Retinal Pathology

Dick Dubielzig
Normal Retina
Normal Primate Fovea
Golden Eagle Convexiclivate Fovea
Multi-focal ERG
Avian Photoreceptors
Cystoid Change in Dogs and Cats

- **Dogs**
  - Cystic degeneration in the retinal neuropil
  - Cystic spaces have hyaluronic acid
  - Age related

- **Cats**
  - Cystic changes are in the pars plana epithelium
  - Cystic spaces filled with hyaluronic acid
  - Age related
Feline
Canine
Retinal Folds/Dysplasia
Vitreoretinal dysplasia

- General characteristics
  - Retinal detachment and giant tear in severe cases
  - Liquid vitreous or vitreous strands
  - Disorganized retina, rarely
- Oculoskeletal syndrome
- Shih Tzu vitreoretinopathy
- Feline vasoproliferative vitreoretinopathy
Oculoskeletal Dysplasia
Labrador/Samoyed
Oculoskeletal syndrome
Oculoskeletal syndrome
Growth plate
Oculoskeletal syndrome
Oculoskeletal syndrome
Oculoskeletal syndrome: Inner retinal gliosis
Shih Tzu Vitreoretinopathy
Shih Tzu Vitreoretinopathy
Feline vasoproliferative vitreoretinopathy

- Seen as a developmental disorder in young cats
- Avascular peripheral retina and vascularized vitreous in the area of the central retina
- Interrupted vascularization of the peripheral retina like Retinopathy of Prematurity (ROP)
- Features other than the primary lesions
  - Retinal detachment
  - PIFM and PAS
  - Glaucoma
  - Hemorrhage
80% OXYGEN FOR 21 DAYS AND THEN ROOM AIR

Experimental Retinopathy of Prematurity (ROP)
Feline Vasoproliferative Vitreoretinopathy
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Feline Vasoproliferative Vitreoretinopathy

Avascular Peripheral Retina
PIFM - Preiridal fibrovascular membrane
Photoreceptor Loss

- Progressive Retinal Atrophy (PRA)
- Phototoxic Retinopathy
- Fluoroquinolone Toxicity in Cats
- Taurine Deficiency in Cats
- Oxidative Stress &/or Vit E Selenium Def.
- SARDS
- Phototoxicity
- Other Toxic Reactions
PRA
Normal Irish Setter

Early PRA Irish Setter
Phototoxic Retinopathy
Albino Laboratory Rodents
Fluoroquinolone retinal toxicity in cats

• Baytril™ (Enrofloxacin)
  – Discovered after Bayer was allowed to switch from 2.5 mg/kg to 5 to 20 mg/kg
  – Disappeared after the dose was dropped to no more than 5 mg/kg

• Orbifloxacin™ (Orbax)
  – Discovered in a safety evaluation after the Baytril issue became public
Fluoroquinolone retinal toxicity
Acute Baytril™ Toxicity

Control
Three Day Toxicity
Five Day Toxicity
Seven Day Toxicity
Thirty Day Chronic Retinopathy, Orbax ™
Thirty Day Chronic Retinopathy, Orbax™
Baytril™
Feline Central Progressive Retinal Degeneration (Taurine Deficiency)
Feline Central Progressive Retinal Degeneration
Feline Central Progressive Retinal Degeneration
Feline Central Progressive Retinal Degeneration
Feline Central Progressive Retinal Degeneration
Feline Central Progressive Retinal Degeneration
Canine Central Progressive Retinal Atrophy

Retinal Lipofuscinosis
Central Progressive Retinal Atrophy
PAS stain

Autofluorescence
Retinal toxicity

RPE cell swelling
Canine Hemeralopelia

Definition (Millodot’s *Dictionary of Optometry and Visual Science*)
- A term used to mean either **night blindness** …
or **Day blindness**…
- European definition … night blindness

- **Day Blindness in Alaskan Malamute**
- **Achromatopsia**
Phototoxicity in Albino Rodents
Acute Phototoxicity in Albino Mice
Retinal Trauma/Contusion

• A blunt blow to the eye at just the right force sets up an energy wave which propagates through the retina and fragments the tissue.

• A more powerful force will tear the retina, but not propagate as a wave.

• A less powerful force can cause reversible damage with no detectable structural damage.
Acute Severe Trauma
Neonatal Horse Kicked
Lenticular metaplasia in the traumatized bird retina

- Lenticular metaplasia can be induced in vitro in the chick embryo, but not the hatched bird retina (Research that was popular until the mid-80s)
- Müller cells switch from GFAP to αA-crystallin
- Cells become phenotypical lens balloon cells
Lenticular metaplasia
αA-crystallin
Lenticular metaplasia
Sudden Acquired Retinal Degeneration Syndrome (SARDS)

- Sudden blindness
- Flat ERG, indicative of photoreceptor damage
- Affected dogs have
  - PU/PD
  - Obese
  - Polyphagia
SARDS
SARDS
SARDS
Apoptosis by TUNEL assay
Retinal Detachment

• Normal retina prevented from detaching because of the tight junctions of the Müller cells and tight junctions at the apex of the RPE cells
• Vitreous body provides gentle support
• Morphologic features
  – Material in subretinal space
  – Hypertrophy of RPE cells
• Risk Factors for Detachment
  – Trauma
  – Vascular leakage
  – Retinal traction
  – Retinal holes
Normal Retina
Subretinal fluid
Giant Retinal Tear (Equine)
RPE hypertrophy, “tombstoning”
Not likely to be Retinal Detachment
Retinal holes

• Causes of retinal holes
  – Trauma
  – Traction
  – Retinal degeneration
  – Infarction
Retinal holes
Giant Retinal Tear
Retinal Holes
Viral Retinal Diseases

- Canine distemper
- Herpes in llama
- West Nile virus in raptors
Canine Distemper
Canine Distemper
Canine Distemper
Canine Distemper
Herpesvirus Retinitis in Llamas
Herpesvirus Retinitis in Llamas
Herpesvirus retinitis:
Retinal degeneration &
Viral inclusion bodies
Herpesvirus Retinitis in Llamas
West Nile Virus in Raptors
West Nile Virus in Raptors
West Nile Virus in Raptors
West Nile Virus in Raptors

Pectenitis
West Nile Virus in Raptors

Immunohistochemistry
Equine Senile Retinal Degeneration

- Seldom clinically significant
- Multi-focal to coalescing peripheral retinal degeneration
- Abnormal RPE neuroretinal relationship
With retina removed, showing RPE changes
PAS+ membranous matrix material
Ora ciliaris retinae
RPE Hypertrophy
Bilateral Optic Atrophy of Macaques

- Variable decrease in ganglion cells in the macula with NO OTHER changes in the retina
- Decreased axons in the temporal aspect of the optic nerve and NO OTHER changes
- No behavioral changes noted
- Severe changes can be picked up on fundoscopy but the mild changes are difficult to recognize
- Not detected on standard ERG
- Severe changes associated with diminished flash VEP
- Southeast Asian origin???
Bilateral Optic Atrophy of Macaques
Normal Male
Bilateral Optic Atrophy of Macaques

Normal Male
Bilateral Optic Atrophy of Macaques
Normal Male
Bilateral Optic Atrophy of Macaques
Severely-affected Female
Bilateral Optic Atrophy of Macaques
Severely-affected Female

Temporal

Nasal
Bilateral Optic Atrophy of Macaques
Severely-affected Female
Bilateral Optic Atrophy of Macaques
Moderately-affected Male
Temporal  Nasal
Bilateral Optic Atrophy of Macaques
Moderately-affected Male
Moderately-affected Control Female
Moderately-affected Control Female
Moderately-affected Control Female
Hypertensive Choroidal and Retinal Vasculopathy

- Affects both dogs and cats
- Vascular disease can be localized and needs to be searched for with a PAS stain
- Hemorrhage, retinal detachment
- Rarely affects the iris
Hypertensive Vasculopathy
Hypertension
Hypertensive Vasculopathy

Fibrinoproliferative Lesion
Hypertensive vasculopathy in the choroid
Diabetic Retinopathy in Dogs

Although clinical complications of spontaneous diabetic retinopathy in dogs are extremely rare, the dog has successfully been used experimentally to induce diabetic retinopathy.

Proliferative neovascularization and retinal detachment are the only features which cannot be induced.
Canine Experimental Diabetic Retinopathy
Canine Experimental Diabetic Retinopathy
Canine Trypsin Digest

Normal

Diabetic
Canine ocular gliovascular syndrome

• The syndrome consists of the following:
  – Intraocular hemorrhage
  – Neovascular glaucoma
  – Retinal detachment
  – Clusters of GFAP+ cells in the vitreous behind the lens
  – Neovascular proliferation extending into the vitreous from the retina or optic nerve head
• Glassy hyalin collagen surrounds the neovascular proliferation
Canine ocular gliovascular syndrome
Retinal Tumors in dogs

22 cases in COPLOW/5964 total tumors

- Glioma (astrocytoma)
  - GFAP+
  - Usually central +/- extension into the optic nerve
  - Optic nerve extension determines prognosis
Other retinal tumors

GFAP

Synaptophysin
Retinoblastoma, human