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THE LABORATORY DOG

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Disclaimer

- This is not an ACLAM sanctioned presentation
- No information presented is known to be specifically included in ACLAM Board examinations
- This is a highlight of the NIEHS slide set and by no means covers all the things needed to be known about dogs ☺
- All information is deemed reliable and correct
  - No warranty for accuracy

Outline

- Taxonomy
- Reproduction
- Behavior
- **Diseases**
- Models
- Literature

Primary Species

Taxonomy

KINGDOM: Animal
PHYLUM: Chordata
SUBPHYLUM: Vertebrata
CLASS: Mammalia
SUBCLASS: Theria
INFRACLASS: Eutheria
ORDER: Carnivora
FAMILY: Canidae
SUBFAMILY: Caninae
GENUS: ***Canis***
SPECIES: ***familiaris***

Most commonly used dog breed in research?

Reproduction

- Monoestrous cycle
  - Clinical estrus predominantly in Jan/Feb and July/August
- Estrus: 9 days
- Fertilization-may occur as late as 8 days post-coitus
- Ovulated oocytes generally remain viable for only 12 – 24 hours
- Gestation: 59-63d

Reproduction

- Placentation:
  - Endothelialchorial-**4 layers**: uterine endothelium, fetal chorion, fetal mesenchymal and fetal endothelial tissues
  - Zonary-placental villi are arranged in **a belt** around the fetus
  - Deciduate-Maternal decidual cells **shed with placenta**
- Luteal progesterone maintains pregnancy
- Pathological age related conditions in female
  - Cysts, hyperplasia, atrophy, neoplasia

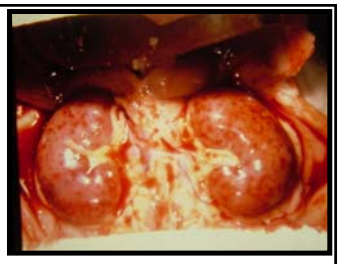
Behavior

- Social, pack animal
- Sexually mature at: 6-9 months
- Socially mature at: 18 – 36 months
- Socialization
  - 3 – 8 weeks of age (conspecifics)
  - 5 – 12 weeks of age (humans)

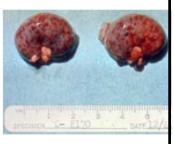
Diseases

- Diseases
  - **Infectious**
    - **Viral**
    - Bacterial
    - Rickettsial
  - Parasitic
  - Miscellaneous
  - Fungal
  - Traumatic
  - Iatrogenic
  - Neoplastic

Description: **Ecchymotic hemorrhages & petechia of kidney**, liver, lungs and GI from a dog



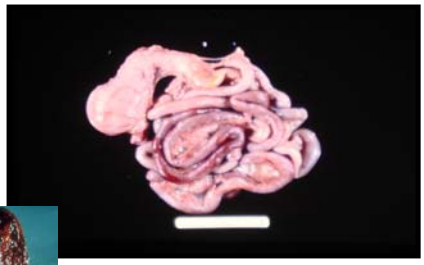
"turkey egg"
Causative Agent:_____



Canine Herpes Virus

- Characterized by rapidly fatal illness in young puppies, and by rhinitis and vaginitis in adults.
- A DNA virus is transmitted by direct contact or saliva.
- Causes focal necrosis and hemorrhage in a variety of tissues. **Basophilic intranuclear inclusions** may be seen.
- Treatment is seldom successful.

Very sick puppy with vomitting and diarrhea,
High mortality, Etiology.....?



Gross appearance:

Segmental hemorrhagic enteritis

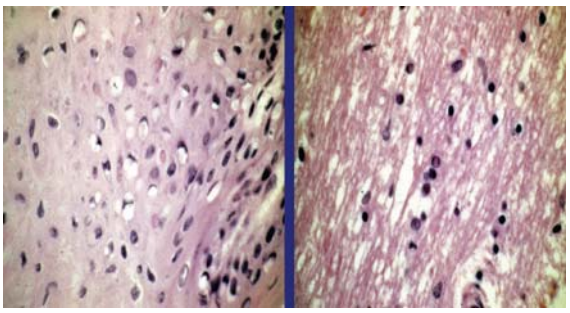
Canine Parvo Virus

- DNA virus –puppies 6-20 weeks
- 85% affected with severe leukopenia
- Affinity for rapidly dividing cells of intestine
- Intestinal crypt necrosis and villous atrophy
- Breeds predisposed?

Suppurative, diffuse bronchopneumonia

enamel defect

Marked ocular and nasal discharge & Hyperkeratosis of the planum nasale and foot pads



INIB tongue

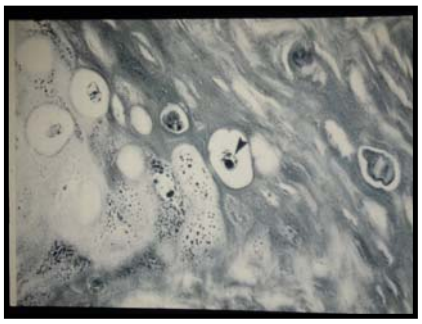
INIB brain

What Virus?

Canine Distemper Virus

- Family Paramyxoviridae
  - Genus? **Morbillivirus**
- Intracytoplasmic inclusions
  - Epithelial cells of mucous membranes, reticulum cells, leukocytes, glia and neurons
- Intranuclear inclusions
  - Glandular epithelium and ganglion cells

Buccal surface- Diagnosis? **Canine oral papillomatosis**



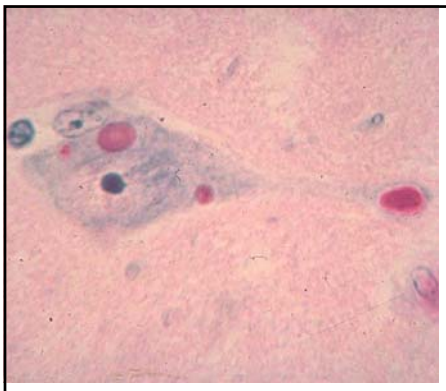
Histo

What is the diagnosis? K9 oral papillomatosis

Primary site of infection? Oral mucosa

Secondary sites of infection? Conjunctiva and planum nasale

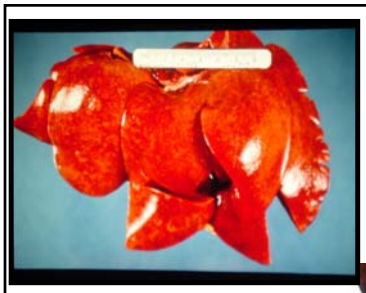
This may progress in the dog to what condition? Squamous Cell Carcinoma



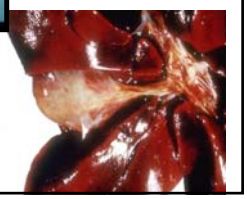
A higher power view of hippocampal cell.
ICIB in purkinjie cells- Specific name for these is_____ **Negri bodies, associated with??**

Rabies

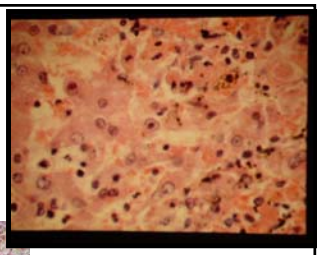
- Rhabdovirus
- Fluorescent antibody demonstration
  - Negri bodies in hippocampal cells
- Virus migrates **centripetally** via peripheral nerves to CNS then brain.
- Virus then moves **centrifugally** to salivary glands

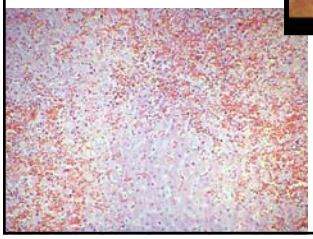


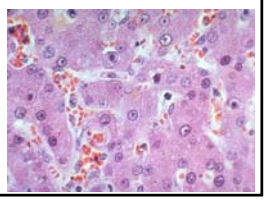
The hallmark lesion of _____is a swollen edematous gall bladder, depicted here.



The characteristic lesion is **hepatic** hemorrhage and necrosis.







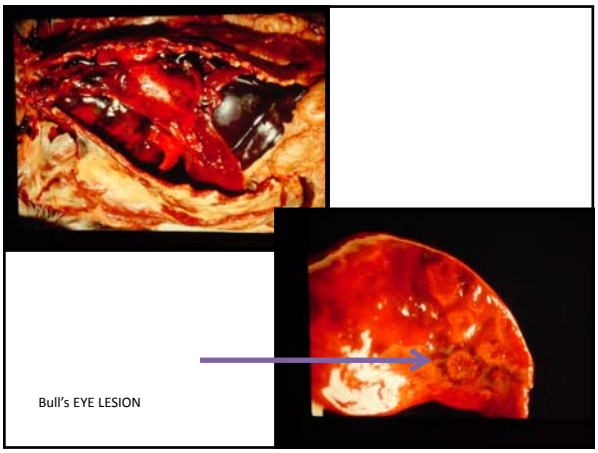
Canine Adenovirus

- CAV-1 (ICH) is a non-enveloped, DNA virus that is transmitted mainly by ingestion.
- Characterized by fever, anorexia, hemorrhages.
- Lesions are necrosis and hemorrhage.
- Produces intranuclear inclusion bodies in hepatic and endothelial cells.
- **Spontaneous corneal opacity** _____ can be seen in the recovery phase.

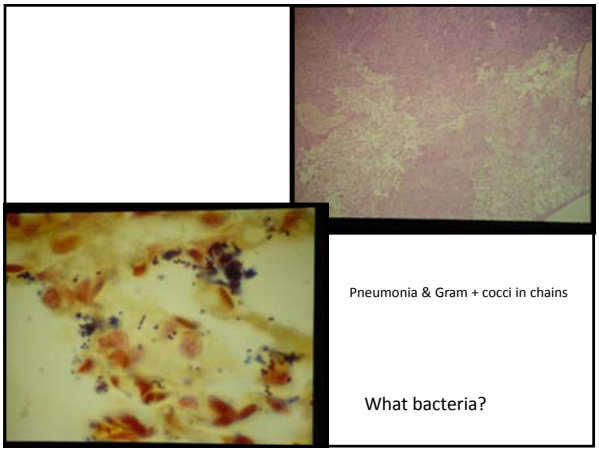
The kidneys are also affected by CAV-1 as shown here. The virus can persist in the kidneys for months, and transmission can occur via contaminated urine

Diseases

- Diseases
  - **Infectious**
    - Viral
    - **Bacterial**
    - **Rickettsial**
  - Parasitic
  - Miscellaneous
  - Fungal
  - Traumatic
  - Iatrogenic
  - Neoplastic



Bull's EYE LESION



Pneumonia & Gram + cocci in chains

What bacteria?

Diseases of the Canine

- *Streptococcus zooepidemicus*
  - Beta hemolytic, Lancefield's Group C Streptococcus
  - Inhabits respiratory tract and vagina
  - Pneumonia and septicemia
  - Epizootics and per acute deaths
    - Transportation within 7 days a factor
    - Hemorrhage
      - Mouth
      - Nose
      - Pleural cavity

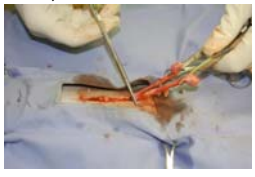
"Bull's eye" lesions on pleural surfaces of lungs

Pyometra- primarily culture

: ***E. coli***

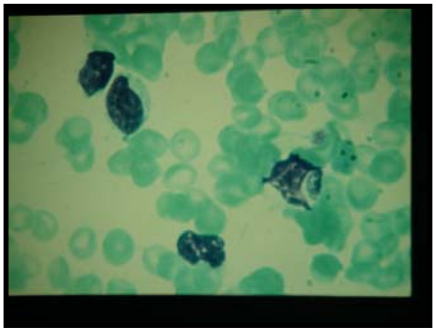
Closed more serious than open- no outlet

Primary Treatment?

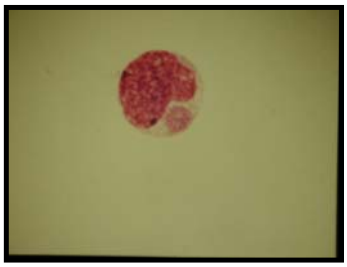


German Shepherd with nasal hemorrhage (SLIDE 1 OF4)

hind leg edema (2/4)



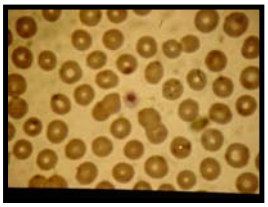
Blood, INTRACELLULAR morula in WBC (present in first two weeks of infection) (3/4)



Macrophage
What disease?

canine rickettsiosis (**canine hemorrhagic fever**, **canine typhus**, **tracker dog disease**, and **tropical canine pancytopenia)** is a TICK BORNE disease of dogs usually caused by the organism *Ehrlichia canis*. German Shepards are thought to be severely affected by the disease, other breeds generally have milder clinical signs.

Transmitted by? **Rhipicephalus sanguineus**- BROWN DOG TICK



Blood smear from research dog in N Carolina
what is the blood cell in center of slide?
Platelet (smaller than RBC)

What is the organism?

Erlichia platys ONLY one that infects platelet...

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Retrospective Clinical and Molecular Analysis of Conditioned Laboratory Dogs (*Canis familiaris*) with Serologic Reactions to *Ehrlichia canis*, *Borrelia burgdorferi*, and *Rickettsia rickettsii*

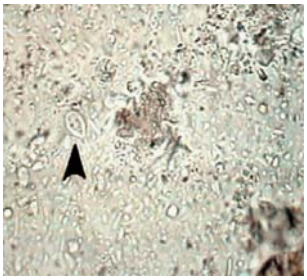
Diana G Scorpio,[1,*] Lynn M Wachtman,[1,†] Richard S Tunin,[2] Nicole C Barat,[3] Justin W Garyu,[1,3,‡] and J Stephen Dumler[3]

Dogs are susceptible to different tickborne infections, including members of the *Anaplasmataceae* (*Ehrlichia canis*, *E. ewingii*, *E. chaffeensis*, *Anaplasma phagocytophilum*, *A. platys*), *Borrelia burgdorferi*, and *Rickettsia rickettsii*. These diseases can manifest with clinical signs including fever, anorexia, malaise, lameness, rash, and bleeding episodes; however, these signs are nonpathognomonic, and infections can occur in the absence of clinical signs. Hematologic abnormalities can include leukopenia, thrombocytopenia, hyperproteinemia and hypergammaglobulinemia. In biomedical research, diseases such as canine monocytic ehrlichiosis, Lyme disease, and Rocky Mountain spotted fever may cause morbidity among exposed dogs and confound research results. Random-source dogs are susceptible to these diseases because of their increased risk of arthropod exposure. Nonpurpose bred, randomly selected conditioned dogs (n = 21) were examined; blood samples were taken for hematology, biochemistry analysis, tickborne pathogen serology, and PCR. Of these, 2 dogs (10% of the population) presented with illness characterized by fever, malaise, lameness, or hemostatic abnormalities, and 15 (71%) had antibodies to one or more tickborne pathogens. No specific hematologic or biochemical differences were apparent between seronegative dogs and seropositive dogs reactive to all 3 pathogens. *E. canis* and *B. burgdorferi* PCR of tissues and blood were negative for all dogs. PCR amplification of several *Ehrlichia* and *Anaplasma* genes yielded no positive samples. From this cohort of dogs, serologic and molecular results indicate prior exposure without active infection or clinical disease. Exposure to and potential for infection with these bacteria and other pathogens may contribute to blood and tissue alterations that could confound experiments and lead to misinterpretation of data in canine models.

Diseases

- Diseases
  - Infectious
    - Viral
    - Bacterial
    - Rickettsial
  - **Parasitic**
  - Miscellaneous
  - Fungal
  - Traumatic
  - Iatrogenic
  - Neoplastic

Diseases of the Canine



Your dog presents with watery, profuse Diarrhea after hiking in the woods and Drinking from a stream…….

Protozoa: Binucleate flagellate
Giardia duodenalis (lamblia)

Dog Esophagus

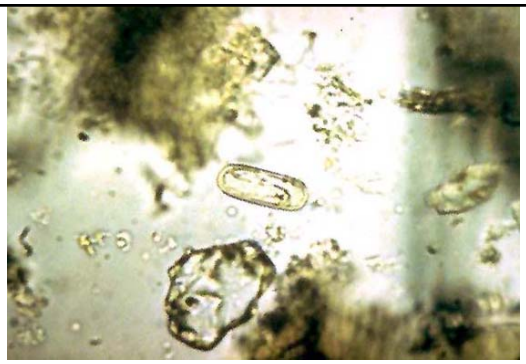
•Tumor like nodules due to granulomatous reaction

•Malignant Tumors often develop at site of nodules

What nematode causes this?

Spirocerca lupi

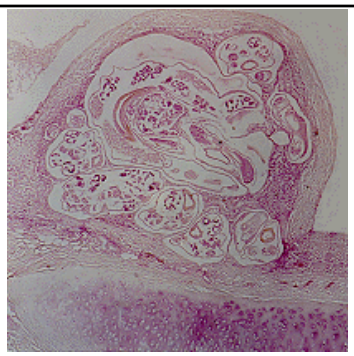
marked breed predisposition to malignancy formation in hounds, pointers and setters.



Egg from Spirocerca lupi
Note eggs are larvated

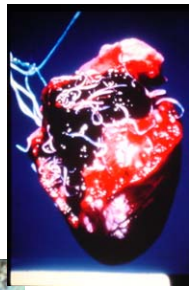
Trachea

Adult nodules in trachea, caused by? **Oslerus (Filaroides) osleri**



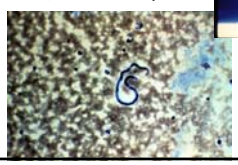
Adults of Oslerus (Filaroides) osleri live in nodules in the trachea of dogs, and larvated eggs laid by adults hatch there. Pups become infected from saliva or feces of an infected dog, in the former case by being licked by their dams= direct life cycle

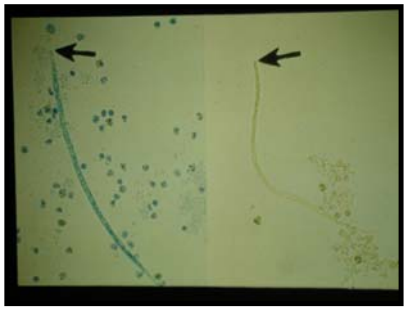
Heartworm- genus and species? ***Dirofilaria immitis***



HW infection is caused by a filarial organism.
At least 70 species of **mosquitos can serve as intermediate hosts**; Aedes , Anopheles , and Culex are the most common genera acting as vectors.

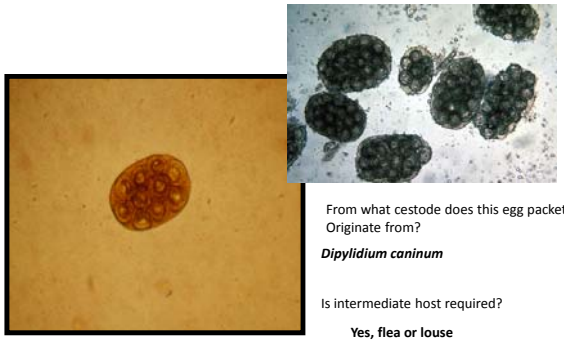
The **severity of cardiopulmonary pathology in dogs is determined by worm numbers, host immune response, duration of infection, and host activity level**.





L= dirofilaria, R= also found in blood, Genus & species?
Dipetalonema reconditum

These filarial worms are transmitted by fleas and biting lice. The adult worms live beneath the skin and microfilariae make their way into the main circulation where the are ingested by fleas.



From what cestode does this egg packet Originate from?

Dipylidium caninum

Is intermediate host required?

Yes, flea or louse

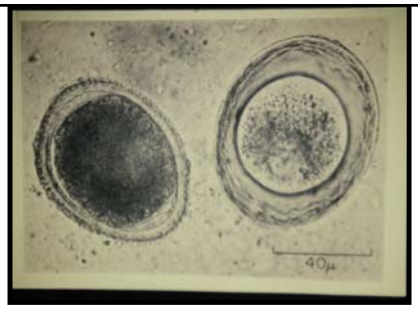
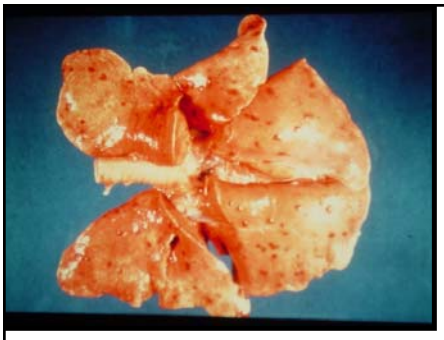
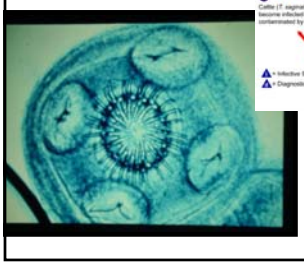


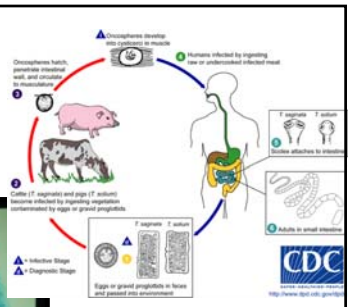
Photo of two common roundworms, what is genus and species?
Left Toxocara canis;
Right Toxascaris leonina



Canine lung- with ascarid migration

What other roundworm related to T. canis is found in raccoons? ***Baylisascaris procyonis***





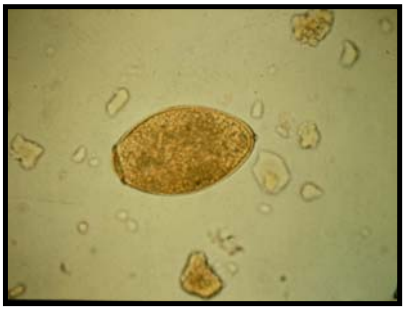
SCOLEX of cestode
What is the common name?

TAPEWORMS

Egg of cestode, what genus and species? ***Taenia pisiformis***

What is the intermediate host? **Rodent or Lagomorph & small ruminants**

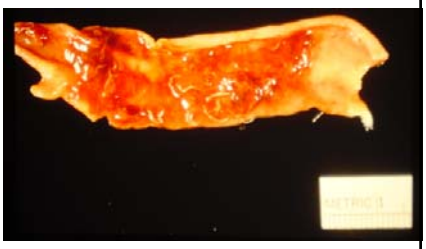
Dog lung (1/2)



Egg found from dog seen in previous lung image (2/2),
What is the common name of this trematode? **Lung Fluke**

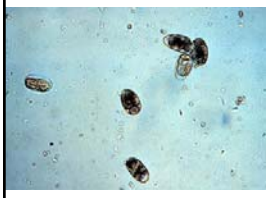
What is genus and species? ***Paragonimus kellicoti, IH?***

Low PCV- Anemia



Hemorrhagic enteritis

An acute normocytic, normochromic anemia followed by hypochromic, microcytic anemia

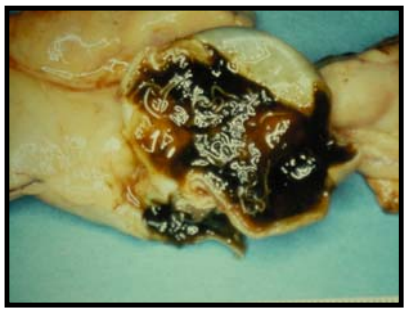


The infective larvae of canine hookworms may penetrate and wander under the skin of people and cause either **cutaneous larva migrans** or eosinophilic enteritis.

Found on fecal float, name the Organism:

Ancylostoma caninum

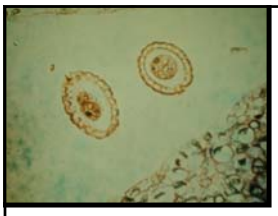
Other Hookworm species?
Uncinaria stenocephala or A. brasiliense

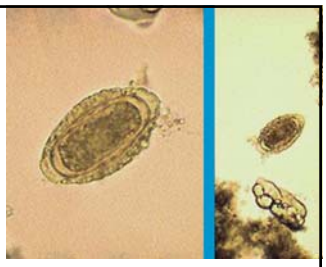


Cecum with typhlitis, causative agent?

whipworm, *Trichuris vulpis*

Kidney

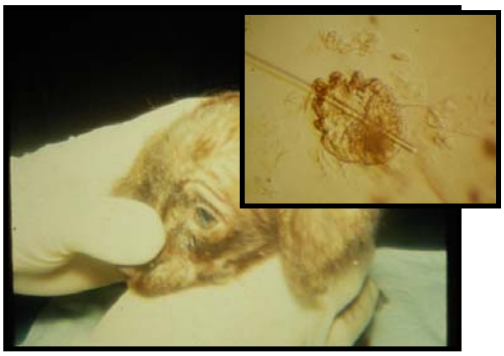




Eggs in renal pelvis:

Dioctophyme renale (giant kidney worm)

The worms are transmitted in aquatic annelids and may be eaten by crayfish resulting in the latter serving as a paratenic host. Worms are usually found in the peritoneal cavity or in large cysts that destroy the integrity of the affected kidney.



Puppy skin scraping reavealed…….
What is genus and species

Sarcoptes scabeii

Ectoparasite seen on this slide? **Brown dog tick**

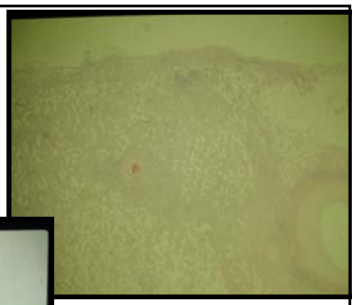
Genus and Species? ***Rhipicephalus sanguineus***

species is unusual among ticks in that its entire life cyclecan be completed indoors (on host)
Clockwise from top right: larva, male, female, nymph
Transmits- *Babesia, Erlichia*, & RMSF- NOT Lyme Disease

Diseases

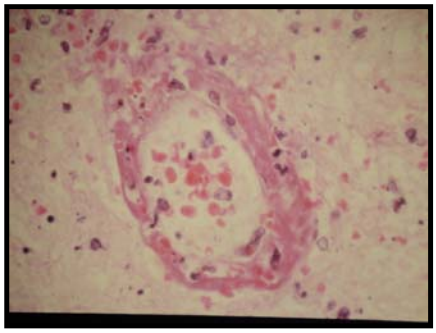
- Diseases
  - Infectious
    - Viral
    - Bacterial
    - Rickettsial
  - Parasitic
  - **Miscellaneous**
  - Fungal
  - Traumatic
  - Iatrogenic
  - Neoplastic

This was a young beagle used for use on a tox study that presented with cervical pain



Beagle's heart

Histo of heart (poor) :
necrotizing vasculitis and periarteritis

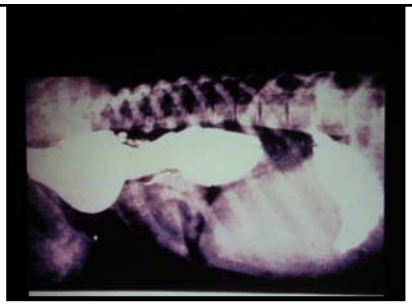


Brain histology from same beagle= showing vasculitis
What is the suspected condition? **beagle pain syndrome (juvenile polyarteritis syndrome)**

Suspected MOA? **suspect immune mediated mechanism, Responds to prednisone, May be hereditary**

Name condition pictured here:
Interdigital cyst- common in BEAGLE (& German Shepard) btwn ¾ digit

Not cysts- chronic inflammation
"sterile pyogranuloma complex", & Gaurded prognosis



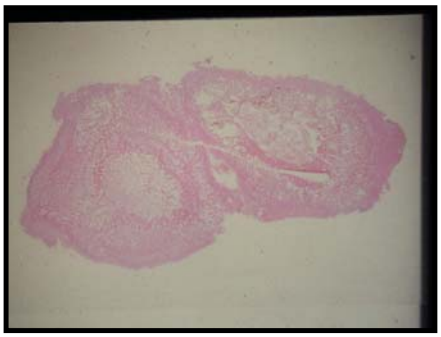
Contrast radiograph showing what malady? **Megaesophogus; causes/breeds?**

Causes- congenital, neuromuscular dysfunction, idiopathic stricture from foreign body, neoplasia, etc.

Breeds commonly affected include: German Shepard, fox terrier, miniature schnauzer, Newfoundland, Great Dane, Irish setter, Chinese shar-pei, pug, and greyhound.

Dog presents as shown

Enlargement of humerus and radius from previously pictured dog



Histology: hyperostosis
Condition? **Secondary pulmonary osteoarthropathy**

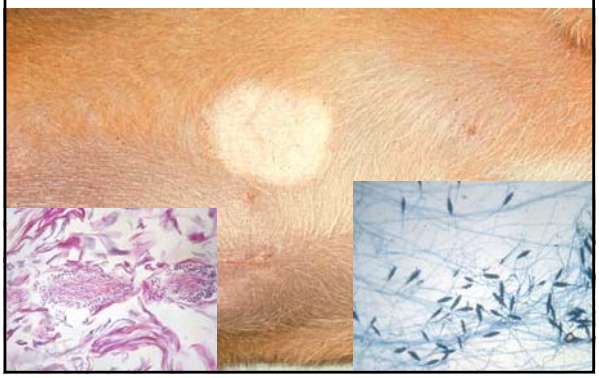
Identify - From dog urine sample **Calcium oxalate crystals**

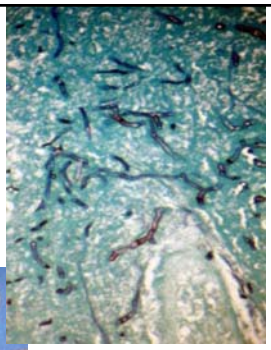
If seen with renal failure what may it suggest? **ethylene glycol toxicosis**

Diseases

- Diseases
  - Infectious
    - Viral
    - Bacterial
    - Rickettsial
  - Parasitic
  - Miscellaneous
  - **Fungal**
  - Traumatic
  - Iatrogenic
  - Neoplastic

What condition? Ringworm in a dog.





Broad poorly septate hyphae

Stain used- Silver

Condition- Pythiosis- Pythium insidiosum

Diseases

- Diseases
  - Infectious
    - Viral
    - Bacterial
    - Rickettsial
  - Parasitic
  - Miscellaneous
  - Fungal
  - **Traumatic**
  - **Iatrogenic**
  - Neoplastic

Diseases of the Canine

- Traumatic Disorders
  - Wounds
  - Pressure Sores - decubital ulcers
  - Acral Lick Granuloma
    - Psychodermatosis
    - Self-trauma promotes release of endorphins
    - Treatment - opioid antagonists
  - Elbow Hygroma
  - Corneal Ulcers

Diseases of the Canine

- Iatrogenic Diseases
  - Indwelling intravascular catheter
    - Infections – number one complication
    - Catheters:
      - Nonthrombogenic
      - Simple as possible
      - Long extension of tubing connect to port best – reduces potential for infection
      - Catheters used to deliver drugs should be placed in the vena cava and not the right atrium to avoid damage to the tricuspid valve

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Vol 46, No 4
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Pages 55–60

Case Reports

Comparison of Two Strategies for Diagnosis and Treatment of Infection in Dogs (*Canis familiaris*) with Long-term Intravascular Catheters

Christina L Winnicker,* Thomas E Martin, and Joanne Tetens-Woodring

Exteriorized chronic intravascular catheters (ECICs) are used frequently for repeated substance administration, sampling, and measuring of hemodynamic parameters in biomedical research protocols. ECICs can be a management challenge because they have been associated with catheter occlusion, thrombosis, sepsis, and serious clinical sequela. A monitoring regimen that identified infection early and a treatment protocol that eliminated infection would be of great benefit to animals and to research protocols using ECICs. Using clinical pathology and other parameters, this study compares 2 management strategies in their ability to maintain the physiologic condition of the animals with ECICs. We compared the clinical outcome of treatment initiated in light of an elevated white blood cell count without delay for development of left shift or clinical signs coupled with prolonged duration of treatment (28 d for the first treatment and 42 d for subsequent treatments) with conventional antibiotic treatment initiated after the advent of clinical signs. Significant findings of the study were that the use of fever as an indicator of infection unnecessarily delayed the initiation of treatment by an average of 12 d and that the use of a single clinical pathologic parameter (white blood cell count more than 18,000 cells/ml) as indication for treatment, with or without fever, in addition to prolonged antibiotic treatment (28 d for the first treatment and 42 d for subsequent treatment) initiated as soon as the white blood cell count exceeded 18,000 cells/ml and without delay for development of fever resulted in superior health of the animals with ECICs.

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Vol 48, No 1
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Pages 76–78

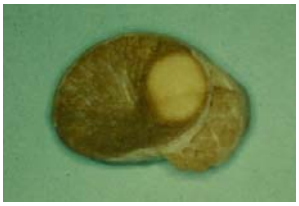
Injury Related to Environmental Enrichment in a Dog (*Canis familiaris*): Gastric Foreign Body

Christin L Veeder* and Douglas K Taylor

A pregnant 7-y-old Beagle crossbreed dog (*Canis familiaris*) presented with clinical signs of lethargy, dehydration, and occasional vomiting. The dog was managed with fluids, antibiotics, and supportive care for several days in an effort to maintain the pregnancy. The bitch aborted the pups at approximately 50 d of gestation and was euthanized due to her poor reproductive performance and age. Necropsy revealed a compact mass of plastic pieces in the pylorus of the stomach. The gastric foreign body was discovered to be the vinyl covering of a bed that was in the dog's run as part of the environmental enrichment program for this animal. The use of that type of dog bed was discontinued. This case emphasizes that any type of enrichment can cause harm and the risks must be assessed carefully before implementing any enrichment device.

Diseases

- Diseases
  - Infectious
    - Viral
    - Bacterial
    - Rickettsial
  - Parasitic
  - Miscellaneous
  - Fungal
  - Traumatic
  - Iatrogenic
  - **Neoplastic**



- Middle aged dog with infantile penis (feminizing) and alopecia, WYD?

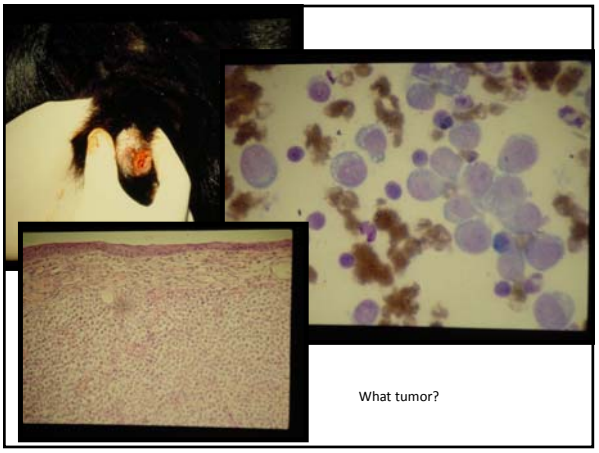
Sertoli cell tumor

What is most common testicular tumor in dog?

Leydig (interstitial cell)

What is other type found in teste?

Seminoma



What tumor?

TVT

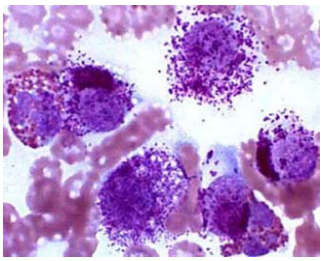
- Canine **Transmissible Venereal Tumor**
  - Round cell, disrete, high N:C ratio
  - Tumor transplantation- *NOT Virus*
- Contagious neoplasm involving external genitalia
  - Spread is thought to occur from secondary implantation from primary tumor- "Sticker tumor", "transmissible sarcoma"
  - What other species in the news recently?

Cell

Genome Sequencing and Analysis of the Tasmanian Devil and Its Transmissible Cancer

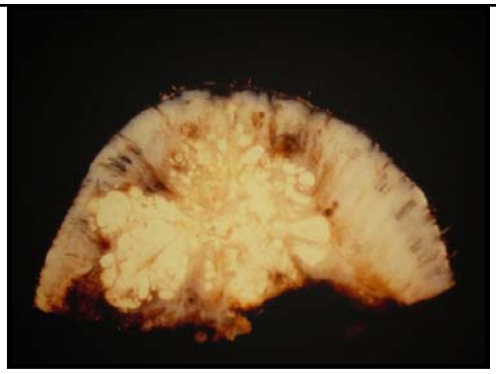
The Tasmanian devil (*Sarcophilus harrisii*), the largest marsupial carnivore, is endangered due to a transmissible facial cancer spread by direct transfer of living cancer cells through biting. Here we describe the sequencing, assembly, and annotation of the Tasmanian devil genome and whole-genome sequences for two geographically distant subclones of the cancer. Genomic analysis suggests that the cancer first arose from a female Tasmanian devil and that the clone has subsequently genetically diverged during its spread across Tasmania. The devil cancer genome contains more than 17,000 somatic base substitution mutations and bears the imprint of a distinct mutational process. Genotyping of somatic mutations in 104 geographically and temporally distributed Tasmanian devil tumors reveals the pattern of evolution and spread of this parasitic clonal lineage, with evidence of a selective sweep in one geographical area and persistence of parallel lineages in other populations.

Diseases of the Canine

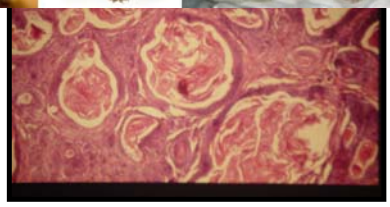


Most common observed skin tumor of the dog? **Cutaneous mast cell tumor**

Secondary lesion? **Gastric ulcers, histamine stimulates H2 receptors of parietal cells**

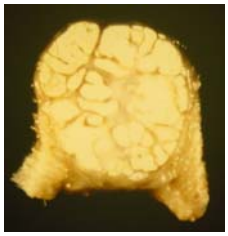


Dog skin



Dog skin- keratinized cysts

Rare follicular tumors of dogs composed of the inferior and isthmic regions of multiple abortive follicles that extrude their lumenal contents into a dilated abnormal cystic infundibulum. A benign usually solitary dome-shaped nodular lesion derived from a hair follicle, they appear as firm nodules which may have tufts of hair protruding. WYD? **Trichofolliculoma (also seen in what other LA?)**



Dog with Cushing's Disease presents with Small firm mass on dorsum….. WYD?

Calcinosis cutis =calcified; associated with Cushing's; hyperadrenocorticism

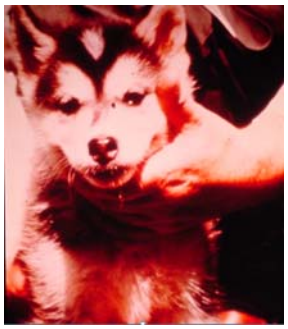
Dermatologic manifestations are numerous and often include truncal alopecia, thin skin, comedones, bruising, cutaneous hyperpigmentation, calcinosis cutis, pyoderma, dermal atrophy, secondary demodicosis, and seborrhea.

Cutaneous mineralization (calcinosis cutis) is a characteristic although infrequent finding in dogs The mineral **deposits occur despite normal blood calcium and phosphorus levels** probably because of the gluconeogenic and protein catabolic actions of cortisol.

Dog Models of Disease

gray collie; What is the most common in this breed with this color mutation?

cyclic neutropenia



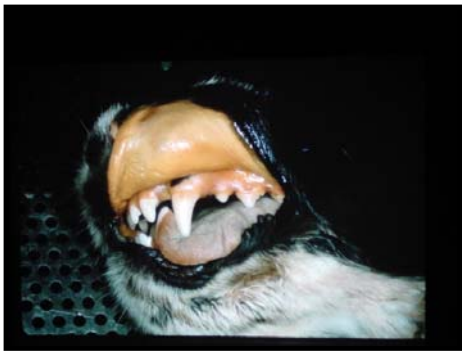
achondroplasia
hemolytic anemia

Alaskan malamute; common diseases of this breed?

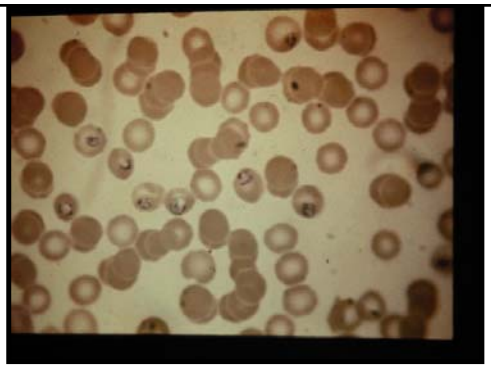
Common names for this disease? **stretchy skin; Ehlers Danlos; dermatosporaxis, collagen disease**

Autosomal Dominant or recessive? **autosomal dominant**

What species is this seen in? **dogs, cats, mink**



hemolytic icterus



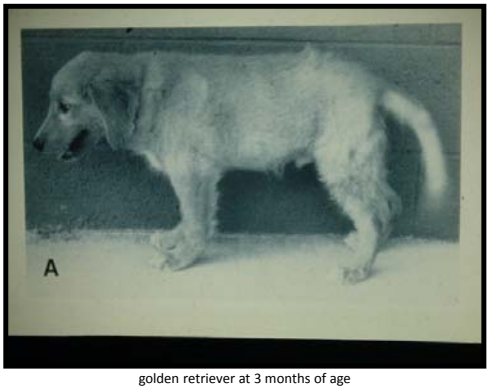
blood smear from previous slide, causitive agent:

Babesia canis
Large babesias "butterfly wings" "two pears"; all forms in blood

English Springer Spaniel with icterus following hemolytic crisis induced by hyperventilation
what is the cause? **PFK (phosphofructokinase) deficiency**

Icteric mucous membranes- Bedlington Terrier

Liver with hepatocellular degeneration
What is the likely diagnosis? **inherited copper toxicosis; copper storage disease, Wilson's disease**
What stain would be used for copper? **Rubeanic acid stain**
What rat strain/stock is a model for this? **LEC rat- Long Evans Cinnamon**
what fish is a model? **white perch= Morones americana**

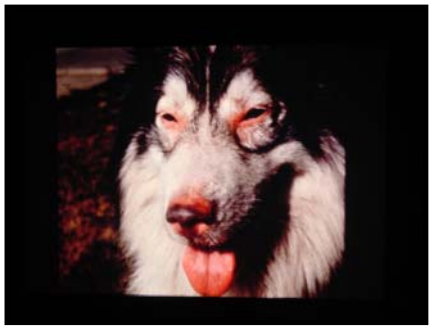


golden retriever at 3 months of age

Canine models of Duchenne muscular dystrophy and their use in therapeutic strategies

Golden at 6 months
What is the disease condition?

Muscular Dystrophy



Dog with depigmentation,photophobia, ocular disorders
What syndrome? **uveodermatologic syndrome ; VKH syndrome= voigt-koyanagi-harada**

Recent Literature

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Vol 58, No 5
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Pages 490-495

A Canine Model of Sustained Atrial Fibrillation Induced by Rapid Atrial Pacing and Phenylephrine

Anusak Kijtawornrat,[1,2] Brian M Roche,[1] and Robert L Hamlin[1,3,*]

Atrial fibrillation is a common arrhythmia with considerable morbidity and mortality. Limitations in studying both the mechanisms and therapy of atrial fibrillation arise due to the paucity of models that yield sufficiently high-quality data, are not costly, and in which atrial fibrillation is sustained long enough to make the necessary observations. The canine model we present is based on the hypothesis that atrial fibrillation requires heterogeneity of repolarization, that distribution of vagal fibers is heterogeneous in the atria, and that atrial fibrillation will persist after reflex stimulation of vagal efferents by increased systemic arterial pressure. Dogs were anesthetized with morphine–chloralose because this combination maintains nearly intact autonomic control. Systemic arterial pressure was elevated approximately 75 mm Hg during infusion of phenylephrine (2 μg/kg · min^{-1}). The right atrium was paced for 20 min at 40 Hz. Atrial fibrillation was sustained after cessation of atrial pacing in dogs receiving phenylephrine, but terminated within seconds in normotensive animals. In conclusion, atrial fibrillation can be maintained for at least 40 min after cessation of rapid atrial pacing in dogs with phenylephrine-induced hypertension.

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Inadvertent Propagation of Factor VII Deficiency in a Canine Mucopolysaccharidosis Type I Research Breeding Colony

Lucas P Carlstrom,[1] Jackie K Jens,[1] Marley E Dobyns,[1] Merry Passage,[2] Patricia I Dickson,[2] and N Matthew Ellinwood[1,*]

Issues of cost and genetics can result in inbreeding of canine genetic disease colonies. Beagles often are used to maintain such colonies, providing stock for outcrosses. Factor VII (FVII) deficiency is a hemostatic disorder found at increased frequency in beagles and has been characterized at the DNA level. Deficiency of FVII presents obstacles in colonies founded with beagles. An initial finding of a FVII-deficient pup from a longstanding colony prompted us to evaluate FVII deficiency fully in this colony. Current and archival records and tissues were used to reconstruct the colony pedigree, assess the contribution from beagles, and test samples to document the source and frequency of the mutant FVII allele. As part of this study we developed a PCR-based diagnostic assay that was simpler than what was previously available. Pedigree analysis revealed a founder effect implicating beagles that led to high frequency (55%) of the mutant allele. In addition, affected animals were identified. The complete picture of the clinical effect within the colony remains unclear, but unusual neonatal presentations, including hemoabdomen, have occurred in pups affected with FVII deficiency. Use of a PCR-based diagnostic assay to screen all potential beagle breeding stock will prevent similar occurrences of FVII deficiency in future canine research colonies.

Abbreviations: FVII, factor VII; MPS I, mucopolysaccharidosis I; PT, prothrombin time.

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Intussusception in Canine Recipients of Hematopoietic Cell Grafts and Surgical Correction

Murad Y Yunusov,[1] Fabio Kerbauy,[1] Kraig Abrams,[1] Eustacia Zellmer,[1] Michele Spector,[2] Christian S Kuhr,[1,4] Billanna Hwang,[1] Barry Storer,[1] George E Georges,[1,3] Benjamin J Weigler,[2] Rainer Storb,[1,3] and Richard A Nash[1,3,*]

Intussusception is a common complication after canine hematopoietic cell transplantation (HCT). The present study was undertaken to evaluate predisposing factors of intussusception and to test whether intussusception can be managed surgically during the period immediately after HCT. We determined the incidence of intussusception after HCT was performed in 325 canine recipients (autologous, n = 43; allogeneic, n = 282) during the interval from January 2002 to May 2005. Intussusception was diagnosed in 16 of 325 dogs (4.9%). Intussusception was not significantly associated with the dose of irradiation, source of hematopoietic graft, use of immunosuppressive agents, gender, or age at transplant. A group of 9 of the affected dogs underwent small-bowel resection after diagnosis, and 7 were managed without surgical intervention. Despite complicating factors such as gastrointestinal toxicity and low neutrophil and platelet counts induced by the marrow conditioning regimen and the use of immunosuppressive agents, successful surgical management of intussusception was achieved in 6 of 9 dogs, as compared with successful management of 0 of 7 without surgery. Intussusception did not recur after surgical intervention in any dog. Recent HCT and post-transplant immunosuppressive therapy are not absolute contraindications to surgical intervention for intussusception in canine recipients of HCT.

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Vol 50, No 3
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Hyperhidrosis in Naïve Purpose-Bred Beagle Dogs (*Canis familiaris*)

Catherine A Carrier,[1,*] Jennifer L Seeman,[1] and Guenther Hoffmann[2]

This case study details the unusual clinical findings in a unique paw-pad disorder that recently emerged among 2 male and 1 female naïve purpose-bred beagle dogs (*Canis familiaris*) newly received into our facility. During acclimation period physical examinations, the affected dogs demonstrated constantly moist, soft paw pads on all 4 feet. No information was available regarding the epidemiology and pathogenesis of this pad condition in beagle dogs. Here, we report the results of physical examination, clinical chemistry analysis, hematology, histopathology, detailed observations, and novel testing techniques performed during the acclimation period. Histopathology of several sections of affected footpads was compared with that of an age-matched dog with clinically normal paw pads. We describe the morphologic features of a distinctive cutaneous canine footpad condition and discuss the possible differential diagnoses. The histologic and clinical features were most consistent with those of hyperhidrosis; to our knowledge, this report is the first description of hyperhidrosis as a distinct condition in purpose-bred beagle dogs.

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Refinement of Canine Pancreatitis Model: Inducing Pancreatitis by Using Endoscopic Retrograde Cholangiopancreatography

Dawn S Ruben,* Diana G Scorpio, and Jonathan M Buscaglia

The causes and treatments of pancreatitis have been studied in diverse species, but the canine pancreatitis model has been used most often due to its similarities to the condition in humans. Although pancreatitis in dogs can be induced readily by numerous methods, managing these dogs can be difficult because they often develop severe abdominal pain, vomiting, inappetance, and lethargy. In an effort to study pancreatitis, we performed a pilot study to determine whether an endoscopic pancreatic procedure would be possible in a dog and whether, through various manipulations, a new method of inducing pancreatitis could be developed. The model uses endoscopic retrograde cholangiopancreatography (ERCP), a common procedure in human gastroenterology that has been associated with postprocedural pancreatitis. Although all 8 dogs used in developing the ERCP model had both biochemical and histologic changes consistent with pancreatitis, 7 of the 8 dogs remained free of classic clinical signs of the disease. This method is presented as a refinement of a canine model and presents an alternative method of inducing pancreatitis, with decreased risk of

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Three-Dimensional Time-of-Flight Magnetic Resonance Angiography of Intracranial Vessels in a Canine Model of Ischemic Stroke with Permanent Occlusion of the Middle Cerebral Artery

Byeong-Teck Kang,[1] Dong-Pyo Jang,[1] Su-Hyun Gu,[1] Young-Bo Kim,[1] Chae-Young Lim,[1] Jong-Hwan Lee,[1] Eung-Je Woo,[1] Zang-Hee Cho,[1,*] and Hee-Myung Park[1,*]

The purpose of this study was to evaluate the potential efficacy of 3-dimensional time-of-flight magnetic resonance angiography (TOF-MRA) to validate a canine ischemic stroke model. Ischemic stroke was induced through permanent middle cerebral artery occlusion (MCAO) in 8 healthy Beagle dogs. T2-turbo spin echo images and TOF-MRA were obtained with a 1.5-T magnetic resonance system before and 3 and 10 d after MCAO. In 3 dogs, angiograms of the brain obtained at 3 d after MCAO showed complete occlusion of the MCA; in addition, T2 hyperintensities were present unilaterally in the striatocapsular and cerebral cortex lesions. Partial occlusion of the proximal part of the MCA was identified in the 2 remaining dogs, with T2 hyperintensities present only in the striatocapsular lesions. The occluded sites were confirmed at necropsy. The results of this study demonstrate the potential of TOF-MRA to provide a detailed description of intracranial arteries and aid in the evaluation of flow impairment in a canine MCAO model.

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Intestinal Cytokine mRNA Expression in Canine Inflammatory Bowel Disease: A Meta-Analysis with Critical Appraisal

Albert E Jergens,[1,*] Ioana M Sonea,[4] Annette M O'Connor,[2] Linda K Kauffman,[1] Sinisa D Grozdanic,[1] Mark R Ackermann,[3] and Richard B Evans[5]

Data implicating mucosal cytokines in the pathogenesis of canine inflammatory bowel disease (IBD) are limited. The aims of the present study were to report new findings of intestinal cytokine expression in dogs with IBD and to compare these data with previous studies through meta-analysis. Cytokine mRNA abundance in intestinal biopsies collected prospectively was evaluated by using a semiquantitative RT-PCR technique. For meta-analysis, an electronic database search revealed 3 clinical trials, all of which were nonrandomized (type III) case series. Prospective analysis showed that the intestines of healthy dogs and those with IBD express numerous cytokines and that a proinflammatory expression profile is not a feature of small or large-intestinal IBD. The meta-analysis data included 158 dogs characterized as healthy (n = 45), diarrheic nonIBD dogs (n = 6), nonresponders (n = 2), small-intestinal IBD (n = 41), colonic IBD (n = 25), and chronic enteropathy (n = 39). German shepherd dogs were overrepresented in 3 of the 4 studies. Healthy dogs showed mRNA expression for most cytokines including IL2, IL4, IL5, IL10, IL12, IFNγ, TNFα, and TGFβ. Only IL12 mRNA expression was increased consistently in small-intestinal IBD, whereas IBD colitis lacked consistent patterns of expression. In summary, dogs with IBD fail to express a predominant Th1- or Th2 cytokine bias in inflamed mucosa. Heterogeneity of results among these studies might be explained by numerous factors including the method of mRNA quantification, stage of disease, and demographic differences in study populations.

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Pages 465–475

The Anatomy of the Glenoid Labrum: A Comparison between Human and Dog

Martin Sager,[1,*] Monika Herten,[2] Stefanie Ruchay,[2] Josef Assheuer,[3] Martin Kramer,[4] and Marcus Jäger[2]

The anatomy of the glenohumeral joint in humans is characterized by static and dynamic stabilizing structures. In particular the glenoid labrum (GL), the proximal attachment of the joint capsule and the lateral glenohumeral ligament, is an important passive stabilizer in the human shoulder. Although canine animal models are used frequently to investigate the complex biomechanics of the shoulder, few data regarding the microstructure of the canine GL are available. In this study, the anatomy of the canine GL and related structures (n = 20) was investigated and compared with the human anatomic situation (n = 36). In both human and beagle joints, the GL consisted of 3 zones—the transition zone, shifting zone, and meniscoid fold, but not all 3 zones were present in all joint segments from canine joints. In particular the peripheral parts of the GL showed rich vascularization in both species. The height and width of the GL in the histologic specimens indicated that the GL is of less importance as a passive stabilizer in dogs. Additional differences between the human and canine GL include the joint ligaments, tendons of the shoulder joint, and lack of rotator cuff. The structural and biomechanical characteristics of the joints of quadrupedal animals raise the question of their appropriateness for shoulder research.

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Comparison of Telemetry and High-Definition Oscillometry for Blood Pressure Measurements in Conscious Dogs: Effects of Torcetrapib

Olivier Meyer, Roland Jenni, Andrea Greiter-Wilke, Alexander Breidenbach, and Henry H Holzgrefe*

This study compared torcetrapib-induced blood pressure (BP) changes simultaneously obtained by high-definition oscillometry (HDO) and telemetry. Male beagles (n = 6) received single oral doses of vehicle or torcetrapib at 10 or 30 mg/kg; BP were acquired simultaneously by HDO and telemetry from 2 h before dosage until 7 h afterward. Systolic, diastolic, and mean arterial pressures (MAP) and heart rate were compared by using Altman-Bland agreement analysis. Dogs were allocated into subgroups according to temperament and baseline MAP (less than 110 mm Hg and 110 mm Hg or greater). Both methods demonstrated high precision. HDO recordings exhibited higher variability for all parameters (inclusive MAP SDs were 7.0 ± 2.7 mm Hg for HDO compared with 3.4 ± 1.9 mm Hg for telemetry), accompanied by a positive bias for all pressures (systolic, 10.4 mm Hg; diastolic, 5.7 mm Hg; MAP, 1.9 mm Hg). Both methods detected similar maximal increases in MAP with 30 mg/kg torcetrapib (HDO, 15.8 ± 10.4 mm Hg; telemetry, 15.8 ± 5.3 mm Hg). No significant effects were noted for heart rate. Torcetrapib elicited a dose-dependent increase in BP in dogs with baseline MAP of less than 110 mm Hg, whereas increases were maximal with 10 mg/kg in the other group, and dose-dependence was no longer observed. BP changes were influenced by animal temperament, demonstrating that HDO results must be interpreted with caution. HDO may provide a useful and accurate method for noninvasive BP measurements in canine studies.

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Small Intestinal Permeability and Serum Folate and Cobalamin Absorption after Surgical Construction of Permanent Jejunal Fistulas in Laboratory Beagle Dogs

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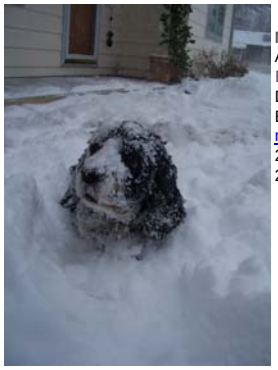
Permanent jejunal fistulas enable easy, noninjurious, repeated and direct administration to and collection from the small intestines of conscious laboratory dogs. This study aimed at identifying potential alterations in the small intestinal morphology and function of this canine model after the surgery required to establish the fistulas. Assays of serum folate and cobalamin and ^{51}Cr-EDTA permeability tests were performed before and 4 wk after experimental jejunoplasties in 14 laboratory beagle dogs. Serum folate concentrations (mean ± SD) before (12.22 ± 1.80 μg/L) and after (14.14 ± 1.70 μg/L) jejunal surgery were within reference ranges for healthy dogs, although folate concentrations were higher after surgery. The cobalamin concentrations and the 6-h urinary excretion of ^{51}Cr-EDTA before (573.50 ± 150.04 ng/L and 6.75 ± 1.56%, respectively) and after (496.71 ± 164.22 ng/L and 6.41 ± 1.10%) were normal for healthy dogs, and no significant differences between pre- and postsurgical values were detected. The findings of the present study indicate that the small intestinal vitamin absorption and permeability of laboratory beagle dogs with jejunal fistulas remains unimpaired.

THE END



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Dog Space

TABLE 3.3 Recommended Minimum Space for Rabbits, Cats, and Dogs Housed in Pairs or Groups*

Animals	Weight,[a] kg	Floor Area/ Animal,[b] ft² (m²)	Height,[c] in. (cm)	Comments
Rabbits	<2	1.5 (0.14)	16 (40.5)	Larger rabbits may require more cage height to allow animals to sit up.
	Up to 4	3.0 (0.28)	16 (40.5)	
	Up to 5.4	4.0 (0.37)	16 (40.5)	
	>5.4[d]	≥5.0 (≥0.46)	16 (40.5)	
Cats	≤4	3.0 (0.28)	24 (60.8)	Vertical space with perches is preferred and may require additional cage height.
	>4[d]	≥4.0 (≥0.37)	24 (60.8)	
Dogs[e]	<15	8.0 (0.74)	—[f]	Cage height should be sufficient for the animals to comfortably stand erect with their feet on the floor.
	Up to 30	12.0 (1.2)	—[f]	
	>30[d]	≥24.0 (≥2.4)	—[f]	

*The interpretation of this table should take into consideration the performance indices described in the text beginning on page 55.

[a]To convert kilograms to pounds, multiply by 2.2.

[b]Singly housed animals may require more space per animal than recommended for pair- or group-housed animals.

[c]From cage floor to cage top.

[d]Larger animals may require more space to meet performance standards (see text).

[e]These recommendations may require modification according to body conformation of individual animals and breeds. Some dogs, especially those toward the upper limit of each weight range, may require additional space to ensure compliance with the regulations of the Animal Welfare Act. These regulations (USDA 1985) mandate that the height of each cage be sufficient to allow the occupant to stand in a "comfortable position" and that the minimal square feet of floor space be equal to the "mathematical square of the sum of the length of the dog in inches (measured from the tip of its nose to the base of its tail) plus 6 inches; then divide the product by 144."

[f]Enclosures that allow greater freedom of movement and unrestricted height (i.e., pens, runs, or kennels) are preferable.