limb and, following identification of the femoral artery, the vessel was cannulated and a catheter was placed using the Seldinger technique. A total of 10 attempts were made, two arteries being catheterized twice in succession.

3) Results: Ultrasound-guided catheterization was successful in 9 of 10 attempts; cannulization was successful in 10 of 10 attempts. Procedure time improved from 10 minutes to 1 minute during practice. The attempt that did not result in catheterization failed due to a technical complication in passing the guide-wire. Each investigator was able to simultaneously ultrasound and cannulate the vessel. The major complication was hematoma formation.

4) Discussion/Conclusions: Ultrasound-guided femoral artery catheterization is feasible and relatively easy to master in medium size, anesthetized dogs.
INTRODUCTION: Dogs with hemoabdomen and/or splenic masses frequently present as veterinary emergencies. Since both benign and malignant processes can be the cause, it is difficult for clinicians and owners to make appropriate treatment decisions with little diagnostic or prognostic information available. Currently, determination of malignancy is invasive and requires surgical intervention or ultrasound-guided biopsy with associated increased morbidity and cost. The goal of this prospective study was to use contrast harmonic ultrasound (CHU) to characterize splenic and hepatic lesions in dogs with suspected hemangiosarcoma (HSA), and to correlate these findings with histopathology.

METHODS: Dogs who were presented to the MJR-VHUP with a splenic mass suspicious of HSA and hemoabdomen and whose owners consented to histopathologic evaluation of liver and spleen were included in the study. Routine abdominal evaluation using conventional ultrasound was followed by CHU. A total of 3-4 intravenous injections of Definity™ contrast medium were administered intravenously at a dose of 0.1 to 0.2 mL, depending on the size of the patient (< or ≥ 16 kg). Hepatic parenchyma and splenic lesions were scanned using phase inversion harmonic imaging (3.5MHz transducer optimized for use of low mechanical index) over a time of 2 minutes after contrast injection. Images were recorded on VHS videotape. Location, enhancement pattern relative to the surrounding parenchyma, and vascularity of detected lesions was described. Liver lesions seen on conventional ultrasound were closely scrutinized for increased, decreased, or unchanged conspicuity, and the liver parenchyma was diffusely evaluated for detection of previously unseen nodules.

RESULTS: 20 dogs representing 11 breeds (12 females, 8 males) were enrolled in the study. The mean age was 10.7 years and the mean weight was 26.9 kg. 18/20 underwent exploratory laparotomy and splenectomy; 2 dogs were directly euthanized and underwent necropsy. 4/18 that had surgery were subsequently euthanized and necropsied. 13/20 were diagnosed with HSA. The enhancement pattern of splenic masses included peripheral enhancement of the lesion with extensions of clusters of small vessels into the center of the mass in all cases (benign and malignant). 10/20 dogs had no lesions in the liver on pre- and post contrast scans. None of these patients had histopathologic evidence of metastatic disease. 4/20 dogs had liver nodules with contrast enhancement similar to the surrounding liver parenchyma. Metastatic disease was not diagnosed in any of these dogs. 6 dogs had liver nodules that remained hypoechogenic throughout the examination. Of these, all but one (83%) had metastatic HSA on histopathology (necropsy). In this dog, the lesion described on CHU was not biopsied to avoid resultant hemorrhage. Sensitivity and specificity of CHU for confirming the presence of metastatic liver nodules was 100% and 93.3%, respectively.

CONCLUSIONS: Contrast harmonic ultrasonography can non-invasively provide information about presence of metastatic liver disease in dogs with splenic HSA prior to surgery. Subjective evaluation of vascularity of splenic lesions was not found to be sensitive for determination of benign vs. malignant splenic masses.
**Introduction/Purpose:** The purpose of this research was to investigate contrast ultrasound as a non-invasive method of evaluating perfusion patterns of the pancreas and duodenum with potential clinical applicability.

**Methods:** Eight normal adult dogs, weighing between 5 and 25kg, were imaged utilizing contrast-enhanced ultrasound after the intravenous administration of a commercially available microbubble contrast medium (Definity®). All dogs received a minimum of two injections in separate boluses of 0.2mL each followed by 3mL of saline flush. Immediately after contrast administration, sonographic evaluation of the proximal descending duodenum and right pancreatic limb were performed via a right intercostal approach. All dogs were imaged with a broadband linear array transducer set at 7MHz coupled with a commercially available ultrasound system (Siemens Acuson Sequoia™ C512) with Cadence™ Contrast Pulse Sequencing (CPS) technology. Mechanical index ranged from 0.31-0.51. Dynamic acquisition of images was obtained at a rate of 10 frames per second for 120 seconds following injection. Time intensity curves were generated from separate selected regions of interest (ROI’s) of duodenal, pancreatic, and liver parenchyma. Major branches of the pancreaticoduodenal artery and vein were excluded from ROI’s. Perfusion parameters extrapolated included: time of first contrast appearance (Time 0), rate of inflow/outflow, time to peak intensity, and peak intensity for each organ.

**Results:** Table 1. Quantitative Perfusion Analysis of the Pancreas and Duodenum.

<table>
<thead>
<tr>
<th></th>
<th>Pancreas</th>
<th>( \bar{R}^2 ) (0.97)</th>
<th>Duodenum</th>
<th>Liver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 0 (sec)</td>
<td>7.86 ± 4.37</td>
<td>( \dagger ) (0.97)</td>
<td>8.06 ± 4.55</td>
<td>*11.28 ± 5.66</td>
</tr>
<tr>
<td>Inflow (dB/sec)</td>
<td>4.51 ± 2.12</td>
<td>( \text{NS} )</td>
<td>4.65 ± 4.08</td>
<td>*1.57 ± 0.66</td>
</tr>
<tr>
<td>Peak Intensity (dB)</td>
<td>23.11 ± 4.74</td>
<td>( \text{NS} )</td>
<td>21.87 ± 4.40</td>
<td>( \text{NS} )21.47 ± 3.46</td>
</tr>
<tr>
<td>Time to Peak Intensity (sec)</td>
<td>13.88 ± 6.62</td>
<td>( \dagger ) (0.96)</td>
<td>13.81 ± 6.47</td>
<td>*28.81 ± 6.93</td>
</tr>
<tr>
<td>Outflow (dB/sec)</td>
<td>-1.52 ± 1.36</td>
<td>( \dagger ) (0.92)</td>
<td>-1.47 ± 1.78</td>
<td>*-0.34 ± 0.33</td>
</tr>
</tbody>
</table>

\( \dagger - P \leq 0.0001 \) association between duodenum and pancreas (R-squared value of linear regression)

\( * - P \leq 0.05 \) difference between liver and both pancreas and duodenum

\( \text{NS} \) - no significant difference

**Discussion/Conclusions:** It is expected that this baseline data will stimulate further investigation of perfusion patterns related to pancreatic and gastrointestinal diseases in veterinary medicine. Research is ongoing using contrast ultrasound for clinical investigation of intra-operative intestinal vascular integrity and for the correlation of perfusion pattern to severity of pancreatitis.
CONTRAST HARMONIC ULTRASOUND IMAGING OF THE NORMAL PANCREAS AND PANCREATITIS IN DOGS. L.Gaschen, D.Schur, M.Kearney. Louisiana State University School of Veterinary Medicine, Louisiana, 70803.

Introduction/Purpose: Contrast harmonic ultrasound is being increasingly used as an advanced approach to the clinical assessment of liver and kidney disease in small animals and humans. Only recently has this imaging modality been used to assess the pancreas in humans. Contrast harmonic ultrasound improves detection of tissue perfusion as well as organ and lesion vascular patterns. To our knowledge, no report of its use for assessing the canine pancreas exists. Our aim is to show that contrast harmonic ultrasound can be used to quantify normal perfusion dynamics of the canine pancreas and detect abnormal patterns in dogs with pancreatitis.

Methods: Ten normal dogs and seven with pancreatitis were selected based on physical examination, abdominal ultrasound, and blood work consisting of CBC, chemistry panel (including amylase and lipase), cPLI and TLI analysis. Following a 12 hour fast, a contrast study was performed three times after injecting 0.1ml(<20kg) or 0.2 ml (>20kg) of Definity®[Bristol-Myers Squibb, New York] contrast medium i.v. followed by 3ml heparinized saline flush. Data analysis was performed using time-intensity curves created by Q-lab advanced ultrasound quantification software version 4.2.[Philips Ultrasound, Bothel, WA]. The best two of the three injections were used and the following was compared statistically between normal and abnormal dogs: parenchymal perfusion as a function of pixel intensity, pancreatoduodenal vein to parenchymal pixel intensity ratios, and time to peak wash in rates for the two injections.

Results: The contrast-enhanced parenchyma of dogs with pancreatitis was subjectively more echogenic than controls. A statistically significant difference (p<0.05) in pixel intensity was shown between the pancreatic parenchyma of normal dogs and those with pancreatitis. This occurred from four through sixty seconds of a sixty second clip, post injection for both injections between the normal and abnormal groups. The analysis of the parenchymal to vessel intensity ratio was also significant (p<0.05) between twenty-three and forty-three seconds between the normal and abnormal groups. The difference in the wash in rates between normal and abnormal dogs approached significance (p=.0731). In one case, a hypoechoic necrotic lesion that was confirmed histologically, which was not apparent in the gray-scale image became clearly visible with use of the contrast medium.

Discussion/Conclusion: Contrast enhanced pancreatic ultrasound is an effective, feasible and reproducible method for the non-invasive quantification of pancreatic perfusion in normal dogs. Significant differences were observed in perfusion patterns between dogs with pancreatitis compared to normal dogs. This method may have future potential for improving the diagnostic and therapeutic strategies in dogs with necrotizing pancreatitis. Wash in rates showed a tendency for differentiating between normal and abnormal parenchyma.
PATTERN RECOGNITION OF THICKENED MUSCULARIS LAYER IN DIFFUSE FELINE SMALL INTESTINAL LYMPHOMA AND INFLAMMATORY BOWEL DISEASE
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Introduction Over the last decade, a pattern of thickening of the muscularis layer has been associated with diffuse infiltrative bowel disease such as lymphoma and inflammatory bowel disease (IBD) in cats. The purpose of this study was to determine the association between muscularis layer thickening and disease type in cats with lymphoma, IBD and normal small intestine; to determine the correlation of ultrasonographic and histopathologic abnormalities; and to characterize the type of lymphoma seen with this pattern.

Methods Patient records were searched from 1998-2006 to identify cats that had a full-thickness intestinal biopsy and an abdominal ultrasound in the 28-day period prior to biopsy. Those with loss of small intestinal layering, a mass, or more than one tumor type were not included. Cats that had concurrent lymphoma and IBD (n=11) were classified as lymphoma for the purposes of this study. Cats with a histological diagnosis of normal small intestine (n=56), lymphoma (n=51) and IBD (n=35) were identified for a total of 142 cats. Ultrasound reports were evaluated for description of muscularis layer thickening, and presence of mesenteric lymphadenopathy. Pathology reports were evaluated for diagnosis, and the layers of the small intestine that contained abnormal cells. Results were analyzed using multinomial logistic regression.

Results Immunophenotyping was available for 45/51 cats with lymphoma. 44 of 45 (98%) were T-cell origin, and 1 of 45 was of non-T, non-B cell origin. Cats with muscularis thickening (OR=4.2, p=0.023) and lymphadenopathy (OR=68, p<0.001) had increased odds of having lymphoma compared to normal cats. Cats with lymphadenopathy also had increased odds (OR=12.6, p=0.024) of having IBD compared to normal cats. There were increased odds of muscularis thickening (OR=4.9, p=0.011) and lymphadenopathy (OR=5.4, p=0.006) in cats with lymphoma compared to those with IBD. Cats with muscularis thickening had increased odds (OR=8.1, p=0.008) of disease in the submucosal layer, and those with lymphadenopathy had increased odds (OR=30.5, p=0.003) of having disease in the submucosal layer, or muscularis layer (OR=72.9, p<0.001). The presence of muscularis layer thickening was not significantly associated with disease in this layer (p=0.30).

Discussion Diffuse feline alimentary lymphoma is almost exclusively of T-cell origin. The pattern of muscularis layer thickening is significantly associated with lymphoma, and not IBD or normal small intestine. This pattern indicates higher odds of disease in the submucosal layer, but is not associated with disease in the muscularis layer. Cats with lymphadenopathy had higher odds of having disease in the submucosal and muscularis layers.
QUANTITATIVE COMPARISON OF THE ULTRASONOGRAPHIC SIGNAL INTENSITY OF THE RENAL CORTEX AND LIVER PARENCHYMA IN HEALTHY DOGS. M. Ivančič-Arndt and W. Mai. Matthew J. Ryan Veterinary Hospital of the University of Pennsylvania, Philadelphia PA, 19104

INTRODUCTION: There currently exists a long-standing widespread acceptance that the echogenicity of the renal cortex in dogs is either isoechoic or hypoechoic to that of the liver. Perceived echogenicity is a result of both ultrasonic backscatter and attenuation, however mean pixel intensity (MPI) can be used to quantify the visual impression of the ultrasonographer. The aim of this prospective, cross-sectional study was to quantitatively examine the MPI of the renal cortex relative to the liver in healthy dogs, using both conventional and harmonic imaging. We hypothesized that the MPI of the renal cortex would prove to be higher than that of the liver, and that this finding could change the interpretation of routine abdominal ultrasonographic examinations.

METHODS: Twenty-five healthy adult dogs without history, clinical signs, biochemical, or urinalysis data indicative of renal or hepatic disease were examined ultrasonographically. Three conventional B-mode images (8MHz) and three tissue harmonics images of the cranial pole of the right kidney adjacent to the caudate lobe of the liver were obtained. For each image, regions of interest (ROI) were drawn within the renal cortex and the adjacent liver parenchyma at equal depths, using two different ROI geometries. In method 1, the ROIs were centered at the focal zone and had a deep rectangular geometry, with the long axis oriented in the direction of the ultrasound beam (MPI affected by backscatter and attenuation). In method 2, smaller square ROIs were placed within the liver and renal cortex as close as possible to the near field (MPI affected primarily by backscatter). Quantification of the corresponding MPIs was derived, and individual subjects’ renal and hepatic MPIs were averaged.

RESULTS: Qualitatively, the renal cortex was hyperechoic to the liver in 54.7% and isoechoic to the liver in 42.0% of dogs. Quantitatively, the mean and 95% confidence interval MPIs of the renal cortex and the liver were as follows: Rectangular ROIs – conventional B-mode: renal cortex = 60.12 (55.34-64.90), liver = 48.12 (43.89-52.34); tissue harmonics: renal cortex = 71.83 (64.56-79.10), liver = 56.49 (49.89-63.09). Square ROIs – conventional B-mode: renal cortex = 41.00 (38.14-43.88), liver = 40.31 (37.39-43.23); tissue harmonics: renal cortex = 49.51 (45.84-53.18), liver = 51.18 (47.08-55.29). Using deep rectangular ROIs, the renal cortex was statistically significantly hyperechoic relative to the liver, for both conventional (p<0.0001) and harmonic (p<0.0001) tissue imaging. There was no difference using the superficial square ROIs (p=0.56 and p=0.35, respectively). With the rectangular ROIs, the absolute MPIs measured were significantly higher with tissue harmonics, and there was a greater difference between renal cortical and hepatic MPI values.

CONCLUSIONS: These findings suggest that the renal cortex is normally slightly hyperechoic to the adjacent liver, and that this difference is even more pronounced in tissue harmonic imaging. As a result, the framework within which the renal cortical parenchyma is routinely evaluated in abdominal ultrasonography of dogs should be reconsidered, and mild hyperechogenicity of the renal cortex relative to the liver (at 8 MHz) should be considered a normal finding.
ULTRASONOGRAPHIC MEASUREMENT OF GALLBLADDER VOLUME IN HEALTHY, ADULT CATS

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Introduction/Purpose Gallbladder volume in healthy cats has not been reported. The aim of this study is to provide an ultrasonographic reference range for gallbladder volume in healthy, fasted cats. We anticipate that this baseline will assist in distinguishing normal gallbladder volumes from those seen with hepatic and pancreatic diseases, including feline cholangitis and extrahepatic biliary obstruction (EHBO).

Methods Forty, adult, domestic short hair cats considered healthy by physical examination were evaluated. All cats were fasted for at least 12 hours. Maximal gallbladder dimensions (height, width, length) were recorded. Gallbladder volume was determined by use of the ellipsoid formula. Three consecutive measurements of the gallbladder volume were obtained by a single investigator (JOS). All examinations were recorded on videotape and images were stored on a digital archive system. Following the ultrasound examination, all cats had a complete blood count and serum chemistry profile performed, and if older than 8 years of age, a serum thyroxine assay.

Results Thirty-one healthy fasted cats (14 spayed females, 15 neutered males, and 1 intact male) were included in the study. Fasting times ranged from 12 to 16 hours. The mean gallbladder volume was determined to be 2.41ml, with a range of 0.84 - 4.50ml. The median gallbladder volume was 2.42ml.

Three of the 31 cats had mild hyperglycemia on serum chemistry profile, attributed to a stress response. Two cats with minimal liver enzyme elevation were included as they were asymptomatic, and the elevated values were less than two units of standard deviation for the laboratory reference ranges.

Of the 9 cats which did not complete the investigation, 5 were excluded due to lack of patient compliance. One cat was excluded based on abnormalities on bloodwork (leukocytosis, elevated liver enzymes), and another cat was excluded due to abnormalities detected on ultrasound examination (mesenteric lymphadenopathy, thickened colon wall) and serum chemistry profile (hyperglobulinemia). Two cats had bilobed gallbladders and were excluded as this shape was non-ellipsoid.

Discussion/Conclusions The establishment of a reference range for gallbladder volume in healthy cats will prove useful in future investigations of feline hepatobiliary, pancreatic, and gastrointestinal disease. Additionally, this reference range may be applied in future sonographic investigations of the biliary tract following feeding or cholecystokinin administration, aiding in the diagnosis of EHBO.

ULTRASONOGRAPHIC EVALUATION OF GALL BLADDER DISEASE. L.J. Crews,

Purpose: To evaluate the use of ultrasonography and to identify imaging characteristics that correlate with histology proven cholecystitis and/or gall bladder (GB) rupture.

Methods: A retrospective study of 45 dogs with surgical or post-mortem confirmation of GB status was performed. Medical records were reviewed for signalment, history, clinical signs, laboratory parameters, bile culture, GB wall histology, surgical/necropsy findings and patient outcome, and compared with ultrasound images and radiographs. Cholecystitis was classified in ascending order of severity as: lymphocytic, fibrotic, proliferative, supplicative, hemorrhagic or necrotic. Spearman’s Correlation and $\chi^2$ analyses were performed to determine if there was any statistical association among the clinical, laboratory and imaging findings and the presence/absence of GB rupture, the type of cholecystitis, and survival. Statistical significance was defined as $p<0.05$.

Results: Of the 45 dogs identified, 43 had GB wall histology confirming cholecystitis and two were surgically confirmed GB rupture or mucocele without histology. Bacteria were cultured in 10/40 (25.0%) aerobic samples, and 1/20 (0.05%) of anaerobic samples. The type of cholecystitis correlated with the GB status at surgery; dogs with necrotic cholecystitis were more likely to have GB rupture. GB rupture was associated with the imaging findings of: echogenic reaction in the GB region, peritoneal fluid in the gall bladder region, peritoneal fluid beyond the GB region, and decreased radiographic serosal detail in the right cranial abdomen and overall in the abdomen. One or more of these findings were present in 14/15 (93.3%) of dogs with confirmed GB rupture and in 14/30 (46.7%) of dogs without GB rupture. Of the 14 dogs with an intact GB, 6 dogs had a mucocele and cholecystitis (2 necrotic, 2 fibrotic, 1 supplicative, 1 lymphocytic). Ultrasound evidence of GB mucocele was seen in 23/45 (51.1%) dogs, 10/23 (43.5%) of mucoceles had confirmed GB rupture, and 2/18 (11.1%) of mucoceles also had bacterial cholecystitis. Most dogs 9/11 (81.8 %) with bacterial cholecystitis did not have a mucocele but did have necrotic cholecystitis 9/11 (81.8%); 5/11 (45.5%) had ruptured.

Of the 45 dogs, 2 were euthanized without therapy, 1 died prior to surgery and 42 were managed with surgery. Survival was 35/43 (81.4%) overall, 12/14 (85.7%) for dogs with bile peritonitis, 8/11 (72.7%) for dogs with bacterial cholecystitis, and 19/23 (82.6%) for dogs with GB mucocele. GB wall echogenicity relative to the liver was the only ultrasonographic parameter that correlated with survival, a hyperechoic GB wall correlated with an increased chance of survival.

Conclusions: Ultrasound findings of peri-GB echogenic reaction, peritoneal fluid near and beyond the GB region and decreased peritoneal detail radiographically should raise the index of suspicion for GB rupture. Mucoceles and bacterial cholecystitis are not necessarily associated; however either can be associated with GB rupture. Ultrasound provides a means for monitoring GB disease and may provide some insight into which patients have, or are at risk of GB rupture. With surgical management patient survival is on average 81.4%, factors including bile peritonitis, bacterial cholecystitis and the presence of a mucocele do not influence survival.
ASSOCIATION BETWEEN ULTRASONOGRAPHICALLY-DETERMINED ADRENAL GLAND SIZE AND RESULTS OF THE ACTH STIMULATION TEST IN DOGS

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Introduction/ Purpose – The adrenal glands are commonly evaluated during abdominal ultrasound examination. Adrenomegaly may increase the index of suspicion for hyperadrenocorticism (HAC) and prompt further testing in dogs with other compatible clinical findings. The adrenocorticotropic hormone (ACTH) stimulation test is commonly performed in screening for HAC. The assumption of the test is that hypertrophic adrenal glands will secrete more cortisol in response to exogenous ACTH. The purpose of the study was to investigate whether post- ACTH cortisol concentrations are correlated with ultrasonographically determined adrenal gland size and to establish whether bilateral adrenomegaly would be predictive of a positive result of an ACTH stimulation test.

Methods - Ultrasound examination of the adrenal glands was performed in dogs undergoing ACTH stimulation testing for the investigation of adrenal gland disease. Dogs were excluded from the study if they had received exogenous corticosteroids in the preceding six weeks or if there was a final diagnosis of hypoadrenocorticism. Blood was collected for cortisol assay one hour after the intravenous injection of a standard dose of synthetic ACTH. Ultrasound examination was performed using a standardized protocol to obtain repeated measurements of the width and length of each adrenal gland. The maximum measurement for each parameter was recorded. Dogs in which the width of one adrenal gland was greater than twice the width of the contralateral gland were excluded from further analysis. Width*length (W*L) product, width per m 2 body surface area (BSA) and W*L/m 2 BSA were calculated. Pearson correlation coefficients for the relationship between post-ACTH cortisol concentrations and each of the recorded and calculated parameters were determined for each adrenal gland and the mean of both adrenal glands. P-values <0.05 were considered significant. For adrenal gland parameters that were significantly correlated with post-ACTH cortisol concentrations, optimal cut-offs for predicting dogs with a post-ACTH cortisol >20 µg/dL were determined.

Results - Thirty-six dogs were included in the analysis. There were significant positive correlations between post-ACTH cortisol concentration and right adrenal width (R=0.475, p=0.003), left adrenal width (R=0.358, p=0.032) and mean adrenal width (R=0.439, p=0.007). There were weaker but significant correlations between post-ACTH cortisol concentration with adrenal width per m 2 BSA (right: R=0.379, p=0.022; left: R=0.356, p=0.033; mean: R=0.374, p=0.025). Post-ACTH cortisol was most strongly correlated with adrenal W*L per m 2 BSA (right: R=0.440, p=0.007; left: R=0.598, p<0.0001; mean: R=0.620, p<0.0001). With a cut-off of 8mm, mean adrenal width was 38% sensitive and 96% specific for predicting a post-ACTH cortisol >20 µg/dL. Using a cut-off of 300 mm 2/m 2, mean adrenal W*L/m 2 BSA was 62.5% sensitive and 100% specific for predicting a post-ACTH cortisol >20 µg/dL.

Conclusion - In patients with a mean adrenal width > 8mm or mean adrenal W*L/m 2 >300mm 2/m 2 an ACTH stimulation test is likely to be positive. Complementary diagnostic tests should be considered instead to determine whether the ultrasonographically-determined adrenomegaly is due to HAC or non-adrenal illness.
Correlations between age, body weight and ultrasound measures of medial retropharyngeal lymph node size in apparently healthy dogs

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Abstract

The aims of this study were to determine the size of the medial retropharyngeal lymph nodes (MRLN) in healthy dogs using ultrasonography and to investigate correlations between body weight (1.8 to 59 kg), age (1.0 to 15 years) and MRLN size. The sample population consisted of 100 apparently healthy, volunteered, adult dogs. The data were normally distributed, thus mean, SD and Pearson’s correlation were used. Repeatability of ultrasound measures was assessed as the percentage of differences between duplicate measures that were within 2 SDs of the differences: all measures were at least 93% repeatable (mean differences typically were ≤0.25 cm and always <1 cm). No difference between sexes was observed. The MRLN increased in size with increased body weight (r= 0.46 to 0.59) and decreased in size with increased age (r = -0.30 to -0.50). Although statistically significant, the actual variation is not likely clinically important. Therefore, regardless of body weight or age, the MRLN size in normal dogs generally does not exceed 2 cm in width, 1 cm in height, and 5 cm in length and, with exception, any change ≥0.5 cm with width, ≥0.4 cm in height, or ≥1.0 cm in length in a follow up measurement probably represents a true biological change rather than measurement error.
THE PREVALENCE OF LYMPHOSARCOMA IN DOGS WITH SUBLUMBAR LYMPHADENOPATHY.

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Introduction/Purpose: Lymphosarcoma is one of the most common neoplasms of dogs, accounting for approximately 7-24% of all canine neoplasia. It has an annual incidence estimated to be approximately 13-24 cases per 100,000 dogs at risk. Abdominal lymphadenopathy, including the mesenteric and the sublumbar lymph nodes, is a common ultrasonographic and radiographic finding in dogs with lymphoma. The purpose of this study was to investigate the prevalence of lymphosarcoma and various disease processes in dogs with sublumbar lymphadenopathy.

Methods: A random selection of approximately 2600 cases of dogs with ultrasound images, collected at the University of Georgia Veterinary Medical Teaching Hospital between 2002-2007, were evaluated for the diagnosis of sublumbar lymphadenopathy. Dogs were diagnosed with sublumbar lymphadenopathy if they had one or more of the following characteristics: enlarged size of the lymph node, irregular lymph node shape, or abnormal lymph node echogenicity. Medical records were evaluated and only dogs with a definitive cytologic or histopathologic diagnosis were included in the study. A total of 125 dogs fit both criteria. Information collected in this study included the definitive diagnosis; measurements, echogenicity, and shape of the sublumbar lymph nodes; and whether sublumbar lymphadenopathy was seen radiographically. A chi-square test and McNemar’s test were performed for statistical analysis on all data.

Results: The five most common disease processes with sublumbar lymphadenopathy as determined in this study were: lymphosarcoma, mast cell tumor, apocrine gland adenocarcinoma, hemangiosarcoma, and transitional cell carcinoma. Twenty-six separate disease processes were identified in dogs with sublumbar lymphadenopathy. The proportion of subjects having lymphosarcoma (40%) was significantly higher than the proportion of subjects having mast cell tumor (12%, p<0.0001) or any of the other diseases (P<0.0001 for each of the 24 remaining paired comparisons). The proportion of subjects having mast cell tumor was not significantly different than the proportion of subjects having apocrine gland adenocarcinoma (11%, p=0.4328) or hemangiosarcoma (8%, p=0.1444) or transitional cell sarcoma (8%, p=0.1444).

Discussion/Conclusion: Sublumbar lymphadenopathy can be found in numerous diseases. Neoplasia accounted for 83.2% of the 125 cases in this study. Of the total number of cases, 40% were dogs with lymphosarcoma. The data in this report will aid in ranking differential diagnoses in dogs that have sublumbar lymphadenopathy.
EVALUATION OF LEFT VENTRICULAR FUNCTION USING PULSED TISSUE DOPPLER IMAGING IN NORMAL DOGS

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Introduction/Purpose

Pulsed tissue Doppler imaging (pulsed TDI) has been demonstrated to be useful for the estimation of left ventricular (LV) functions in human. Several studies have already shown that TDI is a more sensitive imaging technique than conventional Doppler echocardiography for detecting moderate myocardial lesions such as hypertrophic cardiomyopathies, ischemia and heart transplant disorders. The objectives of the present study were to evaluate left ventricular function using pulsed TDI in healthy dogs and to provide the normal values of various parameters.

Methods

ANIMALS: twenty healthy mongrel dogs. PROCEDURE: All dogs (< 8 years old) were examined via conventional echocardiography and pulsed TDI. Myocardial velocities in the LV wall were recorded from left apical 4-chamber (longitudinal motion) views at septal mitral annulus. Cardiac assessments via pulsed TDI included maximal systolic (Sm) and early (Em) and late (Am) diastolic LV velocities. The early diastolic mitral inflow velocity (E)/Em ratio and Em/Am ratio were calculated.

Results

All dogs were in good health condition and mean body weight was 6.22 ± 2.92 kg, mean age, 4.83 ± 3.71 years, and mean heart rate, 93.41 ± 25.4 beats per minute. All velocity profiles included 1 positive systolic wave and 2 negative diastolic waves. The mean value of every wave was following; Em 5.7 ± 1.1 cm/sec, Am 4.0 ± 1.0 cm/sec, Sm 6.5 ± 1.4 cm/sec. The mean ratio of Em/Am was 1.5 ± 0.3 and E/Em was 12.8 ± 3.0. Systolic wave was higher than diastolic waves and E wave was consistently hyper than the A wave. Therefore, the Em–to-Am ratio was over than one.

Discussion/Conclusions

These findings suggest that canine pulsed TDI can be applied clinically for estimation of cardiac function. The results are thought to be comparable with those of previous reports. And the reliable reference range for myocardial function using pulsed TDI need to be further established, particularly, according to various factors including breed, age, sample position, and also in dogs with cardiac disease.

Introduction/Purpose:
The popularity of reptile pets is increasing and they are increasingly presented for advanced veterinary care. Although good overviews of reptile ultrasonography exist, a thorough description of normal ultrasonographic anatomy, in English, is lacking in many reptile species, including the green iguana (Iguana iguana), a popular companion and zoological exhibit animal. The purpose of this research project is to describe coelomic ultrasonographic findings in normal green iguanas, in order to provide a reference for veterinary radiologists and exotic species practitioners.

Methods:
Coelomic ultrasonography was performed on 20 male and 6 female Green Iguanas using a 5-12 MHz linear array transducer. Animals were restrained by a single assistant in dorsal recumbency.

Results:
Coelomic ultrasonography, performed in dorsal recumbency was well-tolerated by all animals using gentle manual restraint, without the need for sedation or anesthesia. The coelomic cavity can be examined thoroughly and efficiently once familiarity with the anatomy is gained. Structures which are consistently well-evaluated with ultrasound include: the heart, liver, caudal vena cava, hepatic veins, intrahepatic portal vein, gall bladder, pyloric antrum and distended urinary bladder. Structures which are inconsistently identified include the cecum, colon, spleen and cranial pole of the kidneys. The seasonal reproductive state of the animal greatly changes the conspicuity of the gonads, which varied from undetectable to very large. Seasonal physiologic enlargement of the testes provides an acoustic window for visualization of the spleen in males. Much of the gastrointestinal tract cannot be well-identified due to the thin nature of the walls and the presence of intraluminal gas in this hindgut fermenting, herbivorous species. Dorsal coelomic structures such as the spleen and quiescent gonads are often obscured by overlying gas-containing stomach and intestine. The intrapelvic location of the kidneys prevents good visualization in a normal animal, using a transabdominal approach. The finding of free coelomic fluid was noted in many animals.

Discussion/Conclusions:
Coelomic ultrasound offers an easy, noninvasive, means of examining the coelomic cavity in the green iguana. The information gathered in this study should be useful for ultrasonographers who do not have extensive experience scanning iguanid lizards.
Introduction/Purpose: Quantitation of glomerular filtration rate (GFR) using 99mTc-Diethylenetriaminepentaacetic acid (99mTc-DTPA) in dogs and cats is often used to determine global and individual kidney GFR, to detect early impairment of renal function, to evaluate a patient’s response to treatment, to evaluate a contralateral kidney prior to nephrectomy, and to determine severity of subclinical renal disease in patients receiving nephrotoxic therapies. The effect of sedation protocols on the determination of GFR in dogs using quantitative renal scintigraphy (QRS) has been described. The objective of this investigation was to evaluate several sedation protocols for any effect on GFR in cats as measured by QRS. Inter-observer differences in GFR calculation were also analyzed.

Methods: All protocols were reviewed and approved by the Institutional Animal Care and Use Committee at Iowa State University. Six cats (2 intact males, 1 neutered male, and 3 intact females) were obtained from laboratory animal resources at Iowa State University College of Veterinary Medicine. Physical examination and routine laboratory evaluations were performed (complete blood count, blood chemistry analysis, urinalysis). All values were within normal limits. One cat was subsequently diagnosed with polycystic renal disease and was removed from the study. A randomized cross-over design was employed. Three sedation protocols commonly employed at Iowa State University College of Veterinary Medicine were employed: Medetomidine [11 μg/kg]/butorphanol [0.22 mg/kg] IM (MB); ketamine [10 mg/kg]/midazolam [0.5 mg/kg] IV (KM); ketamine [10 mg/kg]/midazolam [0.5 mg/kg]/acepromazine [0.05 mg/kg] IM (KMA) [dose]. These were compared to studies performed without sedation (NS). Scintigraphic images were reviewed at a dedicated workstation with nuclear medicine software. Summed images were created and regions of interest were drawn around each kidney and around background regions by two operators (MDW and RV) as described. Using a statistics program (SAS), log transformation of the data was performed. One way analysis of variance (ANOVA) was used to test the hypothesis that sedation would exert an effect on GFR as determined by QRS. Inter-observer differences in GFR calculation were also analyzed.

Results: There was no significant difference between GFR measurements associated with the 3 sedation protocols as compared to the control protocol (p=0.23). The greatest mean GFR values were seen with the MB and KM protocols. Differences between observers were evident in our calculations; however, these differences were not significant (p=0.066).

Conclusions: Results suggest that the sedation protocols evaluated in this study show no significant effects on GFR calculated using QRS as compared to studies performed without sedation. However, mild differences are evident; a study with greater statistical power is needed. No statistically significant inter-observer error was evident.
COMPARISON OF $^{99m}$Tc-MIBI BILIARY EXCRETION IN DOGS WITH ABCB1 GENE MUTATION VERSUS NORMAL DOGS. J.C. Coelho, K. L. Mealey, R. Tucker, J.S. Mattoon, G. Roberts, D. Waiting. Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Washington State University, Pullman, WA 99164-6610.

Introduction/Purpose: P-glycoprotein (P-gp), the product of ABCB1 gene, is a membrane protein that is expressed in the liver of humans and rodents, where it plays an active role in biliary drug transport. It has been proven that altered ABCB1 gene expression affects hepatic sestamibi excretion in these species. P-glycoprotein has been also identified in various canine organs including the liver. P-glycoprotein has wide substrate specificity and multiple drugs that are P-gp substrates are commonly used in veterinary medicine. These include antibiotics, antiemetic drugs, antiparasitics, cardiac glycosides and anticancer agents. Dogs with ABCB1 gene mutation may have decreased hepatobiliary excretion of drugs that are P-gp substrates, which may contribute to the toxicity of therapeutic doses in these dogs. The aims of this study are to document the normal hepatobiliary excretion of Technetium-99m sestamibi ($^{99m}$Tc-MIBI) by nuclear scintigraphy in the homozygous dog for the normal ABCB1 gene (wild/wild) and to compare the hepatic excretion of $^{99m}$Tc-MIBI between dogs without mutation of ABCB1 gene (wild/wild), dogs with mutation of one ABCB1 allele (wild/mutant) and dogs with mutation of both ABCB1 alleles (mutant/mutant). We hypothesized that the hepatobiliary excretion of $^{99m}$Tc-MIBI is markedly decreased in dogs with mutation of one or of both ABCB1 alleles (mutant/mutant and wild/mutant) compared to that of dogs homozygous for the normal ABCB1 gene (wild/wild).

Methods: Six dogs homozygous for the wild ABCB1 allele (wild/wild), 2 dogs heterozygous for the mutant ABCB1 allele (wild/mutant) and 2 dogs homozygous for the mutant ABCB1 allele (mutant/mutant) were used in this study. Ventral static images were acquired every 5 minutes post intravenous administration of approximately 10 mCi $^{99m}$Tc-MIBI, up to 120 minutes. Change in gall bladder and liver radioactivity over time was determined, by outlining regions of interest (ROI) and calculating the ratio of gall bladder activity to liver activity.

Results: This study showed, within a period of 2 hours post-injection of $^{99m}$Tc-MIBI, significant decrease of biliary excretion of $^{99m}$Tc-MIBI in mutant/mutant compared to wild type dogs and mutant/wild animals. In the same period of time, there was no statistical significant difference between the biliary excretion of $^{99m}$Tc-MIBI between mutant/wild and wild type animals.

Discussion/Conclusions: P-glycoprotein appears to play a major role in the biliary excretion of $^{99m}$Tc-MIBI in the dog. Based on the result of this study, it is likely that other drugs that are substrates of P-gp, such as chemotherapeutic drugs, have also delayed and/or reduced biliary excretion in mutant/mutant dogs compared to mutant/wild and wild type dogs. The delayed biliary excretion may contribute to the increased toxicity of these drugs that has been documented to occur in mutant/mutant dogs.
EVALUATION OF 99M TECHNETIUM-LABELED BIOTIN AS A SOFT TISSUE INFLAMMATION SEEKING AGENT IN HORSES. L.G. Kleine, M Solano, M. Rusckowski, K.E. Hunt, K.L. Johnson, C.A. Kirker-Head. Tufts University, Cummings School of Veterinary Medicine. 200 Westborough Rd, North Grafton, MA 01536

Purpose: To evaluate a 99m-technetium EDTA-biotin monomer (99mTc-EB1) as a soft tissue imaging agent by determining its safety, blood/tissue clearance, and imaging protocol. Radiolabeled biotin has been used in humans as part of a pre-targeting system with avidin or streptavidin for localizing soft tissue infection and inflammation. Currently available radiopharmaceuticals have limitations for imaging inflammation. Among them: rapid clearance from tissues (99mTc-HDP, and sodium pertechnetate), elaborate labeling techniques (technetium-labeled leucocytes), and higher radiation exposure to patients resulting in prolonged hospitalization (indium-labeled leukocytes).

Methods: In 6 healthy horses 1.4 GBq of 99mTc-EB1 was administered IV, followed by immediate acquisition of images at regular intervals over a 24-hour period. Inflammation was induced by injecting 0.4 mg/kg of mepivicaine, IM, into the neck and perineurally in the proximal palmar metacarpal region of 2 horses. Six hours post-mepivicaine injection, 2.8 GBq of 99mTc-EB1 was administered IV. Comparative soft tissue images were also acquired using 99mTc-HDP.

Results: No abnormalities in physical exam parameters or CBC/serum chemistry were detected after injection of 99mTc-EB1. Blood clearance of 99mTc-EB1 showed an alpha phase of 2.2 minutes and a beta phase of 58 minutes. Soft tissue uptake of 99mTc-EB1 was immediate and persisted up to 4 hours after injection. Inflammation, secondary to intramuscular and perineural mepivicaine administration, was detected up to 6 hours after injection.

Conclusions: 99mTc-EB1 is safe for use in horses and capable of detecting inflammation without concurrent uptake in bone while providing a longer imaging window when compared to soft tissue phase imaging with 99mTc-HDP.
Introduction/ Purpose: Sacroiliac disease is widely recognized as reason for poor performance and hind limb lameness or reduced impulsion in horses. Although nonspecific, nuclear bone scintigraphy is considered as sensitive for detection of sacroiliac injuries and can be evaluated subjectively or semi-quantitatively. The radiographic appearance of the sacroiliac joint region is described as highly variable with different shapes of the sacral wings and variable degree of overlap of the sacral and iliac wings. The aim of the present retrospective study was to determine if there exists any correlation between the radiopharmaceutical uptake pattern and the radiographic appearance of the sacroiliac region in anaesthetized horses.

Materials and Methods: Seventy nine horses (age range 4-20 years, mean 10.3 years) undergoing bone scintigraphy with Tc-99m- HDP and radiography of the pelvis because of lameness or poor performance between January 2004 and January 2006 were studied. Subjective (symmetry, definition, counts compared to the tuber sacrale) and semi-quantitative methods (ROI and profile analysis) were used to characterize and compare the RU between horses. Ventrodorsal radiographs of the region were obtained of all horses and were evaluated using the procedure and the criteria described in a previous study.

Results: Subjectively, 70 horses (88.6%) showed an abnormal uptake pattern. In 9 horses, the sacroiliac region was evaluated as normal (11.4%). Subjective evaluation of the scintigraphic images did not correlate with the indices calculated by semi-quantitative methods. Comparison of the indices with the radiographic appearance revealed correlation between the uptake and the conformation (T- or Y-like form) and shape (butterfly, wing, leaf or horn-like shape) of the sacrum. A T-like appearance of the sacrum and a wing-like shape had significantly higher indices in comparison to a Y-like conformation and other shapes. Additionally, the radiopharmaceutical uptake of the tubera sacralia was correlated to age, bodyweight and gender. Gender showed a significant correlation to uptake with higher indices in males than in females (left p=0.002, right p=0.003).

Discussion/ Conclusion: Whether the different shapes and conformations as seen on radiographs represent anatomical variations or pathology remains unclear. However, the morphology of the sacrum plays an important role in the scintigraphic appearance of the sacroiliac region and might be one cause of variable uptake between individuals. As subjective evaluation did not correlate with the semi-quantitative indices both methods have to be critically evaluated and interpreted in combination with the results of other imaging modalities and in the light of the clinical examination.

TECHNETIUM 99m THYROID TO BACKGROUND (T:B) RATIOS FOR FELINE $^{131}$I TREATMENT SUCCESSES AND FAILURES USING 4 mCi I-131.

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Introduction: Standard dosing of 4 mCi for treatment of feline hyperthyroidism is common. A 4 mCi dose has been documented to have a 95-98% cure rate. In people, treatment failures for therapy have been associated with inadequate $^{131}$I dosage, large goiter volume and a higher T$_3$ or T$_4$. Similar associations have been seen in cats. The objective of this study was to evaluate the thyroid to a standardized background ROI on the pre-treatment thyroid scan to obtain a thyroid to background (T:B) ratio.

Methods: This is a retrospective study in which eight $^{131}$I treatment failures and thirty age matched $^{131}$I treatment successes were compared. All cats underwent a pretreatment pertechnetate thyroid scan using 3.0 mCi the day of $^{131}$I treatment. Within 4 hours after doing the thyroid scan, these patients received a subcutaneous injection of 4 mCi of $^{131}$I. T$_4$ was measured at 1,3,6 and 12 months following $^{131}$I therapy. A treatment failure was defined by a continued elevation in T4 and residual overactive thyroid tissue, in the same location as pre-treatment, on a follow-up pertechnetate thyroid scan. The thyroid to background ratio (T:B) was performed on the initial pre-treatment thyroid scan using Mirage software and the A/B ratio. All thyroid scans were measured with the color palette set to aqua marine which resulted in a distinct aqua border around the overactive thyroid tissue. The background ratio was the default circle and placed over the left or right axillary region. The thyroid tissue was manually traced along the outer margin of the aqua marine colored thyroid activity. All thyroids in this study had a benign appearance consisting of a smooth margin and rounded shape. Biopsy confirmation of the thyroid tissue was not performed.

Results: Six of eight (6/8) treatment failures had a pretreatment thyroid to background ratio greater than 11 with a mean T:B of 29.87. In contrast, 27 of 30 treatment successes had a pretreatment thyroid to background ratio less than 11 with a mean of 7.92. The treatment failures had a T:B range of 5.76-75.16. The treatment successes had a T:B range of 1.77-52.75.

Conclusions: The findings suggest a trend towards a higher T:B ratio in $^{131}$I treatment failures using a 4 mCi dose with a suspected adenoma. Other factors could be thyroid size, patient weight, sex, age, methimazole dosage, methimazole withdrawal time prior to therapy, length of methimazole treatment, T$_4$. The thyroid scan may be useful as a pretreatment test to identify cats that may require more than 4 mCi of $^{131}$I to successfully treat feline hyperthyroidism.
THE RELATIONSHIP OF RADIOGRAPHIC HILAR LYMPHADENOPATHY TO SEROLOGIC TITERS FOR COCCIDIOIDES SP. IN DOGS IN AN ENDEMIC REGION
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Introduction
Coccidioidomycosis is a fungal disease caused by Coccidioides sp that is endemic to areas of the southwestern United States, Mexico, and Central and South America. Primary infection occurs within the lungs while disseminated infection occurs by spread to hilar lymph nodes then to multiple organ sites. The presence of hilar lymphadenopathy has been reported in numerous studies as a radiographic finding in coccidioides infections. Serologic studies are most often used for the diagnosis of coccidioidomycosis in endemic areas, with IgG titers $\geq 1:8$ considered positive for infection and lower IgG titers of $<1:8$ are considered to be indicative of exposure and not necessarily related to organism presence. The objective of this study was to determine the relationship of hilar lymphadenopathy to coccidioidomycosis titers for dogs in an endemic area to assist practitioners in determining when treatment is indicated prior to titer results.

Methods
A retrospective selection of cases seen at VCA Animal Referral and Emergency Center of Arizona from 6/2004-6/2006 had both thoracic radiographs and coccidioidomycosis titers performed within 21 days of each other. Breed, gender, age, weight, presenting complaint, and titer results were collected from the records. Presenting complaints were divided into categories of respiratory signs, musculoskeletal signs, central nervous system signs, nonspecific signs, and other. Serologic titers with IgM positive or IgG positive at $\geq 1:8$ were classified as positive, titers $<1:8$ were classified as negative. Two radiologists (DK and HD) reviewed the 3-view thoracic radiographic studies without knowledge of the patient’s titer status or presenting complaint and recorded the presence/absence of hilar lymphadenopathy.

Results
The statistical analysis included 142 cases (16 intact males, 65 castrated males, 12 intact females, 49 spayed females). Presenting complaints included respiratory (n=74), musculoskeletal (n=5), neurologic (n=22), nonspecific (n=26), other (n=12), combined (n=3). Serology results were positive (n=28) and negative (n=114). Radiographic hilar lymphadenopathy was present (n=23) or absent (n=119). Hilar lymphadenopathy was present in 9/25 (36.0%) titer-positive dogs and in 11/106 (10.4%) of titer-negative dogs. Hilar lymphadenopathy was present in 9/14 (64.3%) and absent in 5/14 (35.7%) of titer-positive dogs presenting for respiratory signs. Hilar lymphadenopathy was present in 1/14 (7.1%) and absent in 13/14 (92.9%) of titer-positive dogs presenting for non-respiratory signs. There was no statistically significant association between the titer result and presenting complaint, gender, age, weight, or breed.

Conclusions
The radiographic finding of hilar lymphadenopathy appears to be a more useful indicator of thoracic coccidioidomycosis infection in an endemic population of dogs with respiratory signs than infection in other regions of the body. This supports the treatment of patients for coccidioidomycosis when hilar lymphadenopathy is present and prior to obtaining serology results.
EXAMINING THE RELIABILITY OF CERVICAL VERTEBRAL RADIOPHOTOGRAHY FOR THE ASSESSMENT OF EQUINE CERVICAL ARTICULAR PROCESS JOINT OSTEOARTHRITIS.

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**Purpose:** Lateral radiographs of the cervical vertebrae are frequently acquired when evaluating horses presenting with ataxia, lameness or neck pain and in these cases the severity of degenerative joint disease (DJD in the articular process joints (APJs)) is generally assessed. This study aimed to determine whether the subjective radiographic appearance of DJD in APJs of equine cervical vertebrae is correlated with the gross post mortem appearance of the same joints, and to examine and compare pathology on each side of the neck and at different levels. **Methods:** APJs between C3 and C7 of 9 cadaveric necks, of horses (older than 15 years) were evaluated. Lateral radiographs of the cervical region and digital photography of the articular cartilage surfaces before and after staining with Indian ink were acquired. Two blinded independent observers scored both the radiographs and articular cartilage surfaces for DJD and osteochondrosis (OC)-related changes for each APJ between C3 and C7 twice. **Results:** Intra- and inter-observer agreements were moderate-good. From radiographs, caudal joints were assigned significantly higher DJD scores than cranial joints (p= 0.04), however there was no significant difference between gross post mortem scores for DJD or OC at different intervertebral levels. There was no significant association between the radiographic and post mortem appearance for DJD or OC scores. A significant association was observed between the left and right APJs at each vertebral level for both DJD (rho = 0.47; P = 0.01) and OC scores (rho = 0.60; p = 0.001). There was no association between gross DJD scores and the OC scores. **Conclusions:** This study suggests that radiographic assessment of equine cervical vertebral articular process joints should be interpreted with caution, as radiographic appearance is not an accurate predictor of severity of apparent DJD as assessed at gross post mortem. Without additional information, it appears prudent to medicate articular process joints bilaterally when attempting to treat cervical vertebral pathology since severity of DJD was correlated between left and right sides. Further studies are required to determine whether these results apply also to younger animals.
FACTORS AFFECTING WIDTH OF THE CANINE FEMOROTIBIAL JOINT SPACE IN 
NON-WEIGHT-BEARING RADIOGRAPHS
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Introduction: A narrowed radiographic joint space is evidence of reduced thickness of 
articular cartilage, and is considered an important sign of arthritis in dogs and man. 
Weight-bearing radiographs are more sensitive for detection of joint space narrowing; 
however, difficulty obtaining radiographs of standing dogs inhibits their use in a clinical 
setting. There is a lack of information about factors that may affect the width of the 
radiographic joint space in non-weight-bearing radiographs. For example, it is not 
known if cranial cruciate ligament and/or medial meniscus injuries in dogs alter the 
radiographic femorotibial joint space in non-weight-bearing radiographs.

Purpose: To test the hypothesis that the width of the radiographic femorotibial joint 
space in non-weight-bearing radiographs of canine stifles will be affected by patient 
position, direction of the x-ray beam, and injuries affecting the cranial cruciate ligament 
and medial meniscus.

Methods: A series of 15 caudocranial radiographs with variations in centering and 
positioning were made of both stifles of two greyhound cadavers. Radiographs were 
repeated after each of three different surgical procedures performed in the following 
order: cranial cruciate desmotomy; type 1 medial meniscal tear; medial meniscectomy. 
The radiographic femorotibial joint space was measured on medial and lateral aspects 
of the joint by a blinded observer. Data were analyzed using univariate and multivariate 
linear regression.

Results: One dog had significantly wider mean radiographic femorotibial joint space 
than the other (1.0 mm versus 1.5 mm, p<0.001). The mean radiographic joint space on 
the lateral aspect of the stifle was wider than that on the medial aspect (1.7 mm versus 
0.7 mm, p<0.001). Medial rotation of the stifle resulted in widening of the radiographic 
joint space on its lateral aspect (p=0.001), whereas lateral rotation of the stifle reduced 
the radiographic joint space on its lateral aspect (p=0.004). Decentering of the x-ray 
beam had no significant effect on the width of the radiographic femorotibial joint space. 
Manually applied stress on the medial or lateral aspect of the stifle significantly 
increased the width of that aspect of the radiographic joint space (p<0.001). Cranial 
cruciate desmotomy was associated with a wider radiographic joint space (p<0.001), 
and medial meniscectomy was associated with a reduced radiographic joint space on 
the medial aspect (p=0.002).

Conclusion: Although the radiographic femorotibial joint space in non-weight-bearing 
radiographs is affected by iatrogenic stifle injuries, it also varies with individual dog and 
with medial or lateral rotation of the stifle, hence it should be assessed with caution 
when interpreting radiographs of patients with suspected stifle injury.
ACCURACY OF VETERINARY DIAGNOSTIC IMAGING: A SYSTEMATIC REVIEW
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Introduction/purpose: In the 21st century, veterinary radiologists are able to utilize a wide range of diagnostic modalities, and their services are in greater demand than ever before; however, it is unclear what impact this specialty is having because relatively few publications about imaging veterinary patients provide good evidence of diagnostic accuracy. For example in *Veterinary Radiology & Ultrasound* in 2006, 13 (14%) papers described observational studies compared to 76 (80%) papers that described normal animals, individual patients or series of patients. The purpose of this study was to compile data about the accuracy of veterinary diagnostic imaging.

Methods: Literature search of Pub Med, Cab Direct and Web of Science databases from inception until December 2006. Keywords for search were sensitivity, specificity, diagnostic accuracy, animals, ultrasonography, radiography, ultrasound, magnetic resonance imaging, computed tomography, and scintigraphy. Retrieved citations were imported into an Endnote library and filtered by deleting duplicates, then deleting articles considered not relevant on the basis of the title and/or abstract, then by detailed review. Studies were eligible that compared results of imaging with a reference standard for veterinary species with naturally-occurring conditions (including pregnancy), had at least 10 subjects, and reported sufficient data to enable a 2x2 table of test performance to be constructed. Imaging modality, study design, species, diagnosis, number of subjects, true positives, false positives, true negatives, and false negatives were recorded. Sensitivity, specificity, prevalence, and likelihood ratios for positive (PLR) and negative results (NLR) were calculated.

Results: Initial literature search found 5,936 articles, which were reduced to 144 on the basis of title and/or abstract, then to 88 by detailed review. These articles described 103 studies. The most frequently studied imaging modality was ultrasound (58%); the most frequently studied species was dog (51%). Pregnancy diagnosis using Doppler or two-dimensional, grey scale ultrasonography was the subject of 26 (25%) studies. For studies of pregnancy, median (range) number of subjects was 207 (29-1458), sensitivity 98% (76-100%), specificity 91% (40-99%), and prevalence 82% (46-97%). PLR for pregnancy diagnosis was >10 in 14 (54%) studies and NLR was <0.1 in 24 (92%). For other diagnostic studies, median (range) number of subjects was 44 (12-320), sensitivity 78% (0-100%), specificity 92% (33-100%), and prevalence 50% (13-90%). PLR was >10 in 21 (27%) studies and NLR was <0.1 in 13 (17%). Only 13 (50%) pregnancy studies and 8 (10%) other diagnostic studies had both high PLR and low NLR.

Conclusion: Of 103 eligible studies retrieved, only 21 provide evidence that an imaging test can be used to rule in and rule out conditions, and the majority of these concern diagnosis of pregnancy. There is a need for more studies to assess the accuracy of imaging tests for veterinary patients, and for critical evaluation of the likely impact of inaccurate imaging tests.
ARTIFACTS IN DIGITAL RADIOGRAPHY

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Introduction. The increasing use of digital radiography in veterinary medicine has introduced a number of artifacts created by this modality. Artifact recognition, categorization, and identification are important in the process of correcting artifacts and minimizing the potential interpretative errors that accompany them. Identifying artifacts using standardized nomenclature facilitates the continued understanding of digital radiography as it becomes more prevalent in veterinary medicine. The purpose of this project is to name, identify the cause, describe the appearance, and provide methods of resolution of digital artifacts.

Methods. Digital radiography artifacts were labeled and stored as they were spontaneously produced during the daily use of photostimulable phosphor systems and direct digital radiographs. A journal search was conducted to amass a current catalog of known digital artifacts. Many examples of these artifacts were present in previously imaged veterinary patients. Other artifacts were created with patient or phantom models. Some artifacts encountered in practice have not been described in available published data and were added to the increasing list of described artifacts in digital radiography. All artifacts were categorized according to the step of imaging in which they were created. The acquired data was summarized as a comprehensive reference of digital radiography artifacts.

Results. Artifacts can be divided into categories corresponding to the step during which they are created (1. Exposure, 2. Scatter, 3. Grid, 4. Cassette, 5. Imaging plate, 6. Detector, 7. Imaging plate reader, 8. Transfer, 9. Processing, 10. Imaging plate erasure). Most digital radiography artifacts differ from those seen with film-screen radiography. Even when similar, the high sensitivity of digital radiography systems makes them more susceptible to exposure and scatter artifacts. Digitization of images is a source of grid, detector array, image transfer, and image processing artifacts. Cassette, imaging plate, imaging plate reader, and imaging plate erasure artifacts are integrally related to the physics of photostimulable phosphor systems. The appearance of many artifacts is attributable to the preferences chosen during workstation set-up, which are carefully studied and selected for each type of radiographic study at each workstation.

Discussion. Hardware and software troubleshooting in digital radiography differs from film-screen radiography and should be addressed accordingly. Artifacts in digital radiography can decrease image quality and mask or mimic radiographic abnormalities. An artifact in digital radiography is identified by its appearance and categorized according to the step during which it was created. The continued recognition and understanding of artifacts in digital radiography facilitates their reduction and decreases misinterpretation.
OBJECTIVE RADIOGRAPHIC EVALUATION OF PROVENTRICULUS SIZE IN PSITTACINES (PARROTS).

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Introduction
Psittacines are the most important order of birds within the aviculture and pet industries. Increasingly, parrots are presented for radiographic studies of their unique gastrointestinal system. Vomiting, regurgitation or the passage of undigested food are common presentations in parrots with proventriculus (gastric) disease. Currently, radiographic evaluation of proventriculus size is subjective. The aim of this study was to determine a method for objective evaluation of proventriculus size.

Method
Proventriculus diameter measured at the level of the last thoracic vertebra on right lateral radiographs was compared to:

1) Coelomic cavity height (level of the proximal proventriculus).
2) Maximum distance between the proximal proventriculus and the dorsal cortex of the sternum.
3) Maximum dorsoventral height of the keel of the sternum.

In addition, the maximal distance of the proximal proventriculus was compared to the maximum coelomic cavity height.

Parrots with non-gastric presenting signs were measured and compared to those presenting with gastric signs. Parrots with gastric signs were included in the study if disease was confirmed by surgery, necropsy or fluoroscopy. Ratios were compared using non-parametric statistical analysis.

Results
A significant correlation was identified between proventriculus diameter and maximum dorsoventral height of the keel (PV: keel ratio) without range overlap between the two groups. In non-gastric parrots (n=100), all PV: keel ratios were <0.48. Parrots with confirmed proventricular disease (n=19) all had ratios ≥0.52. Sensitivity and specificity using this ratio was 100% and 100% respectively.

Conclusion
PV: keel ratio ≥0.52 is consistent with clinical proventricular disease in psittacines.
RESULTS OF PORTOGRAPHY HELP PREDICT OUTCOME IN CATS HAVING SURGICAL TREATMENT FOR CONGENITAL PORTOSYSTEMIC SHUNT


Introduction: In dogs, results of operative mesenteric portography (OMP) may be used to help predict outcome following surgical treatment of congenital portosystemic shunt (CPSS). The degree of opacification of intrahepatic portal vessels as assessed by OMP is greater in dogs tolerating complete rather than partial attenuation, is negatively correlated with pre-prandial bile acid concentrations postoperatively, and positively correlated with clinical improvement.

Purpose: To determine if hepatic portal vascularity assessed by OMP is related to outcome in cats having surgical treatment for CPSS.

Methods: Retrospective, cross-sectional study of client-owned cats having surgical treatment of a single CPSS. Prints of all portograms were ranked according to degree of opacification of intrahepatic portal vessels by two observers reaching a consensus without reference to any clinical data. Hepatic portal vascularity was assigned a grade according to an ordinal scale previously used in dogs.

Results: OMP was performed before and during temporary complete occlusion of CPSS in 25 cats, and was followed by complete (9 cats) or partial (16 cats) shunt attenuation. Three to twelve months later, 12 cats that originally had partial shunt attenuation had repeat OMP and surgery, enabling complete shunt attenuation in 9 cats and further partial attenuation in 1 cat. OMP in the remaining two cats revealed CPSS occlusion and multiple acquired portosystemic shunts. Portogram grade increased significantly immediately (p<0.001) and during the months following CPSS attenuation (p=0.01). Cats with the highest temporary occlusion portogram grade at first surgery were older (p=0.04), had longer duration of medical therapy prior to surgery (p=0.01), better response to medical therapy prior to surgery (p=0.03), and better clinical response to the first surgery (p<0.001). Cats with the highest temporary occlusion portogram grade at first surgery also had clinical signs affecting fewer body systems at the time of first surgery (p=0.009) and second surgery (p=0.03), had lower pre- and postprandial serum bile acid concentrations at follow-up (p=0.04), and were less likely to have postoperative neurologic signs (p=0.04) or neurologic signs at follow-up (p=0.006).

Conclusion: Degree of opacification of intrahepatic portal vessels helps predict postoperative neurologic signs and other clinical and biochemical outcomes following CPSS attenuation in cats. Cats with the highest temporary occlusion portogram grade at first surgery have better prognosis.

Introduction/Purpose: Changes in the subchondral bone are an integral feature of osteoarthritis (OA); their assessment over time may characterize disease-related modifications. In vivo non-invasive assessment of bone mineral density (BMD) is desirable in OA. Our objective was to assess, using clinical CT equipment, changes in BMD at different depths from the articular surface in an in vivo rabbit model of OA.

Methods: Transection of the cranial cruciate ligament (CCLT) was performed on a randomly assigned stifle in skeletally mature male New Zealand White rabbits (n=10). A sham surgery was performed on the contralateral joints (n=10). Control rabbits (n=6) did not undergo surgery. Stifle joints were placed longitudinally on a solid dipotassium phosphate bone density calibration phantom and scanned in a transverse image plane with a helical single-slice CT scanner. Density data in Hounsfield Units was obtained from regions of interest placed in each phantom rod and each epiphyseal compartment [lateral and medial femoral condyle (LF and MF) and tibial plateau (LT and MT)]. BMD was calculated using linear regression at depths of 1, 2, 3, 4, 5 and 6 mm from the articular surface in the femur, and at 1, 2 and 3 mm in the tibia. Baseline BMD measurements were made 2 weeks before surgery, and then repeated at weeks 2, 4 and 8 post-surgery for all 10 CCLT rabbits, and at week 12 for 5 of the CCLT rabbits. BMD was measured at weeks -2 and 8 in the 6 control rabbits. The evolution of BMD over time and the differences between depths, and compartments were assessed within and between groups using a repeated-measures linear model with depth and time as within-subject factors.

Results: For the control group, BMD decreased with increasing distance from the articular surface and overall remained stable over time. A reduction of BMD over time was the most frequent change observed in the CCLT joints. This significant reduction was observed by week 2 post-operatively in 3 compartments (LF, MF and MT) in the CCLT joints, but not in the sham joints. At week 12 this significant reduction in BMD persisted in all 4 compartments but not at all depths. In the MF of CCLT joints, at weeks 4, 8 and 12, the reduction in BMD was observed to occur at greater depths into the bone (at all 6 depths at week 8). These changes were restricted to depths of 1 and 2 mm in the LF. At week 8 in the LT and MT, reductions were measured at all 3 depths in the CCLT group, occurring more frequently in the MT. At week 12, a modest reduction was observed in the LT and MT of the sham joints.

Conclusion: Clinical CT equipment permitted non-invasive assessment of BMD in an in vivo rabbit model of OA. Compared with control and sham-operated joints, BMD decreased more significantly by 2 weeks and remained decreased at 12 weeks in most compartments in joints that underwent CCLT and developed osteoarthritis.
**IN VIVO MULTIMODALITY IMAGING OF TEMPORAL CHANGES IN STIFLE OSTEOARTHRITIS (OA) LESIONS IN A RABBIT MODEL**

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**Introduction:** Osteoarthritis (OA) results in joint structural changes that can be assessed *in vivo* with different imaging modalities. However, spatial resolution can be limited in small OA models. Our objective was to describe the evolution over time of lesions in an *in vivo* rabbit model of OA with clinically-available modalities: computed radiography (CR), single-slice computed tomography (CT), and 1.5T magnetic resonance imaging (MRI).

**Methods:** Transection of the cranial cruciate ligament (CCLT) was performed on a randomly assigned stifle in skeletally mature male New Zealand White rabbits (n=10). A sham surgery was performed on the contralateral joints (n=10). Control rabbits (n=6) did not undergo surgery. CR, CT and MRI were performed 2 weeks before surgery and repeated at weeks 2, 4 and 8 post-surgery for all 10 CCLT and sham joints, and at week 12 for 5 of the CCLT. Images were acquired at weeks -2 and 8 in the 6 control rabbits to detect changes related to time in normal animals. The following parameters were assessed: osteophytosis [CR, CT, MRI: 3D SPGR-Fat Sat (FS) and PD/T2-FS], subchondral bone sclerosis (CR, CT), bone marrow lesions (MRI PD/T2-FS), joint space width (CR, CT, MRI: 3D SPGR-FS and PD/T2-FS), femoropatellar effusion (CR, CT, MRI 3D SPGR-FS), cartilage thickness (mm) and defects (mm) (MRI 3D SPGR-FS and PD/T2-FS). The sensitivity (Se) and specificity (Sp) of the 3 imaging modalities to detect osteophytes, and of MRI to detect cartilage defects, were calculated in regard to macroscopic and histologic evaluations, which were performed post-mortem after the last imaging session. Changes over time and between joint groups were assessed with a repeated-measures linear model (quantitative parameters) with time and groups as within-subject factors or with a Cochran-Mantel-Haenszel test (semi-quantitative parameters).

**Results:** CT had the highest Se (90%) and Sp (91%) to detect osteophytes, with a significant increase in total joint osteophyte score at 2 weeks post-CCLT (p = 0.04) persisting until week 12 (p = 0.03). Bone sclerosis was not reliably assessed. Bone marrow lesions occurred most commonly in the lateral femoral condyle of the CCLT joints with the most severe at week 4, and were not detected in the tibia in any group. Mean joint space width in the lateral compartment increased significantly at weeks 4 (p=0.0007), 8 (p=0.02) and 12 (p=0.006) in the CCLT joints. A significant increase in joint effusion was measured at week 2 (p=0.01), peaked at week 4 (p=0.002) and remained elevated until week 8 (p=0.03) in the CCLT joints. 1.5 T MRI had a low Se and Sp to detect articular cartilage defects.

**Conclusion:** Combined clinically-available CT and 1.5 T MRI all owed assessment of most of the characteristics of OA over time. However, 1.5 T MRI in this rabbit OA model was not able to detect cartilage lesions.
Introduction/Purpose: The purpose of this study was to evaluate the utility of single-detector computed tomography arthrography (CTA) for the diagnosis of caudal cruciate, cranial cruciate and meniscal ligament pathology in the dog stifle. We hypothesized that computed tomography arthrography would be comparable to surgical findings in identifying intra-articular ligamentous pathology.

Methods: Thirty dogs determined to have stifle joint pathology related to intra-articular ligamentous insufficiency based on clinical history, orthopedic examination, and survey orthogonal radiographs, underwent CTA using a previously described protocol. Arthroscopy or arthrotomy was performed, immediately following CT, to fully assess intra-articular ligamentous structures. Four normal stifle joints from three canine cadavers were similarly imaged and confirmed normal at necropsy. Three board certified radiologists reviewed all CT studies independently and without knowledge of surgical or necropsy outcomes. Kappa analysis was performed to assess interpreter agreement with surgical or necropsy outcome. Agreement between the three interpreters with respect to the presence or absence of caudal cruciate, cranial cruciate, and/or meniscal ligament tears was also assessed.

Results: Good to excellent agreement between each interpreter and surgical or necropsy outcome was seen in evaluation of caudal cruciate ligament tears for all three interpreters. Fair to good agreement between interpreter and surgical or necropsy outcome was seen in evaluation of cranial cruciate ligament tears by two of the interpreters. Poor agreement between interpreter and surgical or necropsy outcome was seen in the evaluation of cranial cruciate ligament tears by one interpreter. Agreement between each interpreter and surgical or necropsy outcome was poor in evaluation of meniscal ligament tears. Overall agreement between interpreters was poor for assessing tears of the caudal cruciate (0.2016) and the meniscal (0.1726) ligaments. Overall agreement between interpreters was fair for assessing tears of the cranial cruciate ligament (0.3454).

Discussion/Conclusions: Single-detector CTA maybe useful for identifying pathology of the canine cruciate ligaments but is of questionable value for assessing the meniscal ligaments. Lack of interpreter experience in assessing canine stifle CT arthrograms may have negatively affected statistical results.

WHAT IS THE DIAGNOSTIC IMPACT OF COMPUTED TOMOGRAPHY IN DOGS WITH SUSPECTED ELBOW ARTHRITIS?

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Introduction: Elbow arthritis as a result of fragmented medial coronoid process (MCP), osteochondritis dissecans (OCD) of the humeral condyle, and/or joint incongruity is a major problem in young dogs. Survey radiography is not considered accurate enough for reliable diagnosis of these conditions and computed x-ray tomography (CT) is increasing used instead.

Purpose: To assess the diagnostic impact of CT in dogs with suspected elbow arthritis.

Methods: Retrospective cross-sectional study of dogs that had elbow CT and arthroscopy within 7 days. Contiguous 1-1.5mm transverse images, and sagittal and coronal reconstructions were used by 2 blinded observers who reached a consensus about the presence or absence of marginal osteophytes, lesions affecting the MCP, subchondral sclerosis of the ulnar trochlear notch and/or humeral condyle, irregularity of the radial incisure of the ulna, subchondral defect of the humeral condyle, and radioulnar incongruity. Osteophytes were graded as follows: 0, no osteophytes present; 1, all osteophytes <2mm; 2, osteophytes 2-5mm; 3, osteophytes >5mm. Arthroscopic reports included degree of cartilage erosion affecting the MCP and/or humeral condyle, and presence or absence of fragmentation of the MCP, humeral OCD, and radioulnar incongruity. Positive (PLR) and negative (NLR) likelihood ratios were calculated.

Results: One hundred and one elbows from 58 dogs were used in this study. Twelve breeds of dog were represented; retrievers (52 elbows) and Rottweilers (12 elbows) were the most frequent. There were 43 males and 15 females. Median age was 1y (range 5m to 9y). Arthroscopic diagnoses were fragmented MCP (51 elbows), articular cartilage erosion only (19), radioulnar joint incongruity (14), stable fissure in MCP (7), OCD (6), and normal (15). There was a positive correlation between the CT osteophyte grade and the degree of cartilage erosion at arthroscopy (p=0.01). CT showing fragmented MCP was a predictor of displaced fragment on arthroscopy (PLR 5.3, 95% confidence interval (CI) 2.8-10.1) and cartilage erosion affecting the humerus (PLR 3.1, 95% CI 1.8-5.4). Sclerosis of the MCP on CT was a predictor of cartilage erosion affecting the MCP (PLR 5.6, 95% CI 2.6-11.8). Humeral subchondral defect on CT was a predictor of OCD (PLR 3.0, 95% CI 1.9-4.9). Lack of periarticular osteophytes on CT was a predictor of lack of fragmented MCP (NLR 0.14, 95% CI 0.034-0.59) and lack of cartilage erosion on the humerus (NLR 0.27, 95% CI 0.08-0.88). Lack of a fragment on CT was a predictor of lack of a displaced fragment on arthroscopy (NLR 0.18, 95% CI 0.085-0.38) and lack of cartilage erosion on the humerus (NLR 0.44, 95% CI 0.29-0.66). Lack of sclerosis of the MCP on CT was a predictor of lack of cartilage erosion on the MCP (NLR 0.19, 95% CI 0.11-0.35).

Discussion: Although there are significant associations between certain CT signs and arthroscopic findings, we found no signs that could be used to reliably rule in or rule out elbow lesions. Hence CT should not be used to determine the need for arthroscopy (or arthrotomy) in a young dog with suspected elbow arthritis.
COMPARISON OF ULTRASOUND, CT, AND MRI IN DETECTION OF ACUTE WOODEN FOREIGN BODIES IN THE CANINE MANUS


Introduction
Foreign bodies affecting the integumentary and musculoskeletal systems are common causes of recurrent pain, lameness, swelling, and infection in dogs and humans. While metallic and mineral objects (such as gravel) may be readily detected through use of survey radiography, many offending sources of injury in dogs (such as plant matter) are radiolucent. A method for early detection of radiolucent foreign bodies would be helpful for reducing complications associated with infections and recurrent surgeries, particularly in working dogs. The objective of this in-vitro study was to compare the diagnostic sensitivity of ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) for detection of acute wooden foreign bodies in the canine manus.

Materials and Methods
Thirty canine cadaver forelimbs were harvested, and skin defects were created at nine sites on the palmar surface of each manus: 3 each in the interdigital skin, metacarpal pad, and tissues palmar to the metacarpal bones. Wooden foreign bodies were inserted into the tissues at some of these sites; presence or absence of an object at each site was randomly determined. All paws were then imaged using ultrasound, CT, and MRI. Images for each modality were evaluated independently by a single observer with expertise in that modality. The observers did not know the status of any of the possible foreign body sites. Each possible site was graded as positive or negative for presence of a foreign body, and diagnostic certainty was graded on a 1-10 scale. Sensitivity and specificity for each modality was calculated for each foreign body location, and ROC curves were generated. Certainty scores between modalities were also compared.

Results
The sensitivity for CT detection of foreign bodies was the highest (0.75), followed by ultrasound (0.54) and MRI (0.02); all differences were statistically significant (p < 0.001). There were no significant differences in specificity among the three modalities (p > 0.30). When evaluating the area under the ROC curves, there was no significant difference between ultrasound and CT (p = 0.15), indicating equivalent overall accuracy; the AUC for each of these was greater than that for MRI (both p < 0.0001). The observer certainty was greater for CT than for ultrasound (p = 0.002), and certainty for each of these was greater than for MRI (both p < 0.0001).

Conclusion
CT was more sensitive than and as accurate as ultrasound for detection of acute wooden foreign bodies in this in vitro study. MRI was not found to be useful.
ESTABLISHMENT OF A COMPUTED TOMOGRAPHIC PROTOCOL FOR THE CANINE DENTITION

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Introduction:
Intraoral radiography is the current mainstay of diagnosis for canine dental diseases. Dental radiography requires general anaesthesia, is technically demanding and time consuming. Computed tomography (CT) is commonly used for many conditions of the canine head, including oral lesions, however there is no established protocol for canine dental CT. CT has potential as a time efficient substitute for oral radiography. Purpose of this study was to create a dental CT protocol and to evaluate its sensitivity for depiction of the dental anatomy.

Methods:
A post mortem canine head specimen with complete and normal dentition (1 year old Beagle mix, mesaticephalic skull conformation, 42 teeth with 68 roots) was imaged with a variety of different CT settings (1/2/3 mm slice width and interval, axial versus helical mode, helical pitch of 1 or 2 and detail/ bone/ edge enhanced bone reconstruction algorithm). A GE HighSpeed® single detector-row helical CT unit was used with constant parameteres of 1s rotation time, 100 mAs, 120 kVp and a 10.8 cm display field of view. The scan time and the number of generated images were recorded for each series. All image series were assessed by a single reviewer, a board-certified radiologist, who counted all visible tooth roots and scored each of them as completely or incompletely assessed. A completely assessed tooth root required visualization of the root apex and shaft. The clarity of the alveolo-dental margin was rated as poor, good or excellent for the maxillary and mandibular M1 tooth on axial and sagittally reconstructed images respectively.

Results:
The highest score was achieved with 1 mm slice width and interval, axial mode with bone or edge enhanced bone algorithm (100% sensitivity for tooth root numbers and completely assessed roots) which generated 109 images with a scan time of 6.30 min. Edge enhancement increased clarity of the alveolo-dental margin (excellent). Helical CT with a pitch of 1 and otherwise similar settings achieved identical results except for a slightly reduced clarity of the alveolo-dental margin (good) with a 2.11 min scan time. Increasing slice width, leaving slice gaps and increasing the helical pitch resulted in decreased root counts or number of completely assessed roots and reduced clarity of the alveolo-dental margin. For sagittal reconstructions, only the above mentioned axial and helical series showed a distinguishable alveolo-dental margin.

Conclusions:
Thin continuous slicing with edge-enhanced bone reconstruction algorithm in axial mode provides best imaging results for CT of the canine dentition. Helical mode imaging with a pitch of 1 provides acceptable results; however there is only very little time saved that would be better invested in optimal image quality.
VIRTUAL ENDOSCOPY IMAGING OF THE MIDDLE EAR CAVITY AND OSSICLES IN DOGS.

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Introduction
The goal of this study has been to produce images that are more informative than ordinary studies of CT-slices and that give detailed information about the middle ear cavity and ossicles. Special attention has been paid to the ossicular chain.

Methods
Six beagle dogs and one cadaver were studied with multi detector computed tomography(Somatom Sensation 16, Siemens, Germany) in order to produce topographic images, which are more informative than ordinary CT-slices. Virtual endoscopic images were produced with commercially available software(Rapidia; INFINITT Co., Korea), paying attention to the middle ear cavity and ossicles. The bony or soft tissue surfaces can be visualized according to the viewer’s needs.

Results
Four major viewing locations for virtual endoscopy (the ear canal, tympanic bulla, Eustachian tube and ossicular chain) developed images acceptably. The malleus was visualized properly. Small structures such as the incus and stapes sometimes failed to have good imaging. The Eustachian tube and attic virtual views, which are usually not receptive to ordinary endoscopy, gave proper visualization of middle ear structures.

Conclusions
Virtual endoscopic images, or topographic images, of the middle ear and ossicles contribute to the understanding of the anatomy of the middle ear, thus enhancing the chances for successful diagnosis and surgical planning of middle ear disease as well as the quality and efficiency of student education.
OSTEOPHYTOSIS, SUBCHONDRAL SCLEROSIS, JOINT EFFUSION AND SYNOVIAL THICKENING IN CANINE EXPERIMENTAL STIFLE OSTEOARTHRITIS: A COMPARISON BETWEEN 1.5 T MRI AND COMPUTED RADIOGRAPHY.

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INTRO/PURPOSE: Radiography is routinely used to measure the progression of naturally occurring and experimental osteoarthritis (OA) in dogs. In humans, magnetic resonance imaging (MRI) is now recognized as a more sensitive tool to assess OA occurrence and progression. The purpose of this study was to compare the use of 1.5T MRI and computed radiography (CR) in the morphological and temporal evaluation of osteophytosis, subchondral sclerosis, joint effusion and synovial thickening in canine experimental stifle OA.

METHODS: CR (mediolateral and caudocranial views) and MRI [dorsal 3D T1-weighted gradient echo; sagittal fat-suppressed 3D T2*-weighted spoiled gradient recalled acquisition at a steady state (SPGR) and T2-weighted fast spin echo with fat saturation] were performed at baseline (n=8) and at week 4 (n=5), week 8 (n=8) and week 26 (n=5) following transection of the cranial cruciate ligament in 8 mongrel dogs (23.5 ± 2.3 kg, skeletally mature). Osteophytosis and subchondral sclerosis were scored at 15 and 8 (respectively) joint anatomical compartments for CR and MRI, based on their severity (0:none, 1:mild, 2:moderate, 3:severe). Joint effusion was also scored similarly for CR and MRI (0:none, 1:mild, 2:moderate, 3:severe), and synovial thickening for MRI.

RESULTS: Grade 1 osteophytes were detected earlier with MRI and global scores for osteophytosis were significantly higher for MRI versus CR at weeks 4 and 8 (p<0.05), even though scores for this parameter strongly correlated between modalities (Spearman correlation coefficient of 0.94; p<0.001). A correlation was also found for the assessment of subchondral bone sclerosis (0.54; p<0.004) and joint effusion (0.80; p<0.001). However, the discrimination between joint effusion and synovial thickening was only possible with MRI. Scores for sclerosis were higher for CR, although not statistically significant. Joint effusion and synovial thickening reached a peak for MRI at week 8, before partially regressing at week 26. Conversely, osteophytosis and sclerosis progressed semi-linearly over 26 weeks.

DISCUSSION: High-field MRI is more sensitive than CR in assessing the onset and progression of osteophytosis in canine experimental stifle OA. MRI also allows to accurately discriminate joint effusion and synovial thickening, and subchondral sclerosis, which may be over interpreted on radiographs. In the context of research looking at structural changes and effects of disease-modifying OA drugs using the canine OA model, MRI offers significant advantages over CR.
TEMPORAL ASSESSMENT OF BONE MARROW LESIONS IN A CANINE MODEL OF STIFLE OSTEOARTHRITIS: IMPACT OF SEQUENCE SELECTION ON MRI

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INTRO/PURPOSE: Bone marrow lesions (BML) have been recognized as an important component of structural changes that accompany osteoarthritis (OA) in people and animals, as well as a potential source of pain and a target in the development of disease-modifying OA drugs. BML are routinely described as a change in marrow signal on MRI that is hyperintense on T2-weighted (T2w) and hypointense on T1w sequences. The purpose of this study was to compare the temporal evolution of BML using 3 different MRI sequences in a canine model of OA.

METHODS: Three MRI sequences [dorsal 3D T1w gradient echo (T1-GRE), sagittal fat-suppressed 3D T2*w spoiled gradient echo at a steady state (SPGR), and sagittal T2w fast spin echo with fat saturation (T2-FS)] were performed at baseline, and at week 4, 8 and 26 in 5 dogs (23.5 ± 2.3 kg, skeletally mature) following transection of the cranial cruciate ligament. Subchondral BML were scored (0-3) blindly and twice, according to their extent in 9 anatomical joint compartments, for each imaging session and on each of the 3 MRI sequences. Wilcoxon-signed rank tests (p<0.05) compared delta-evolutions of score on different sequences. Spearman correlation coefficient and Bland-Altman tests evaluated intra-reader repeatability.

RESULTS: BML were most prevalent in the central and medial portions of the tibial plateau. Intra-reader repeatability was good to excellent for each sequence (rs=0.87-0.97; p<0.001), with maximal variability reaching 24% on T2-FS. Higher BML scores were associated with highest variations between both readings. Averaged global scores rapidly increased at week 4 and 8, similarly on all 3 sequences, but at week 26, scores on T2-FS were significantly lower than on T1-GRE or SPGR (Fig.1). As opposed to T1-GRE and SPGR, BML scores on T2-FS regressed between week 8 and 26.

DISCUSSION: In this canine model of OA, BML vary differently in time on different MRI sequences. As opposed to previous studies, our results suggest that a component of these lesions may resolve over time, and that its evolution may follow more specifically the signal intensity observed on T2-FS. Hence, until the complex nature of these lesions is fully resolved, BML should be evaluated separately in different MRI sequences in dogs with experimental OA. The intra-reader variability that was most pronounced on T2-FS shows that these lesions can be difficult to evaluate, because of their heterogeneity, poor conspicuity and complex anatomical distribution, particularly when severe.
Percutaneous ultrasound guided popliteal lymphography for computed tomographic imaging of canine thoracic ducts

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Purpose: The purposes of this study were to delineate the radiographic and computed tomographic appearance of canine thoracic duct and its branches by injection of contrast medium into a popliteal lymph node under the guidance of ultrasound and to determine the effective dose of contrast medium, delay time and duration time. Also, we assessed the accuracy and usefulness of computed tomography (CT) for the identification of the thoracic ducts.

Methods: Three different doses (30, 60, and 90 mgI/kg) of water-soluble iodinated contrast medium were injected under the guidance of ultrasound into 15 popliteal lymph nodes of 10 healthy adult Beagle dogs and radiographs and CT were obtained. Filling and duration time of contrast media and the number of visible ducts from popliteal lymph nodes to the thoracic duct and its branches were recorded from the level of the sixth thoracic vertebra to the first lumbar vertebra. Blind test was carried out to determine the diagnostic quality of radiographic lymphography at each dose.

Results: The dose of contrast media did not affect the filling time (P = 0.281) and duration time (P = 0.114) of thoracic ducts. Radiographs obtained between 130 and 800 seconds after injection of contrast medium provided the detailed appearance of thoracic duct. Radiographic lymphography with the dose of 60mgI/kg and 90mgI/kg was determined to have diagnostic image quality. There was no significant difference in the number of thoracic ducts between two modalities at each anatomic locations. However, CT lymphography provided images of thoracic ducts with better spatial resolution without superimposition of surrounding tissues.

Discussion/Conclusions: Direct injection of contrast media into a popliteal lymph node appears to be an easy technique for identification of thoracic ducts, and this technique can be applied to the diagnosis of diseases associated with chest lymphatic drainage.
ASSESSMENT OF AIRWAY DISEASE IN 5 DOGS USING MULTIDETECTOR ROW COMPUTED TOMOGRAPHY AND RADIOGRAPHY UNDER SEDATION AND BRONCHOSCOPY

Introduction/Purpose
In dogs with chronic cough, bronchoscopy provides a means for direct evaluation of the airways and for culture and cytologic sample collection. The disadvantages of the procedure include invasiveness, need for general anesthesia, and a relatively high operator skill requirement. Radiography is also essential for evaluation of the airways and for exclusion of other causes of cough, but it may underestimate disease or dynamic airway changes. Multidetector row computed tomography (MDCT) provides a means of rapid imaging of the airways while potentially avoiding the need for general anesthesia and providing more information than radiography alone. The purpose of this study is to compare sedated MDCT, radiography, and bronchoscopy results in an attempt to find a subset of dogs presenting for chronic cough in which sedated exams could replace or supplement bronchoscopy.

Methods
Five dogs presenting to NCSU VTH for chronic cough from 07/06 – 07/07 were evaluated using radiographs and MDCT under sedation followed by conventional bronchoscopy under general anesthesia. Final diagnoses were based on bronchoscopic exam, cytology, and culture. Diagnoses included bronchitis, eosinophilic bronchitis, redundant dorsal tracheal membrane, and dynamic airway collapse of the trachea, mainstem bronchi, lobar bronchi, and 4th generation airways. Radiographs and MDCT were assessed by agreement of 2 evaluators and compared to bronchoscopy results.

Results
MDCT and radiography agreed approximately 67% of the time in regards to bronchiectasis, bronchial wall thickening, and redundant dorsal tracheal membrane. Radiographs did not identify any mainstem bronchial or lobar bronchial collapse. There was 100% agreement between MDCT and bronchoscopy regarding moderate to severe redundant dorsal tracheal membrane, lobar bronchial collapse, and right mainstem bronchial collapse, and 67% agreement regarding left mainstem bronchial collapse. MDCT identified mild redundant dorsal tracheal membrane in more dogs than did bronchoscopy, and bronchoscopy did not identify bronchiectasis in any dog. Disadvantages of sedated MDCT include occasional respiration artifacts, inability to observe mucosal changes, inability to obtain diagnostic samples, and lack of oxygen and airway support in sedated animals with respiratory compromise.

Discussion/Conclusions
While bronchoscopy remains a necessary modality for the diagnosis of many respiratory diseases which cause chronic cough, sedated MDCT provides a safe alternative or complimentary diagnostic test for thickening, collapse, or dilation of the airways in dogs.
COMPARISON OF DIFFERENT HELICAL CT PROTOCOLS FOR THE DETECTION OF SOFT TISSUE PULMONARY NODULES IN THE DOG.

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INTRODUCTION/PURPOSE: Helical computed tomography (CT) has become an important tool in tumor staging in dogs. Several protocols of acquisition and reconstruction can be used to image the thorax, theoretically affecting spatial resolution. However, the impact of these parameters on the detection of pulmonary nodules in dogs remains uncertain. The goal of our study was to compare different CT protocols in their capacity to identify pulmonary soft tissue nodules in dogs.

METHODS: Two dogs (4 kg and 38 kg) with primary extra-thoracic malignant neoplasia and pulmonary nodules were scanned [single-slice helical CT; 1.0 sec tube rotation; sharp reconstruction algorithm (CHEST)]. Each dog’s thorax was scanned with 12 different protocols using variable slice collimation [narrow (3 or 5 mm) and wide (5 or 7 mm)], pitch (1, 1.5 and 2), and reconstruction interval (0.5 and 1). All images for each protocol were independently evaluated by two ACVR-diplomats and one third year radiology resident. Protocol order was randomized and evaluators were blinded to the protocol parameters. For each protocol, every identified nodule was assigned a spatial address (x, y, z) and attributed a score of 1 (probably not a nodule), 2 (probably a nodule) or 3 (definitely a nodule). Our gold standard for the existence of each nodule (score of 2 or 3) consisted of a consensus evaluation of the images obtained with the protocol with the highest theoretical spatial resolution (narrow collimation, reconstruction interval of 0.5 and pitch of 1). Using these results, nodules that were not identified by an observer on individual evaluations were scored as 0. The size of each nodule was also determined by consensus and classified as small (<3 mm) or large (≥3 mm). Inter-observer agreement was assessed by kappa statistics.

RESULTS: For both dogs, a total of 82 nodules were detected using our gold standard. For each scanning protocol, moderate agreement (mean=0.53) in nodule scoring was found between the evaluators. This agreement did not vary significantly between protocols, although the agreement was generally higher for larger nodules (k=0.59 vs 0.5 for small). Consequently, the results of one evaluator (H.J.) for each protocol were analyzed in comparison to our gold standard. The sensitivity for nodule detection did not significantly differ between protocols (mean=83%). The specificity was significantly better using protocols with a wide collimation (mean=89%) than with a narrow collimation (mean=82%) (p= 0.007). The specificity was also significantly better with a pitch of 1.5 and 2 (mean=89% and 88%, respectively), compared with a pitch of 1 (mean=80%) (p=0.01). Reconstruction interval and nodule size did not significantly influence the sensitivity or specificity of nodule detection.

DISCUSSION/CONCLUSIONS: This study shows that protocols resulting in higher spatial resolution do not always improve pulmonary nodule detection. Faster protocols that generate fewer images and reduce motion artifacts and radiation dose can result in similar sensitivity for nodule detection. Additionally, these faster protocols seem to be more specific, generating fewer false positive diagnoses. Further studies are needed to evaluate the slice thickness at which nodule detection becomes less sensitive.
The aims of this study were: to set up the dynamics of acute phase proteins serum concentrations in pregnant bitches and ultrasonographic features of conceptus and make a correlation among acute phase proteins serum levels, ultrasonographic features of conceptus and gestational age. Serial ultrasonographic examinations were performed on 09 boxer bitches, 2 or 3 times per week from 18º day of gestation until parturition. The used device is a portable GE®, Logic α 100 MP, equipped with a sectorial transducer 5,0 MHz and another linear one of 7,5 MHz. Embryonic and fetal parameters had been measured: DBP, DC e EP. Serum samples were collected in the same day and acute phase proteins (Hp, GAα1 e CRP) were measured by commercial kits (Phase Haptoglobin Assay®, Canine α1 Acid Glycoprotein measurement kit®; Phase Canine C – Reactive Protein Assay®, Tridelta Development Limited). Serum samples of non pregnant bitches were collected from the beginnig of proestrous to the end of diestrous. The gestational period was divided into 9 weeks, each one of them (from the 3rd to the 9th week of gestation) was associated to a range of ultrasonographic features of the conceptus. Ultrasonographic mensurations (DBP, DC e EP) were linearly correlated to gestational age. The $R^2$ values were > 0,9 in all cases, which indicates that more than 90% of the variability of gestational age was explained by any one of these measurements. Those mensurations were put in a multivariated model and resulted in an equation: $Y = 22,886 + 1,26 \text{DBP} + 0,107 \text{DC}$ ($p < 0,0001$ e $R^2 = 0,99$) that is able to estimate the gestational age. Hp, GAα1 e CRP seric concentrations were statistically more elevated in pregnant than in non pregnant bitches, from the 4th week of gestation until parturition. The acute phase proteins didn’t present good correlation to the gestational age like the ultrasonographic mensurations did, however it is possible to affirm that their concentrations reached maximum values (Hp = 11,11 ± 1,7 mg/ml, GAα1 = 449,44 ± 146,91 µg/ml e CRP = 58,30 ± 14,69 µg/ml) on the 5th week. The dynamic of the acute phase proteins (Hp, GAα1 e CRP) and ultrasonographic mensurations (DBP, DC e EP) was performed in order to visualise the profile of all mean measurements, one regarding to the other, during gestation in boxer bitches, and is illustrated in the graphic below.
DIAGNOSTIC VALUE OF FREE HAND ULTRASOUND-GUIDED FINE NEEDLE SAMPLING OF GASTROINTESTINAL TRACT LESIONS IN DOGS AND CATS. C.A. Robert, P. Roberta, *M. Gabrielle
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Introduction
Ultrasound-guided fine needle aspiration or biopsy (without aspiration) is the most common procedure utilized to obtain cytological samples from intraabdominal organs and superficial organs or lesions. The goal of this study was to retrospectively determine the usefulness of ultrasound-guided fine needle aspirate/biopsy (UGFN) of gastrointestinal tract (GIT) lesions in dogs and cats.

Material and Methods
The medical records of 24 dogs and 10 cats with an ultrasonographic diagnosis of GIT mural lesion presented to the VTH of the University of Guelph were reviewed. Animals with an UGFN of the GIT mural lesion and a complete cytopathological report were included in the study. The cytopathological reports were reviewed for quality of the sample obtained (good, moderate, or poor), whether or not the sample was diagnostic, and final cytological diagnosis. The ultrasonographic lesions were reviewed for lesion description and thickness (cm). ANOVA was used to determine significant differences in mean thickness between the quality categories. Pooled t – test was used to determine differences between the means of the thickness for diagnostic and non diagnostic samples. Exact conditional logistic regression was utilized to determine if thickness could be used as a predictor of a positive diagnosis. P values of <0.05 were considered significant for all tests.

Results
The sample was diagnostic in 67.6 % (23/34) animals and non diagnostic (poor quality) in 32.4% (11/34) animals. Lymphoma was diagnosed in 52.1% (12/23, 9 confirmed by histology), carcinoma in 21.7% (5/23, 4 confirmed by histology), sarcoma in 4.34% (1/23, confirmed by histology) and inflammation in 13.04% (3/23, 1 confirmed by histology). The diagnosis was uncertain in 8.6% (2/23) of the lesions with these lesions having a thickness that was the smallest of the group (0.81 and 0.75 cm). The lesions for diagnostic samples were significantly thicker (1.79 ± 0.875 cm) than the lesions for non diagnostic samples (1.22 ± 0.570 cm) (p=0.047). For the diagnostic samples, 29.4% (10/23) were of moderate quality and 38.2% (13/23) of good/excellent quality. The mean thickness of good/excellent quality (2.18 ± 0.988 cm) and poor quality (1.22 ± 0.570 cm) samples was statistically different (p=0.01). There were no statistical differences between the means of good/excellent versus moderate (1.372 ± 0.620 cm) samples (p=0.07), and between poor versus moderate quality samples (p=0.81). The logistic regression analysis (p= 0.05) and the calculated odds ratio of 3.08 (CI=1.008 – 12.51) suggested a statistical trend indicating that as thickness of the lesion increased the probability of obtaining a diagnostic sample also increased.

Discussion and Conclusions
We found a moderately high percentage of cytological samples considered diagnostic for gastrointestinal mural lesions obtained from fine needle aspirate/biopsy under ultrasound guidance. It seems that thickness of the lesion plays a major role in obtaining a diagnostic sample. This assumption was also found by Crystal et al. on samples taken with regular needles or automated microcore biopsy. Although lymphoma was overrepresented it seems that the likelihood of obtaining a diagnostic sample is also high with this GIT lesion.
EVALUATION OF LATERAL VENTRICLE USING COMPUTED TOMOGRAPHY IN THE NORMAL SHIH-TZU DOG

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Introduction

Hydrocephalus have been diagnosed by measuring the size of lateral ventricles on computed tomography (CT) and magnetic resonance (MR) imaging. Thus, the variation of normal ventricular anatomy must be recognized when evaluating CT or MR images of the canine brain. The purpose of this study was to design the methods of measurement in size of lateral ventricles and to evaluate the size and asymmetry of the lateral ventricle using CT in the Shih-Tzu dog.

Materials and Methods

CT examinations were performed in thirty Shih-Tzu dogs without neurologic signs. Contiguous 2mm thickness images of the skull were obtained beginning immediately rostral to the optic canal and continuing caudally to a level of tympanic cavity. The size of their lateral ventricles was evaluated as ventricular height (Vh), ventricular width (Vw), ratio of the ventricular height and hemispheric height (Vh/Hh), and ventricular width and hemispheric width (Vw/Hw) at the level of optic canal, interventricular foramen and temporomandibular joint with soft tissue window.

Results

The mean of Vh, Vw, Vh/Hh, and Vw/Hw was the largest value at the level of interventricular foramen. At the level of interventricular foramen, the mean left and right Vh was 5.12 ± 2.17 and 4.86 ± 2.24, respectively. The upper limit of Vh and Vh/Hh in normal Shih-tzu dogs was about 6 mm and 16 % in 95% confidence interval, respectively. In this study, 25 dogs had normal or mildly asymmetric and five had moderately asymmetric lateral ventricles.

Discussion

Measurements of lateral ventricular size using CT was useful and possible in all of thirty Shih-tzu dogs. Also, interventricular foramen level was the most appropriate position for evaluation of ventricular size. Based on this study, clinically insignificant ventricular enlargement or asymmetry was common in normal Shih-tzu dogs. Therefore physical examination and repeated follow-up must execute when Vh or Vh/Hh were more than value of upper limit.

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Introduction:
Magnetic resonance imaging (MRI) is the most sensitive method of diagnostic imaging to evaluate soft tissues, specially the brain, however it is expensive. The method is based on the nuclear magnetic resonance phenomenon that occurs when atomic nucleus with magnetic proprieties in the body are submitted to a strong magnetic field, and excited with radio frequency generating a radio frequency signal captured by a receptive antenna. The signal is processed by Fourier Transform for the image formation. This study had the objective to obtain 10 complete exams of heads in cadavers of normal dogs to MRI and to make an Atlas of head structures, besides to explain the physics of magnetic resonance to the veterinary community.

Methods:
The images were obtained with a magnetic resonance unit Gyroscan S15/HP Philips using a magnetic field of 1.5Tesla. The cadavers were positioned with the head into a human head coil and submitted to sagittal slices used to plan the transverse and dorsal slices in T1, T2 and DP spin-echo sequences. In T1 we adjusted TR=400ms and TE=30ms, in T2 TR=2000ms and TE=80ms and in DP TR=2000ms and TE=30ms. The slice thickness was 4mm, the number of averages 2, the matrix 256x256, the factor 1.0 and the field of view 14cm.

Results:
The duration of the complete exam of the head was 74.5minutes. The images obtained with the described sequences and with the human head coil was of good quality. In T1 fat was hyperintense and fluid was hypointense. In T2 fat was less hyperintense and fluid was hyperintense. The cortical bone and the air were hypointense in all sequences used because of the low proton density. The DP sequence showed the best contrast between white and gray matter when compared with T2 and T1 sequences. Distinction of cerebral sulcus and gyrus was possible because T2 showed the cerebrospinal fluid. The identification of bone structures that compound the region, muscles, main venous and arterial vessels and structures of the central nervous system, besides elements of the digestory and respiratory systems and structures of the eyes among others was possible through contrast obtained with MRI.

Discussion/Conclusions:
It was concluded that: MRI was able to demonstrate the structures of the canine head with rich anatomic details; the time used to do the complete exam of the head is compatible with the use in live animals since properly anesthetized and controlled and DP, T2 and T1 are complementary for the anatomic study because of the differences in contrast. We had opened a way for the study of live animals and for the beginning of disease investigation, mainly that of neurologic origin because this technique is excellent for brain visualization.
This is a case report of congenital hydrocephalus found in an 8-week-old, 300g body weight, male, Sprague-Dawley (SD) rat. Hydrocephalus is a neurological disorder of increasing prevalence characterized by an abnormal accumulation of cerebrospinal fluid (CSF) within the ventricles and subarachnoid spaces. Due to its complex and multi-etiologic nature, the pathogenesis of hydrocephalus has no definitive explanation. For related studies, many hydrocephalus rodent models including the Hy-3 and hyh mouse models, the H-Tx, LEW/Jms, and LEW-HYR rat models, as well as procedures for the kaolin or ethylenethiourea induction of hydrocephalus in normal rat models have been reported. Most hydrocephalic rats die between 4 and 5 weeks of age without treatment. Magnetic resonance imaging (MRI) is one of the most powerful imaging techniques for living organisms as it provides images with excellent anatomical details based on soft-tissue contrast and functional information in a non-invasive and real-time monitoring manner. This report describes a rare case of long-term survival in congenital hydrocephalus found in an 8-week-old, SD rat during an experiment. No evidence of abnormalities of feeding and behavior was seen before performing MRI.

Figure 1. These are axial T2-weighted MR images of the brain of the rat. The ventricles of the brain are markedly dilated and the parenchyma of the brain is severely compressed and thinned by dilated ventricles. The brain was imaged with a 4.7-T Bruker Biospin imager (Bruker Medical Systems, Karlsruhe, Germany). The imaging protocol included a T2-weighted gradient-echo (GRE) sequence (repetition time msec/echo time msec, 356.5/10.3; flip angle, 30°).
EVALUATION OF POSITION’S EFFECTS RELATED TO GRAVITATIONAL PULMONARY DEPENDENT DENSITIES IN DOGS (CANIS FAMILIARIS) BY COMPUTED TOMOGRAPHY. E.A.R. De Freitas, A.C.B.C. Fonseca Pinto, A. Conti, F.A. Sterman, M. Iwasaki. Faculty of Veterinary Medicine, University of São Paulo, SP, Brasil, CEP 05508-270.

1) Introduction: Computed tomography (CT) is the election diagnostic method to evaluate the lungs. The pulmonary atelectasis well known for gravitational dependent pulmonary densities, which is observed during general anesthesia or after long time of recumbency, could increase the risk of obscuring pulmonary lesions, such metastasis.

2) Objective: The purpose of this study was to compare the recumbency’s effects (supine and prone positions), by CT, on the formation of pulmonary densities in anesthetized dogs.

3) Material and Methods: Sixteen healthy Rottweiler dogs (Canis familiaris) were used. These dogs were divided into four groups, which were performed dorsal and prone CT exams each, with different periods of anesthesia: immediately after induction, 20 minutes after induction, 40 minutes and 60 minutes after induction. It was performed four transverse CT scans with 2mm of width at the top of inspiration, in different sites of the chest and were determined mean lung density (sector method according by Rosemblum et al., 1980), pulmonary densities (attenuation) in Hounsfield units (HU) and area in cm² of dense areas in dependent lung regions. The exams were realized at GE CT max 640 with 3 seconds of acquisition.

4) Results: Mean lung density demonstrated that the supine recumbency had a significant density gradient from non-dependent to dependent lung regions, and the prone position hadn’t any density gradient. The incidence of gravitational dependent pulmonary densities were the biggest at caudal regions of lungs. Dense areas were observed in 43,75% of dogs in supine recumbency and in 18,75% in prone recumbency. Atenuation results were between – 48,56 to – 361,94 HU in supine position and – 43,95 to – 248,32 HU in prone position. Area results were between 0,03 to 1,55 cm² in supine recumbency and 0,24 to 0,70 cm² in prone recumbency. Proportion of dense areas related to total transverse area of correspondent lung was between 0,05% to 1,20% in supine and between 0,29% to 0,61% in prone positions.

5) Conclusions: According these results, we suggest that prone position is better than supine position to evaluate the lungs in dogs by CT.
COMPARISON OF HUMAN AND CANINE SANDWICH ELISA DEVELOPMENT KIT FROM R&D SYSTEMS FOR THE DETECTION OF CANINE VEGF

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Introduction: Vascular Edothelial Growth Factor (VEGF) plays a key role as a proangiogenic and autocrine growth factor in several malignancies. Radiotherapy upregulates VEGF production in different neoplasms resulting in radioresistance and relapse. In the past, a human VEGF ELISA system was the only system available for measuring canine VEGF. The manufacturer has not published data on human cross-reactivity with canine VEGF. In this study, cross-over assays were performed in order to compare results measured with the new canine ELISA system to previous canine data detected with human ELISA system.

Methods: Human and canine VEGF ELISA Development Kits from R&D Systems were evaluated in cross-over assay studies. Canine recombinant VEGF was evaluated with the human antibody system and a reverse scenario was explored as well. Human and canine recombinant VEGF were used as standards and respectively as the probes. Assays were performed according to manufacturer guidelines and a seven point standard curve using two fold serial dilutions was used. The optical density of each well was determined using a microplate reader and the respective software (Sunrise, Tecan). Levels of VEGF were expressed as pg/ml. All samples were performed in quadruplicate and the experiments in duplicates.

Results: In this the cross-over assay studies only 60% of canine recombinant VEGF was detected with the human antibody system. In contrast the canine antibody system was able to detect all of the human recombinant VEGF.

Conclusion: The new canine ELISA kit system can more adequately detect and measure canine VEGF secretion than the previously available human kit, which underestimates canine VEGF values. These results should be considered when evaluating previous data in the literature or when using the human ELISA system in ongoing studies.
THE CLINICAL APPLICATION OF THREE-DIMENSIONAL COMPUTED TOMOGRAPHIC IMAGING IN HEAD AND NECK LESIONS

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Introduction
It could be hard to evaluate delicate disorders precisely in head and neck lesions using conventional methods such as radiography and conventional computed tomography (CT). In this respect, 3-dimensional CT (3-D CT) images obtained from CT data can play a key role in the exact diagnosis of such vague bony tissue abnormalities. We introduce 3 cases using 3-D CT imaging which was helpful to diagnose and treat obscure regions in head and neck.

Methods
3-D CT scanning was performed with multi-detector-row CT (Somatom Sensation 16, Siemens, Germany) and 3-D reconstruction imaging was produced by commercially available software (Rapidia 3D, INFINITT co, Korea). In the first case, 5-year-old intact female Poodle dog had cough, persistent regurgitation and dysphagia since birth. The dislocation of hyoid bones was suspected strongly on the survey radiographs and 2-D CT. Secondly, a temporomandibula joint ankylosis in a siamese cat with trismus for more than 4 years was considered. Last, the extent of mandibula fracture was difficult to understand on the conventional images.

Results
In the first case, on the 3-D CT, the apparent hyoid bone malformation was observed. On the necropsy we obtained the same images as that of 3-D CT. 3-D CT images were extremely helpful to confirm the complicated structure rather than radiographs and 2-D CT. In the last two cases, 3-D reconstruction images generated clear pictures of the anatomy of the regions concerned, which were definitive for the safe operations.

Conclusion
It is considered 3-D reconstruction tomographic images are useful and practical in assessing and correcting the complicated lesions under the circumstances that radiographs give vague information inevitably and 2-D CT imaging is not helpful enough to comprehend the subtle lesions completely.
INTRODUCTION: Computed tomography (CT) is an established procedure in veterinary medicine for evaluating patients with lumbosacral syndrome (LSS) as it allows for visualization of structures that cannot be fully evaluated by radiography such as the lateral recesses, intervertebral foramina, and articular processes. Dorsal or ventral compartment instability and dynamic stenosis of the vertebral canal and/or foramina are thought to be important predisposing factors for LSS. At the time of this study we found no published reports that described the effects of spinal positioning (flexion vs. extension) on the morphology of the lumbosacral intervertebral foramina in dogs. The purpose of this retrospective study was to describe positional changes in L7-S1 foramina and to determine if positional CT findings could be related to clinical signs in dogs with LSS.

METHODS: CT logs from 1995-2006 were searched for dogs with LSS that were scanned with the lumbosacral spine in both flexion and extension. Measurements of the lumbosacral angle and of the transverse sectional area of the L7-S1 intervertebral foramina in each position were made using reconstructed images with window and level settings designed to enhance visualization of the osseous boundaries of the foramina. Percent change in the lumbosacral angle and foraminal areas between flexion and extension were calculated. Medical records were used to obtain clinical data for each patient including breed, age, gender, weight and whether lumbosacral pain, right sided lameness, left sided lameness or bilateral lameness were present at the time of CT examination. Two-sample t-tests were used to determine if there was a relationship between percent change in foraminal dimensions or lumbosacral angle and the presence of lameness or lumbosacral pain. The Spearman’s correlation coefficient was also used to determine whether there was a relationship between percent lumbosacral angle change and percent change in foraminal transverse sectional area for dogs in different clinical sign groups.

RESULTS: A total of 81 dogs met the criteria for inclusion in the study. The most common breed included was the German Shepherd dog (n=19). A significant correlation (p<0.05) was found between percent left foraminal area change and percent lumbosacral angle change for dogs with left hind limb lameness. A significant correlation was also found between the pooled left/right percent foraminal area change and percent lumbosacral angle change for dogs with lumbosacral pain. All other correlations were not statistically significant. There was a significant difference in foraminal area in flexion versus extension positioning in the patients examined, confirming the dynamic nature of lumbosacral foraminal morphology. A correlation between percentage change in foraminal size and clinical sign group could not be demonstrated.

CONCLUSIONS: Our findings indicate that positional CT changes in bony foraminal area may not completely explain clinical signs in dogs with LSS. The significant correlation between percent lumbosacral angle and percent foraminal area change for dogs with left sided lameness and lumbosacral pain supports previous studies citing dorsal compartment instability as an important predisposing factor. Future studies are needed in clinically normal dogs to further examine the relationship between percent foraminal area change and percent lumbosacral angle change.
ESTABLISHMENT OF A COMPUTED TOMOGRAPHIC PROTOCOL FOR THE CANINE CERVICAL AND LUMBAR SPINE

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Introduction:
Computed tomography (CT) is commonly used to assess dogs with clinical signs of myelopathy, but with mixed success. This could be attributable to the broad variety of imaging parameters that can be altered on modern CT units. The purpose of this study was to establish an optimized protocol for the evaluation of the canine cervical and lumbar spine.

Methods:
The fresh carcass of a 2 year old female spayed beagle without history of intervertebral disk disease was used. A total of 80 imaging series over a lumbar and cervical spinal segment were obtained on a single detector row helical CT unit (HiSpeed Lxi, GE, Milwaukee, WI, USA) with 120 kVp, 1 s tube rotation time and 10 cm display field of view. Variable parameters were slice width (1, 2 or 3 mm), axial and helical scanning mode, helical pitch (1, 1.4 or 2), tube current (100, 140 or 200 mAs), image reconstruction algorithm (low “soft tissue”, medium “detail” or high “bone”) and reconstruction with or without additional edge enhancement filter. Transverse and reconstructed sagittal images of all series were evaluated by a one board certified radiologist (TS) on print out films as excellent, very good, good, acceptable or unacceptable for spinal cord and intervertebral disk visibility. Furthermore the presence of edge enhancement was subjectively evaluated by the same reviewer. Objective evaluation of spinal cord homogeneity was done by measuring the standard deviation of mean attenuation values over the spinal cord. Anatomical conformation of normalcy was obtained by gross dissection.

Results:
Using thin slice width, axial scanning mode, high tube current and detail algorithm revealed excellent results for visibility of both lumbar and cervical spinal cord and intervertebral disk on transverse and sagittal images. A marked hyperattenuating edge of the spinal cord combined with a hypoattenuating peripheral rim was seen on series with thin slice width and bone reconstruction algorithm. Images acquired with bone reconstruction algorithm had the highest standard deviation of mean attenuation values.

Conclusions:
For optimal spinal CT image detail it is preferable to use axial scan mode with thin slices and a detail image reconstruction algorithm. Bone algorithm deteriorates image quality by high image noise and an artifactual double line along the edge of the spinal cord. This line could be confused with normal epidural fat.
Introduction

Hepatic microvascular dysplasia (HMD) is the term used in veterinary medicine to describe microscopic intrahepatic portosystemic vascular anomalies (PSVA) which can occur concurrently with macroscopic PSVA or alone. Currently, this diagnosis requires an invasive surgical liver biopsy in metabolically unstable patients.

Feridex® is a liver-specific contrast agent composed of superparamagnetic iron oxide (SPIO) particles coated with dextran (Feridex®, Berlex Laboratories, Wayne, NJ). Following intravenous injection, SPIO is taken up by the hepatic Kupffer cells and reticuloendothelial system (RES), and to a minor extent by the spleen and lung RES. The uptake of SPIO causes marked shortening of proton relaxation time, resulting in a loss of signal in the liver.

Methods

Thirty dogs with clinical signs consistent with PSVA and 6 normal dogs were administered Feridex® at a dose of 40 μmol Fe/kg via an intravenous constant rate infusion over 20 minute period. The change in contrast enhancement was quantitated on T1-weighted gradient recalled echo (GRE) and T2-weighted transverse images of the liver obtained prior to and following the administration of Feridex®. Contrast-to-noise ratios (CNR) were calculated on the pre- and post-contrast images using the following equation:

\[ CNR = \frac{\text{Mean Signal Intensity (SI)} \_ \text{LIVER} - \text{Mean SI} \_ \text{MUSCLE}}{\text{Mean SI} \_ \text{BACKGROUND NOISE}} \]

Regions of interest (ROIs) measured liver signal intensity in 3 areas (caudate lobe, left lateral lobe and right medial lobe). These were averaged to produce a global liver CNR. ROIs of the same size were placed in the paraspinal musculature, representing the reference tissue and in the spleen and lung, which served as control tissues since they represent secondary sites of Feridex® uptake. The differences in the pre- and post contrast enhanced images were correlated to histopathologic changes seen in liver samples obtained via intra-operative or laproscopic biopsy.

Results

The control dogs had diffuse uniform decreased liver SI on both GRE and T2-weighted images. Patients with HMD had less reduction of the liver signal intensity on GRE sequences and either reduced or minimally changed CNR on T2 sequences. The decrease in liver SI was not uniform in some cases; this was most dramatic in the dog with multiple acquired extrahepatic PSVA and moderate-to-severe chronic liver disease.

Conclusions

The reduced uptake of Feridex in patients with MVD suggests that the cells of the liver RES, and specifically the Kupffer cells, are either less exposed to the intravascular contrast due to portosystemic shunting of blood or the reduced exposure to hepatotrophic factors alters the RES in patients with HMD.
CORONAL RADIATION HYPERINTENSITY IN MAGNETIC RESONANCE (MR) IMAGES OF CASES WITH PRESUMED HEPATIC ENCEPHALOPATHY (HE)
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Introduction: The clinical signs of hepatic encephalopathy (HE) can include vague behavioral changes to grand mal seizures, which can make the management of the neurological symptoms challenging. At present, the cerebral effects of the circulating toxins that are shunted away from the liver are poorly understood. This study was undertaken to determine if structural brain changes are detectable using MRI in dogs with clinical signs of hepatic encephalopathy (HE).

Methods: Thirty-two dogs with clinical signs consistent with a portosystemic vascular anomaly (PSVA) based on signalment, clinical laboratory abnormalities, and pre- and post-prandial serum bile acid assays were included. MR imaging was performed on a 1.0T Philips Gyroscan NT imaging magnet. Standard brain MR sequences (T2-, Fluid Attenuation Inversion Recovery or FLAIR-, pre- and post- Gadolinium T1-weighted) were acquired. The brain study was performed prior to MR portography, which uses a gadolinium-enhanced 2-D time-of-flight (TOF) sequence in the transverse plane. Images were interpreted by two board certified radiologist, a radiology resident and neurologist, independent of knowledge of clinical evaluations.

Results: Twenty of the 32 dogs had a macroscopic PSVA (14 extrahepatic, 5 intrahepatic & 1 multiple acquired). In 14/20 (70%) dogs, bilateral, nearly symmetric signal hyperintensity in the cerebral white matter of the coronal radiation and/or the immediately adjacent gray matter was present on T2- and FLAIR-weighted sequences. These hyperintense areas did not undergo contrast enhancement, indicating maintenance of blood-brain-barrier. All affected dogs had a single congenital PSVA (11 extrahepatic, 3 intrahepatic). The extent and location of hyperintensity varied (severe 2/14, moderate 5/14, mild 7/14). Of the 14 dogs with altered signal intensity, 64% were neurologically normal and all of those with mild changes had been medically managed prior to the MR exam. One severely affected dog was medically managed for 10 weeks. Repeat neurological examination prior to re-imaging was normal; however, persistence of hyperintensity was seen with reduction in the extent of cerebrum affected. Mild hyperintensity was still seen when the patient was imaged one year following the placement of an ameroid constrictor.

Discussion: Information obtained in these dogs indicates that discrete MR signal abnormalities are present in the brain of some dogs with PSVAs. The presence of these abnormal signal changes within the brain may be subclinical or may be seen in conjunction with neurological signs.
MAGNETIC RESONANCE ANGIOGRAPHY (3D TIME OF FLIGHT) OF THE ARTERIAL BLOOD SUPPLY TO THE CANINE BRAIN. JD Rodriguez, H Rylander, WM Adams. University of Wisconsin, School of Veterinary Medicine, Madison, WI 53706-1100

Introduction. Anatomy of the canine intra-cranial arterial system using MRA has not been reported. MRA has the potential for imaging small intracranial arteries and can be performed without injection of contrast media. The purpose of this study was to describe a technique for time of flight (TOF) brain MRA and to determine the feasibility of non-invasive imaging of the canine intracranial arterial blood supply.

Methods. Six beagle dogs were imaged using 3D TOF MRA technique in a 3.0 T GE MR Scanner. Two of the dogs were then imaged using a 1.0 T GE MR scanner to compare image quality. All dogs received a thorough physical and neurologic exam by a board certified neurologist, prior to routine gas anesthesia. Axial T2 images were obtained to rule out intracranial disease. A plasticized intracranial arterial cast technique was performed post mortem in 1 dog, to measure arterial diameters.

Parameters used for 3T MRA were: ET (1), DFOV (22 x 22cm), Matrix (384 x 224), slice thickness (1mm) no spacing, TR - 20ms, TE - 3.2ms, 15 degrees flip angle, I-S image acquisition direction and 32 slices/slab. A quadrature extremity coil was used.

Parameters used for the 1.0 T MRA were: ET (1), DFOV (16 x 12cm), Matrix (256 x 192), slice thickness (0.7mm) no spacing, TR - 60ms, TE - 10.3ms, 30 degrees flip angle, I-S image acquisition direction and 32 slices/slab. A quadrature head coil was used.

Results. The following 8 major arteries were identified in all dogs using the 3.0 T magnet: External carotid a., internal carotid a., internal carotid within the cavernous sinus, rostral cerebral a., middle cerebral a., rostral communicating a., caudal communicating a., vertebral a. at C1 level and basilar a. Three arteries could be identified using the 1.0 T magnet: carotid a., internal carotid a., internal carotid within the cavernous sinus, vertebral a. at C1 level and basilar a. Based on measurements of the plasticized arterial cast made at post mortem, arteries ranged from 0.3-1.5mm in diameter.

Conclusion: MRA spatial resolution of imaged arteries was 0.5mm for the 3.0T magnet and 1mm for the 1.0T magnet. Signal drop-out occurred consistently on 1.0T magnet images when vessel direction changed dramatically from the dorsal to the axial plane (basilar and penetrating cerebellar arteries). Venous signal suppression was not completely achieved with either magnet, obscuring visualization of the caudal cerebral a. and cerebellar branches of the basilar artery in all subjects. As expected, conspicuity, spatial resolution and image quality were superior using 3.0T.
Purpose: Magnetic resonance (MR) imaging of the stifle in live, full size horses has been impossible due to the size limitations and physical constraints of available MR units. Using a newly available commercial MR scanner (Siemens Magnetom Espree ®), preliminary clinical investigation was performed to assess the feasibility of MR imaging of the stifle in live horses.

Methods: Imaging was performed on a 1.5T, ultrashort and wide bore system. The magnet measures 125 cm from front to back with a 70 cm bore diameter and a 45 cm maximum field of view. The entire hind end of the patient was manually slid into the back side of the magnet while the rest of the patient was supported on a MR compatible table. The stifle was in a normoflexion position. Imaging was performed using the inherent body coil of the system. A variety of sequences were acquired over the range of patients, but typically included proton density, turbo spin echo T2-weighted, T2 STIR (Short Tau Inversion Recovery), and T1-weight VIBE (Volume Interpolated gradient Echo) sequences in sagittal, dorsal, and axial planes. Sagittal and dorsal plane images were post-processed using the proprietary MR system distortion correction software. Distorted (the original) and corrected images were reviewed. All images were reviewed by a board certified radiologist (TCS) and a board certified equine surgeon (CEJ). MR images were compared to previous imaging studies (radiography, ultrasonography, and nuclear scintigraphy) and post-MR arthroscopy findings.

Results: Ten horses were imaged from August 2006-July 2007. Arabians, Thoroughbreds, Warmbloods, and Quarterhorses weighing 250 – 550 kg and ranging in age from 1 to 12 years were evaluated. Horses presented for clinical evaluation for a variety of signs including known femoral subchondral bone cysts, periarticular swelling, and lameness localized to the stifle by intra-articular anesthesia. MR images gave excellent visualization of the intra-articular soft tissue structures, cartilage and subchondral bone, medullary bone cavity, and peri-articular soft tissues. In 60% of the horses the entire stifle region including the patella, the femoral condyles, and the proximal tibia was imaged. In 40% of the horses, the cranial-proximal portion of the patella and the cranial-proximal portion of the femoral condyles were outside of the field of view but the remainder of the stifle region was visible. The ultrashort bore construction resulted in distortion at the periphery of the imaging field in the Bo direction. Image distortion was absent following correction. MR findings included subchondral bone cysts with subchondral bone collapse and articular cartilage erosions, medial meniscus tears, thickened cranial cruciate ligament, periarticular soft tissue edema, intra-articular effusion, and high signal (on fat suppressed sequences) in the medullary bone of the femoral condyles and the proximal tibia.

Conclusions: High field MR imaging of the stifle in live horses is feasible. MR imaging identified lesions that were not visible or underappreciated with other imaging methods.
DISTENSION OF THE NAVICULAR BURSA TO DETERMINE THE PRESENCE OF ADHESIONS USING MAGNETIC RESONANCE IMAGING (RESEARCH ABSTRACT)
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Distension of the navicular bursa further delineates pathological changes in the navicular bursa with MR examination. In particular, the presence and degree of adhesions can be defined.

Introduction
Magnetic Resonance Imaging (MRI) is often performed to determine the cause of palmar heel pain. The presence of adhesions within the navicular bursa to surrounding soft tissue structures carries a poor to grave prognosis. The purpose of this study was to evaluate how injection/distension of the navicular bursa affects the MR appearance of the navicular bursa and associated structures.

Materials and Methods
An MR evaluation was performed on six normal cadaver limbs and two cadaver limbs with lameness localized to the foot. The normal navicular bursae were injected with 2, 4, or 6 mL of solution. The bursae of the feet with lameness were injected with 4 or 6 mL, and MRI was repeated. All the bursae were dissected out to verify the presence (or lack of) adhesions.

This procedure was also used in 2 clinical cases. Both Case 1 and 2 had abnormalities on the initial MRI, suggesting adhesions. The navicular bursa was injected with 6 and 4 mL, respectively.

Results
Distension of the proximal recess of the normal navicular bursa, proximal to the collateral sesamoidean ligament (CSL) was achieved with 2 mL. Separation of the CSL from the deep digital flexor tendon (DDFT) was achieved with 4 mL. The separation of the navicular bone (NB) from the DDFT and DSIL required 6 mL. Adhesions were more clearly defined in the bursa of the 2 pathologic cadaver limbs following distension.

Distension of the navicular bursa in Case 1 separated the DDFT from the CSL, demonstrating the absence of adhesions between those structures. Distension of the navicular bursa in Case 2 failed to separate the DDFT from the CSL, confirming extensive adhesions between the DDFT, navicular bursa and CSL.

Discussion
This study demonstrated the usefulness of distension of the navicular bursa to definitively determine the presence of adhesions with MR imaging. The volume required to more clearly evaluate the navicular bursa and surrounding structures depends on the area of interest and the severity of the abnormalities.
COMPUTED TOMOGRAPHIC EVALUATION OF OTITIS IN THE ALPACA

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Introduction/Purpose
Otitis in South American camelids usually goes undetected until the disease has progressed to the clinically severe stages of otitis media or interna. Diagnosis is complicated by the complex camelid ear anatomy. The long ear canal has a maximum diameter of 6 mm, and narrows to 4 mm at a ventral bend midway into the canal. The canal extends a further 1 cm in horizontal depth before the tympanic membrane is reached. This limits the practitioner since complete examination of the canal and tympanic membrane can be impossible in the smaller alpaca as it is only possible in 50% of larger llama species. Computed tomography allows evaluation of otic structures that would not otherwise be visualized, improving diagnosis and subsequently treatment. Although the CT anatomy of the skull of the llama has been described the detailed otic structures have not. This retrospective study used computed tomography to document the normal otic anatomy and the pathological change associated with otitis in the alpaca.

Methods and materials
Seven alpacas with clinical signs of otitis externa, media, or interna were imaged via computed tomographic exam of the skull. Ear swab cytology, culture and sensitivity were performed in all abnormal alpacas. An otoscopic examination using a small endoscope was completed immediately after CT imaging in all cases. For comparative purposes two normal alpacas, with no clinical history or signs of otitis or vestibular disease, were imaged via computed tomography immediately after euthanasia for unassociated reasons.

CT scanning was done with animals under general anesthesia. Six alpacas were positioned in sternal recumbency with their forelimbs positioned caudally. The seventh was positioned in dorsal recumbency for intraoperative scanning. Pre and post contrast, sharp algorithm (130 kV, 125-200 mA, 157-276 mAs), transverse, contiguous, 2.0 - 3.0 mm thick, fixed images were made of the internal, middle and external ear structures for each animal. In areas of particular interest 1.0 mm thick images were obtained. Images were reconstructed with a high resolution algorithm allowing evaluation of bone and soft tissue window displays.

Results
One of the 7 clinically affected alpacas had normal CT results. Two alpacas showed only increased attenuation of the bulla relative to normal alpacas. Four of the 7 abnormal alpacas had increased attenuation combined with expansile lysis of the tympanic bulla, stylohyoid bone, and/or the inner ear. Distinguishing clinical signs did not necessarily differentiate these severely affected cases from those without lysis. Interestingly the HU ranged between -500 to -300 in normal bullae despite the inclusion of septae in a small ROI. The degree of HU elevation in abnormal bullae varied depending upon the type of material present.

Discussions/Conclusions
Computed tomography is important in the staging of otitis in alpacas since the clinical signs do not necessarily differentiate disease severity. The detailed examination of the external ear, which cannot be performed grossly, can be combined with the middle and inner ear images to provide information important for treatment and prognosis. For surgical procedures such as a ventral bulla osteotomy CT is invaluable for intra and post-surgical evaluations.
Introduction/Purpose:
Acromegaly is a syndrome of bony and soft tissue overgrowth and insulin resistance due to excessive growth hormone (GH) and insulin growth factor-1 (IGF-1) secretion. Feline acromegaly is caused by a pituitary adenoma. The condition is encountered most often in middle-aged and elderly, male, cats. The most common secondary problem in these acromegalic cats is insulin-resistant diabetes mellitus. The diagnosis of GH excess can generally be established by measuring basal plasma GH levels (assay not currently available for feline GH). Measurement of IGF-1 concentration may also contribute to the diagnosis. The IGF-1 concentration is less subject to fluctuation than is GH because IGF-1 is protein bound. When acromegaly is suspected in a cat, the pituitary is often examined for size using computed tomography (CT) or magnetic resonance imaging (MRI). CT findings in veterinary medicine are limited to the description of the pituitary tumor. However, other findings are described in humans, including: an enlarged tongue (macroglossia), expansion of the interdental space and thickening of the calvarium (calvarial hyperostosis). Two acromegalic cats with CT findings of calvarial hyperostosis and pituitary macroadenoma are described.

Methods:
Two cats were initially referred for further evaluation of poorly controlled diabetes mellitus (>20U insulin/cat/day). A diagnosis of diabetes mellitus was confirmed with bloodwork (hyperglycemia) and urine analysis (glucosuria). Both cases had physical exam findings included enlargement of the head and body. IGF-1 serum levels were measured (normal levels are 5-70 nmol/L). Skull CT parameters included 3mm, standard algorithm, pre- and post-contrast images (iohexol-240, 1ml/lb) using a GE cTi scanner.

Results:
IGF-1 levels were 323 nmol/L and >132 nmol/L. The measurements of the cross-sectional thickness of the skulls were made at the level of the frontal sinuses and just caudal to the frontal sinuses, in the cranial aspect of the parietal bone. The measurements were compared to normal feline skull CTs and showed a statistically significant difference in thickness. Additionally, these thickened bones were more sclerotic than normal. Macroglossia and expansion of the interdental space was not appreciated in these two cases.

Discussion/Conclusion:
Currently, prevalence of calvarial hyperostosis in cases of feline acromegaly is unknown. We have identified pituitary macroadenomas in acromegalic cats without calvarial hyperostosis. Efforts to assess for calvarial thickening and sclerosis should be made in cross sectional imaging studies that are also assessing for pituitary enlargement in cats.

Introduction/Purpose:
The popularity of reptiles as zoological exhibits and pets is increasing and it can be expected that they will be presented increasingly for advanced veterinary care. Greater demand for advanced diagnostics such as endoscopy, ultrasound and cross sectional imaging should be anticipated. No reports of computed tomographic (CT) or magnetic resonance (MR) anatomy have been published for the green iguana (*Iguana iguana*), a species commonly maintained in captivity. The purpose of this research project is to illustrate the planar anatomy of the green iguana using CT, MR and gross anatomic sections.

Methods:
4 male and 6 female healthy green iguanas were scanned using both modalities, under general anesthesia. Transverse helical CT and transverse and sagittal MR imaging were performed from the level of the rostrum through the proximal tail. The distal limbs were not included. T1 and T2-weighted MR pulse sequences were obtained in both planes. Additional MR imaging in one animal included dorsal plane T1 and T2-weighted sequences and a post-gadolinium T1-weighted transverse sequence. Several animals were subsequently frozen and sectioned into thin transverse and sagittal slices to aid in illustration of the imaging findings.

Results:
In general, high quality images were obtained with both modalities. CT imaging, as expected due to lack of fat between organs, is not well-suited for examination of caudal coelomic viscera in this species, however respiratory and bony anatomy were well depicted. Initial complications in MR imaging included respiratory motion artifact and susceptibility artifact due to metallic material in the cecum. A differing subsequent anesthetic protocol allowed excellent induction of apnea during scanning. MR provided excellent visualization of cephalic, cervical, coelomic and pelvic anatomy.

Discussion/Conclusions:
Using MR, CT and frozen anatomic sections, a pictorial description of the anatomy of normal green iguanas was generated. MR imaging is generally superior to CT under the conditions of this study. This information should be useful to veterinary radiologists and zoological practitioners for interpretation of CT and MR studies in this and related species. It also represents a novel study of green iguana anatomy *in situ*. 
COMPARISON OF PRE AND POST CONTRAST COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE IMAGING FOR THE EVALUATION OF CANINE NASAL NEOPLASIA

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Introduction:
Canine nasal neoplasia is commonly evaluated with computed tomography (CT) to confirm diagnosis, determine disease extent, guide histological sampling location and for radiation treatment planning. With the expanding use of magnetic resonance imaging (MRI) in veterinary medicine, this modality recently has been applied for the same purpose. Aim of this study was to compare the detectability of the features of canine nasal neoplasia in CT and MRI.

Material and Methods:
21 dogs with histological confirmed nasal neoplasia underwent pre and post contrast transverse plane cross sectional imaging prior to treatment. CT images were acquired on a single slice axial CT unit with 5 mm slice thickness with bone and detail image reconstruction algorithm, additional 1-3 mm slices were added at the level of the cribiform plate if indicated. Transverse T2 and pre and post T1 MRI images were obtained on a 1 Tesla unit, slice thickness 3-5 mm with 1-5 mm skip. Post contrast CT and MR images were obtained immediately after administration of I.V. contrast medium, 740 mgI/kg and 57.4 mg gadodiamide/kg, respectively. Five regions of the nose were evaluated separately for the left and right side (nasal cavity: rostral to maxillary recess, at the level of the maxillary recess, at the level of the ethmoid turbinates caudal to the maxillary recess; frontal sinus; cribiform plate) on CT and MR images independently and blinded. Evaluated parameters included A) bony changes (lysis of turbinates, nasal septum and bordering bones and lysis of cribiform plate), which were scored for each area as normal, less than one third destroyed, one to two thirds destroyed, greater than two thirds destroyed, and B) presence and quantification of abnormal soft tissue, which was scored for each area as none, taking up less than one third, taking up one third to two thirds, taking up greater than two thirds of the respective region. Soft tissue attenuating structures were classified as normal, mass, fluid, mucosal thickening with increased enhancement.

Results:
Overall CT and MRI performed very similarly in detecting bony lysis. However, CT detected more lysis of the bordering bones than MRI (p = 0.031). CT and MRI performed similarly in soft tissue mass detection; additionally in the nasal cavity MRI detected more fluid (p = 0.0022), and CT detected more thickened mucosa (p = 0.0047).

Conclusions:
CT and MRI both equally assess the features of canine nasal neoplasia with regards to disease extent and classification.

This work was supported by National Cancer Institute grant number 1PO1 CA88960.
Introduction  Percent tumor necrosis (%TN) of primary osteosarcoma has been shown to predict tumor control and response to treatment. The gold standard for determining percent tumor necrosis is through analysis of pathological tumor specimens. An in vivo method of indirectly estimating percent tumor necrosis would be advantageous for evaluating early response to neoadjuvant treatment and tailoring therapy. The dynamic contrast enhanced (DCE-MRI) pharmacokinetic factor ktrans, is a constant media uptake rate constant that reflects vascular volume, flow and permeability. We hypothesized that a change in ktrans could be associated with %TN either through vascular injury leading to necrosis, or because of poor enhancement of necrotic tumor regions. We assessed this hypothesis by doing DCE-MRI as part of a clinical oncology trial using novel treatment of a group of dogs with osteosarcoma.

Methods  DCE-MRI was performed on 10 dogs receiving single high dose radiation (15 Gy) with or without neoadjuvant immunomodulator of L-MTP-PE, before and again 3-4 weeks after radiation prior to amputation. MRI was done with a GE 1.5 Tesla Signa LX 9.0 instrument after routine anatomic imaging, by gadolinium DTPA IV injection (0.1 mmol/kg using a controlled injector at 3 ml/sec) while repeatedly imaging the tumor volume using 3D SPGR scans, 30 degree flip, 8 mm slice thickness, with 10-12 seconds per phase for a total of 8-10 minutes. Compartmental analysis of the DCE-MRI signal intensity-time curves was done by regions of interest drawn of the entire tumor volume using 3D geometrically constrained region growth (3D GEORG) (Perfusion Analyzer, VirtualScopics Inc. Rochester, NY). Pathology-derived %TN was derived from surgically amputated limb specimens by image analysis of the decalcified, paraffin-embedded, haematoxylin-eosin stained 4-micron thick longitudinal central tumor sections. Data were statistically analyzed and DCE-MRI results compared against the pathologically based percent tumor necrosis.

Results  Ktrans had a poor correlation with %TN. Ktrans and %TN did not statistically differ between treatment groups and averaged 0.1753 (n=5) and 46% (n=4) respectively for the dogs receiving radiation only, and 0.0815 (n=5) and 54% (n=3) for the radiation plus L-MTP group. Ktrans decreased in 6/10 dogs after radiation, changed little in 3/10 and increased in only one dog. Average change in ktrans was -27.6% (radiation only) and -28.6% (radiation + L-MTP). The average percent on nonenhancing tumor volume did not increase after treatment and this was low overall, averaging 10%.

Conclusions  Neither change in ktrans nor percent of enhancing tumor volume predicted %TN of these canine osteosarcomas. DCE-MRI does seem to provide information regarding radiation effects on tumor vascularity because ktrans decreased in many dogs after radiation (similar to previous results). This is subject of further study in our institute. The limitations of this study included low patient number, low ktrans values found in this particular tumor type (presumably due to large amounts of osteoid and bone matrix), and small canine limb vessels making arterial input estimates more variable.
Expression of Epidermal Growth Factor (EGFR) in Malignant Canine Epithelial Nasal Tumors. K Shiomitsu¹, C.L. Johnson¹, D.E. Malarkey², A.F. Pruitt¹, D.E. Thrall¹ ¹College of Veterinary Medicine, North Carolina State University, Raleigh, NC 27606, ²Laboratory of Experimental Pathology, National Institute of Environmental Health Sciences, RTP, NC 27709

Introduction/Purpose: Epidermal growth factor receptor (EGFR) is highly expressed in many epithelial malignancies in humans. EGFR overexpression is associated with advanced stage and poor prognosis in human head and neck cancer. EGFR inhibitors have improved the response to ionizing radiation both in vitro and in human clinical trials. Radiation therapy is the standard treatment for canine nasal tumors but tumor control and the prognosis in many patients is poor. EGFR inhibitors may be able to improve tumor response to irradiation without escalating acute side effects such as mucositis. We assessed the presence and relative levels of EGFR expression in variety of canine epithelial nasal tumors utilizing immunohistochemistry. The results may indicate that some dogs may benefit from treatment with EGFR inhibitors.

Materials and Methods: Twenty five archived samples of canine nasal tumors were selected from over 96 canine nasal tumor patients identified in the pathology archives at North Carolina State University College of Veterinary Medicine between 2000 and 2006. The cases were selected to obtain different representative histologic subtypes of malignant nasal tumors including 12 adenocarcinomas(ACA), 6 carcinomas(CA), 4 transitional carcinomas(TC) and 3 squamous cell carcinomas(SCC). All tissue was originally fixed in 10% neutral buffered formalin and then paraffin wax-embedded. Characterization of tumor type was confirmed in all dogs in H&E stained sections by an ACVP board certified pathologist (DEM). For immunohistochemistry, tissue blocks were recut, and tissue sections were mounted onto slides and dewaxed and rehydrated. The samples were incubated with monoclonal mouse anti- human EGFR. EGFR immunoreactivity was scored based on the product of percent of tumor cells staining positively (0 = 0%, 1 = <10%, 2 = 10 – 30%, 3 = 31 – 60%, and 4 = >60%) and intensity of EGFR staining (1 = mild, 2 = moderate, 3 = heavy intensity). A total score of <2 was considered negative and a score of ≥2 was considered positive.

Results: Thirteen of 25 samples (52%) were positive for EGFR staining. Positive tumors consisted of 5/12 ACA, 4/6 CA, 2/3 SCC and 2/4 TC. Total staining score ranged from 2-12(median = 6, mean = 7.2). Mean score for ACA, CA, SCC and TC was 7.8, 6.5, 4.0 and 10.0, respectively. Staining pattern was predominantly membranous with occasional cytoplasmic positivity.

Conclusion: EGFR expression was observed in 52% of a collection of epithelial nasal tumors and among the 4 different subtypes reviewed. This frequency of EGFR expression supports testing EGFR inhibitors in combination with radiation in canine nasal tumor patients with overexpression of EGFR.
IN VIVO RADIOSENSITIZATION IN DRUG SENSITIVE AND –RESISTANT TUMOR CELLS BY EPOTHILOLINE B
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Introduction/Purpose: The combined treatment of fractionated ionizing radiation with epothilone B, a non-taxoid microtubule-stabilizing drug, has shown an at least additive growth suppressive in vivo-effect in a preceding study (Hofstetter et al., Clin Canc Res, 2005;11:1588-96). This microtubule targeting agent induces a tumor cell directed G2/M-arrest, and displays also anti-angiogenic properties. In order to better understand how the epothilones exert their potential in combination with irradiation in vitro and vivo, we used an epothilone B-sensitive cell line (A549) and a resistant subline (A549.EpoB40) containing a stable β-tubulin-mutation. We hypothesized that an additive effect of epothilone B in combination with IR might primarily be caused by the anti-angiogenic effect, and thus the additive effect could still be observed in the drug-resistant tumor cell line in the in vivo model.

Methods: In vitro radiation- and drug sensitivity was tested by proliferation- and clonogenic assays. Epothilone B-induced M-phase cell cycle arrest was determined by western blotting using the M-phase-specific MPM-2-phosphorylation epitope. Mice bearing subcutaneous tumor xenografts derived from A549 or A549.EpoB40 (mutant) lung carcinoma cells received vehicle or low doses of patupilone followed by clinically relevant, fractionated doses of irradiation.

Results: The antiproliferative effect of epothilone B in combination with ionizing radiation was tested in vitro over 72 hours. An at least additive antiproliferative effect for the A549 cell line in the range of 0.1-0.2 nM and 5 Gy was determined. For the ~100 fold drug resistant mutant cell line no anti-proliferative effect was observed with doses up to 10-20 nM of epothilone B. Interestingly, the MPM-2 epitope could not be identified at epothilone B-concentrations which already induced a strong antiproliferative effect in combination with IR, indicative for a M-phase-independent effect. However, these epitopes could easily be depicted in cells treated with higher concentrations of the drug. In vivo, treatment with epothilone B or irradiation alone resulted in partial tumor growth suppression, whereas combined treatment exerted a strong tumor growth delay in tumors derived from the drug-sensitive cell line A549. No additive tumor growth delay could be observed in irradiated tumors derived from the epothilone B-resistant tumor cell line, when treated in combination with epothilone B.

Discussion/Conclusions: In vitro and in vivo efficacy-oriented experiments against lung carcinoma demonstrate a strong supra-additive effect in the combined treatment modality of ionizing radiation with epothilone B. In vivo experiments with tumors derived from epothilone B-mutant cell line so far indicate that an anti-tumor cell directed and not an anti-angiogenic effect is mainly responsible for the supra-additive efficacy of this promising combined treatment modality.
CORRELATIONS BETWEEN PAIN SCORES AND ACUTE RADIATION SCORES IN DOGS UNDERGOING CURATIVE INTENT RADIATION THERAPY
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Introduction: Pain is commonly associated with curative intent radiation therapy as a result of damage to acute responding tissues like the skin and mucosa. Pain is often undertreated and can pose significant problems for patient management along with potential reductions in client and referring veterinary acceptance of this important cancer therapy. The studies described here were designed to determine if 1) daily pain scoring of radiation patients was practical and useful in the radiation therapy setting, 2) a correlation exists between daily acute radiation scores (ARS) and pain scores, and 3) ARS can be used to predict the need for escalating and intensifying pain management in these patients.

Methods: Dogs undergoing curative intent radiation therapy for cancer of the antebrachium (7), nasal cavity (6), or face (1) were consecutively enrolled. A treatment plan was developed for each patient by a radiation oncologist. Each day prior to therapy two trained observers recorded ARS and pain scores using the Glasgow composite measures pain scale (GCMPS) short form and the visual analog scale (VAS). Dogs were divided into two groups based on the area receiving radiation therapy: antebrachium and nasal/face groups. Daily scores were averaged and scatter plots were developed. Generalized estimating equation regressions were used to calculate standard error, 95% confidence interval, and p-values for each relationship. Confidence and prediction bands were plotted.

Results: A statistically significant (p<0.0001) correlation between mucosa and skin ARS compared to the VAS and GCMPS pain scores was identified indicating that as the mucosa and skin ARS increased so did the pain scores. General correlation between VAS and GCMPS scores were observed. Early (fraction days 1-6) GCMPS scores were significantly influenced by anxiety behavior unrelated to pain. Mucosa and skin ARS were found to precisely predict current and future presence of pain, but could only predict a range of potential future pain scores based on the pain management approach in use during this study. Pain management generally included a progression of sequentially adding the following drugs in combination: NSAID, tramadol, opioid, and in some cases gabapentin. The drug doses tended to be in the low range and were added following increases in pain rather than in anticipation of pain.

Discussion/Conclusions: Mucosa and skin ARS can provide valuable information for initiating preemptive analgesia and intensifying pain management during curative intent radiation therapy. Daily pain scoring with an acceptable pain scale like the VAS should be used in conjunction with the mucosa and skin ARS to improve patient pain management. Future studies will evaluate the impact on pain scores of early drug initiation and increased dosages.
In a study closely resembling the daily practice of craniospinal irradiation in human children diagnosed with Medulloblastoma, six mini pigs of the Hanford strain were used. For this purpose groups of two animals each underwent conventional and experimental fractionated radiation treatment (RT) schemes, or were assigned to a control (sham) group. All animals were repeatedly anesthetized using Isoflurane (IsoFlo™; Abbott Laboratories, North Chicago, IL). The animals were seven weeks of age at the beginning of the experiment. They were followed through puberty to 8 months of age.

We have seen delays in body weight gain but no differences in bone growth of non-irradiated vertebral bodies between the irradiated and non-irradiated, but anesthetized animals. Animals showed reduction in the rates of weight gain by 26% to 74% of the regular rate during the course of experimental treatment compared to the observation period that followed. We not only observed developmental deceleration during repeat anesthesia plus RT but also a distinguishable influence of anesthesia alone on the weight gain of normal, growing mini pigs. The weight gain rates in our sham and treated animals clearly proved statistically significant differences in the growth rates caused by anesthesia alone and in combination with irradiation treatment. The effect of RT would be overestimated. Thus, the effect of anesthesia by its own should not only be considered in the design of animal experiments but the overall performance of pet animals undergoing RT.
ACCELERATED RADIATION THERAPY IN EQUINES
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Introduction/Purpose: Tumors of the equine eyelids and adnexa are classically treated with surgery, local injection of chemotherapeutics (cisplatin), cryotherapy, or laser therapy. Squamous cell carcinoma (SCC) is the most common tumor associated with the eye followed by sarcoids. Both SCC and sarcoids are aggressive local tumors with a high rate of recurrence. Sarcoids are known to recur more aggressively following ineffective treatment. Advanced lesions or poor surgical technique can result in globe-threatening eyelid conformation (stricture, defects, entropion, etc). Environmental conditions most horses are maintained in require functional eyelids and normal defenses to protect their eyes. Radiation therapy is recommended for treatment of dogs or cats with eyelid tumors (especially SCC) as a means of sparing the eyelid and thus the eye. In our facility, SCC of the feline eyelid would be treated with an accelerated radiation protocol of 10 x 4.2 Gy in 5 days. We proposed that horses could be treated in a similar fashion with minimal problems related to radiation therapy and multiple anesthetic episodes, with a resulting curative outcome.

Methods: Three horses have been treated, two for SCC and one for equine sarcoid. All were treated with electrons and fields were planned to include visible tumor and at least 1 cm margins. The horses were anesthetized with a standard total intravenous anesthetic protocol, and transported to the linear accelerated on a moveable couch. The head was placed on the treatment table and positioned under the beam. A wax shield was placed over the eye under the eyelid for each treatment. Treatment was given twice daily, 4.2 Gy per fraction over a 7 day period. One horse with prolonged anesthetic recovery was treated over a 9 day period with some once daily treatments.

Results: Both horses with SCC had complete responses. The horse with a sarcoid had a decrease in size of his mass and improved comfort and function of the eyelid. Early side effects were mild in all cases with hair loss and mild erythema of the skin over 2-3 weeks following radiation treatment. Late effects were primarily mild alopecia. A fibrotic lesion under the lid was found 1 year post therapy in the sarcoid horse but was diagnosed as recurrent tumor.

Discussion/Conclusions: Radiation for equine tumors is feasible and can be done on a daily and even twice daily schedule. The eyelid is especially amendable to treatment and the functional outcome may be better than with other forms of therapy in this area.
EFFICACY OF RADIATION THERAPY FOR THE TREATMENT OF CANINE SIALOCELE.

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Introduction: Salivary mucocele (sialocele) is a collection of saliva that has leaked from a damaged salivary gland or duct and is surrounded by granulation tissue. The usual therapy is surgery to remove the affected salivary gland and tissue. The purpose of this retrospective study was to evaluate the efficacy of radiotherapy (RT) for the treatment of sialocele.

Methods: Dogs with cytologically confirmed sialocele treated at the University of Zürich were included in the retrospective analysis if they received RT and if follow-up information was available.

Results: Ten dogs qualified for the study. Most dogs were treated previously with 1 (n=1), 2 (n=5) or 3 (n=2) surgeries. All were cervical sialocele and the median sialocele volume was 365 cm³ (10.8-936 cm³). All dogs were treated with an electron field. Seven dogs were treated with 3 weekly fractions of 4 Gy (total dose: 12 Gy). The other 3 dogs received 4 fractions of 4 Gy (total dose: 16 Gy) over an 8 days period. Six dogs achieved a complete response and 4 dogs achieved a partial response (most likely residual granulation tissue) after RT. Three dogs had progression of their sialocele: 2, 4 and 7 months post RT. All 3 dogs had received 12 Gy initially and 2 dogs received 2 additional fractions of 4 Gy (final total dose: 20 Gy) and achieved remission for more than 2 years.

Conclusions: The results of this study suggest that RT is useful for the treatment of recurrent cervical sialocele and that the optimal dose and fractionation is not determined but a minimum total dose of 16 Gy seems to be required.
DOSIMETRIC IMPACT OF DAILY SETUP VARIATIONS DURING TREATMENT OF CANINE NASAL TUMORS USING INTENSITY-MODULATED RADIATION THERAPY

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Purpose
Intensity-modulated radiation therapy (IMRT) can be employed in veterinary medicine and in humans to yield dose distributions that conform tightly to target volumes and to introduce steep dose gradients between target volumes and normal structures that reduce high dose volumes within these structures. Because of these sharp gradients, daily setup variations can have an adverse effect on treatment outcome by overdosing adjacent critical structures and/or under dosing target volumes. This study provides an analysis of the impact of daily setup variations on optimized IMRT canine nasal tumor treatment plans when these are not accounted for prior to delivery.

Methods and Materials
The setup histories of ten canine patients with nasal tumors that have been previously treated using tomotherapy (TomoTherapy Inc., Madison WI) were used to study the impact of daily setup variation on optimized IMRT dose distributions. Patients were placed in sternal recumbency in a Vac-Lok™ mattress (MEDTEC, Orange City IA) and scanned by a computed tomography (CT) system using 3.0 to 5.0 mm slice thickness over the head region. Alignment for each treatment was preformed using lasers, immobilization mattress, and volumetric mega voltage CT (MVCT). Setup accuracy was assessed prior to each treatment delivery by measuring translational and angular deviations between the planning kVCT and the MVCT employing fusion image. These 10 patients were retrospectively re-planned using the Pinnacle3® Treatment Planning System (Philips Medical Systems, Fitchburg WI). A five beam, 6 MV, ‘step and shoot’ IMRT plan was generated to deliver 42 Gy to 95% of the PTV while minimizing dose to eyes, brain, and hard palate. Daily setup variations were applied to these IMRT plans on a fraction-by-fraction basis. In order to assess the expected impact of these setup variations on target volumes and critical structures the equivalent uniform dose (EUD) for targets and the mean normalized total dose (NTD_mean) received by normal structures was calculated.

Results
Using conventional mattress immobilization and laser alignment, mean setup error magnitude in any single dimension was at least 2.5 mm (0-10.0 mm). When all 3 translational coordinates were accounted for, mean composite offset vector was 5.9 mm +/- 3.3 mm. The EUD for tumor volumes decreased by up to 5.6% corresponding to a loss in TCP of up to 39.5%. Normal tissue overdosing was common with increases in NTD_mean and NTD_2% ranging up to 33%.

Conclusion
This study suggests that successful implementation of canine nasal IMRT requires rigid immobilization and daily volumetric image guidance verification to ensure accurate delivery. Unrecognized geographical misses could result in significant underdosing of targets and overdosing of critical structures such as the eyes and brain.

This work was supported by National Cancer Institute grant number 1PO1 CA88960.
A DOSIMETRIC COMPARISON OF INTENSITY MODULATED RADIATION THERAPY VERSUS 3-D CONFORMAL RADIATION THERAPY FOR CANINE NASAL TUMOR PATIENTS.

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INTRODUCTION/PURPOSE
The goal of this study was to investigate the theoretical advantages of using Intensity Modulated Radiation Therapy (IMRT) over conventional 3-D Conformal Radiation Therapy (3DCRT) for the treatment of canine nasal tumors. Inverse planned IMRT should provide a more conformal dose distribution to the target volume, minimizing dose to critical normal tissues, thereby reducing the severity of acute effects and the probability of late effects to normal tissues. Improved dose conformity should also allow for dose escalation within the target volume to achieve superior tumor control while maintaining appropriate normal tissue avoidance.

METHODS
Treatment plans and corresponding images from dogs with tumors of the nasal cavity and paranasal sinuses treated with 3DCRT at Colorado State University using a XiO treatment planning system (CMS, St. Louis) from 2005 to 2007 were selected for evaluation. Each patient received a total prescribed dose of 54 Gy in 3 Gy fractions. Using a Varian Eclipse treatment planning system, IMRT plans are being developed retrospectively for each patient using the same dose prescription, as well as a dose escalated prescription. The plans are being evaluated based on the original parameters used to assess the 3DCRT plans developed for clinical treatment. A direct comparison will be made between the plans based on dose heterogeneity, target volume coverage, and dose-volume histograms of irradiated normal tissues.

RESULTS
Preliminary results suggest improved dose conformality to the target volume using inverse planned IMRT when compared with the 3DCRT plans. Mean and maximum dose to normal tissue volumes evaluated are reduced considerably in IMRT plans that use the original prescribed dose.

DISCUSSION
It is predicted that IMRT will provide significant advantage over conventional 3DCRT in both normal tissue preservation and tumor control. Nasal tumor patients may especially benefit from these advantages given the close proximity of tumor to eyes, brain, and oral cavity and the relatively poor prognosis for tumor control with traditional radiotherapy modalities.