Eye of the Tiger:
Common Feline Eye Conditions
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Lecture Outline

- Feline Herpes Virus – 1
- Feline Uveitis
- Feline Glaucoma
- Retinal Detachment

Feline Herpes Virus-1

- Causative agent of feline viral rhinotracheitis
- Widespread in US - seroprevalence of 50-97%
- Common cause of upper respiratory disease
- MOST common cause of ocular disease
- “Herpes until proven otherwise”

FHV-1: Pathogenesis

- Direct contact
  - Salivary, nasal, ocular secretions
  - Highly contagious
- Infects epithelial cells
  - Respiratory tract, conjunctiva, cornea
- Kittens infected ~ 8-12 weeks old
  - In utero maternal transmission
- Viral-induced cell death
  - Cell lysis → spread to adjacent cell

- Viral clearance (~20%)
  - Primary Infection
    - Latency in trigeminal ganglion (80%)
  - Flare up
    - Viral re-activation – clinical flare ups
      - Associated with stressful events
      - New pet, travel, concurrent illness, steroid therapy, ?
    - Disease manifestation varies
      - Primary infection vs. Recrudescent disease

FHV-1: Disease Manifestations

- Primary exposure in kittens
  - Malaise, fever, sneezing, anorexia
  - Rhinitis, conjunctivitis
  - Supportive care often necessary
  - Can be fatal in young kittens
- Recrudescent “flare up” in adults
  - Often more mild
  - Transient squinting, tearing, discharge
  - May be unilateral
  - Ocular disease can be significant
  - Respiratory signs NOT always present

FHV-1: Clinical Syndromes

- Conjunctivitis
- Corneal Ulcers
- Stromal Keratitis
- Corneal Sequestrum
- Eosinophilic Keratitis
FHV-1: Conjunctivitis
- Most common manifestation of FHV
- Clinical signs
  - Blepharospasm
  - Ocular discharge
    - Serous, mucoid, mucopurulent
  - Conjunctival hyperemia
  - Chemosis
  - Fibrinous, cellular exudates

FHV-1: Ophthalmia Neonatorum
- Conjunctivitis prior to eyelid opening
  - Swelling, hyperemia, pus
  - Establish drainage
- Symblepharon
  - Conjunctival adhesions
    - Break down early, often
    - Regrow aggressively – don’t cut!

FHV-1: Corneal Ulceration
- 2nd most common manifestation
- Viral-induced epithelial cell loss
- Large, superficial ulcer
  - Early dendritic appearance
- Secondary bacterial infection
  - Stromal loss
  - Corneal inflammation
  - Corneal melt, perforation

Kittens & Exploding Eyeballs
- Corneal perforation, dramatic granulation response
  - Surgery is NOT an emergency
  - Systemically ill, immunocompromised, pediatric

FHV-1: Stromal Keratitis
- Inflammatory / immune-mediated
  - Dead / inactive viral particles in stroma
- Deep vascularization
- Stromal haze
- Minimal pain
- No ulceration
**FHV-1: Corneal Sequestrum**
- Corneal stromal necrosis
- Chronic ulceration
- Incomplete blink / brachycephalic
- Black, brown, auburn lesion
  - +/- vascularization
  - +/- ulceration
  - Variable depth
  - Not melanin, not porphyrins...
- Painful when ulcerative
- Discharge, conjunctivitis, chemosis

**FHV-1: Eosinophilic Keratitis**
- “Proliferative keratoconjunctivitis”
- Inflammatory / immune-mediated
- Massive infiltration of WBCs
  - Eosinophils, lymphs, neuts, plasma cells
- Pink raised tissue, lateral limbus
- Vascularization
- White dots
- Ulceration @ leading edge
- Unilateral or bilateral
- 3rd eyelid involvement

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**FHV-1: Diagnostics**
- Confirming FHV-1 is problematic
  - Assume herpes unless proven otherwise
- Available testing methods
  - Virus isolation
  - Fluorescent antibody
  - Serum antibody titers
  - PCR
    - Extremely insensitive
  - Cytology
    - If not vaccinated
  - PCR
    - Clinically normal cats harbor FHV...
  - Cytology
    - Rule out Mycoplasma, Chlamydia

**FHV-1: Treatment**
- Therapeutic goals
  - Reduce viral replication
  - Prevent secondary bacterial infection
  - Reduce inflammation / pain
- Considerations
  - Is treatment necessary?
  - Systemic vs. topical
  - Supportive care
  - Source of stress?

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**FHV-1 - Treatment**
- Indications for treatment
  - Kittens with primary infections
  - Adult cats with moderate – severe conjunctivitis
  - Chronic conjunctivitis
  - Every corneal ulcer
- Treatment Options
  - Antibiotics
  - Antivirals
  - Anti-inflammatory
  - Lysine supplementation

**Antibiotic Therapy**
- Systemic
  - Significant URI
    - Clavamox, Azithromycin
- Topical
  - Moderate to severe conjunctivitis
  - Corneal ulceration
Antibiotic Therapy

**PROPHYLACTIC / NON-INFECTED**
- Erythromycin ointment
- Ciprofloxacin / Tobramycin
- q6-8h dosing

**INFECTED**
- Ofloxacin solution
- +/- Cefazolin solution
- q2.4h dosing


Anaphylactic events observed within 4 h of ocular application of an antibiotic-containing ophthalmic preparation: 61 cats (1993–2010)

Karen M Hume-Smith et al., Alissa o Diggle et al., Mark Walshin et al., Eve nico,

Linda A Walter-Mitt et al., Signe J Runkel et al., David J Rago et al.,

- Polymyxin B in all cats
  - 50% showed signs w/in 10 mins
  - GI, cardiac, resp, neuro, ocular
  - Most survived, 8 died

Antiviral Therapy

- Mainstay of therapy for FHV-1
- No feline-specific drugs
- Safety & efficacy studies
- Virostatic drugs

**Indications**
- Upper respiratory signs
- Mod – severe conjunctivitis
- Chronic conjunctivitis
- Corneal ulceration

Antiviral Options

<table>
<thead>
<tr>
<th>Drug</th>
<th>IC&lt;sub&gt;50&lt;/sub&gt;</th>
<th>Preparations</th>
<th>Availability</th>
<th>Dose Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trifluridine</td>
<td>1–19</td>
<td>1% solution</td>
<td>Commercially available</td>
<td>Topically q4-6h</td>
</tr>
<tr>
<td>Idoxuridine</td>
<td>4–7</td>
<td>0.1% solution, 0.5% ointment</td>
<td>Compounded</td>
<td>Topically q4-6h</td>
</tr>
<tr>
<td>Cidofovir</td>
<td>11</td>
<td>0.5% solution</td>
<td>Compounded</td>
<td>Topically q12h</td>
</tr>
<tr>
<td>Famciclovir</td>
<td>14</td>
<td>125, 250 mg tablets</td>
<td>Commercially available</td>
<td>15-50 mg/kg PO q8-24h for 7-14 days</td>
</tr>
</tbody>
</table>


Antiviral Therapy

- Trifluridine 1%
  - Commercially available
  - Very effective against FHV
  - Frequent dosing: 5-6 times daily
  - Topical irritation in many cats

- Idoxuridine
  - Compound: 0.1% solution, 0.5% ointment
  - Frequent dosing: 5-6 times daily
  - Well tolerated by most cats

Antiviral Therapy

- Cidofovir
  - Compound: 0.5%, 1% solution
  - Refrigerated
  - Shown to be highly effective
  - Reduces clinical disease
  - Reduces virus shedding
  - Long half-life of metabolites
  - Twice daily application!
### Antiviral Therapy
- **Famciclovir**
  - Commercially available
  - 125 mg, 250 mg tablets
  - Compounded: smaller tablets, liquid suspension
- Very effective
  - Antiviral activity via metabolite, penciclovir
- Complex pharmacokinetics
  - Experimentally: 90 mg/kg TID
  - Anecdotally: 15-40 mg/kg SID – TID

### Anti-Inflammatory Therapy
- **Surface ocular inflammation**
  - Pain, swelling, discharge, adhesions
  - Use cautiously – concurrent antivirals
- **Topical steroids** are CONTRAINDICATED
  - **Topical NSAIDs**
    - Diclofenac 0.1%
    - Flurbiprofen 0.03% - irritating
  - T-cell modulation
    - Cyclosporine 0.02% ointment, 1% suspension
    - May also improve tear film quality

### Lysine Supplementation
- Many conflicting studies
  - Bolus vs. continual supplementation
  - Shelter cats!
  - **NO** household cat data
- Not a sole therapy for FHV-1
  - Reduces severity / frequency flare ups
  - Many forms available
    - Powders, gels, foams, treats!
    - Bolus: Kittens 250 mg BID / Adults 500 mg BID

### Corneal Sequestrum
- **Treatment**
  - **Medical**
    - Antivirals
    - Topical antibiotics
  - Some may slough
    - Months - years
  - Surgical
    - Superficial keratectomy

### Eosinophilic Keratitis
- **Diagnosis**
  - Appropriate clinical picture
  - Cytology is diagnostic

### Eosinophilic Keratitis
- **Treatment**
  - Dramatic response to topical steroids
    - Pred acetate 1% TID – QID x 2 weeks
    - Taper slowly over months
    - Recurrence possible
  - **Topical antibiotics**
    - Peri-lesional ulcers
    - Ofloxacin TID x 2 weeks
  - **Systemic antivirals**
    - Famciclovir 40 mg/kg SID x 21d
**FHV Summary**
- FHV-1 is VERY COMMON
- Many clinical syndromes
- Adult cats may not have resp signs
  - Still probably FHV-1!!
- Antivirals are mainstay of therapy
- Steroids are dangerous
  - NPDex = never use in cats!!

**Uveitis Defined**
- Inflammation of the uvea
  - Anterior uveitis – iris, ciliary body
  - Posterior uveitis – choroid, retina
  - Panuveitis

**Uveitis: Etiology**
- Primary ocular disease
  - Corneal ulcers
  - Cataract
  - Primary ocular neoplasia
- Systemic disease
  - Infectious
  - Inflammatory
  - Metastatic neoplasia

**Uveitis: Etiology: Infectious**
- Viral
  - FIP/FeLV/FIV
- Protozoal
  - Toxoplasma gondii
- Bacterial
  - Bartonella henselae
- Fungal
  - Cryptococcus neoformans
  - Coccidioides immitis
  - Blastomyces dermatitidis
  - Candida albicans

**Uveitis Etiology: Neoplastic**
- Primary ocular
  - Uveal adenoma/adenocarcinoma
  - Uveal melanoma
  - Post-traumatic ocular sarcoma
  - Solitary ocular lymphoma?
- Metastatic to the eye
  - Lymphoma
  - Adenocarcinoma
  - Fibrosarcoma
  - Anything is possible...

**Uveitis Etiology: Miscellaneous**
- Hyphema
  - Retinal detachment, coagulopathy, trauma
- Immune-Mediated
  - Idiopathic, lymphocytic/plasmacytic
  - Chronic, recurrent

>75% of cases!
Clinical Signs

- Signs of pain usually mild
- Blepharospasm, epiphora
- Blood-aqueous barrier breakdown
- Aqueous flare (protein), cells
- Fibrin
- Hyphema
- Hypopyon
- Keratic precipitates

Clinical Signs

- Iris changes
- Miosis
- Hyperemia
- Swelling
- Discoloration
- Mass lesions
- Synechia

Clinical Signs

- Posterior uveitis
- Chorioretinal lesions
- Inflammation
- Hemorrhage
- Retinal detachments
- Hazy vitreous

Uveitis: Diagnostics

- Bloodwork
  - CBC/Chemistry/UA
  - FeLV/FIV snap test
- Imaging
  - Chest x-rays
  - Abdominal ultrasound
- Infectious disease testing
  - Feline Serology: FeLV/FIV, FCV, Toxo, Crypto (Antech)
  - Bartonella serology (NCSU)

Uveitis: Treatment

- Anti-inflammatories
  - Topical anti-inflammatories – q6-12
    - Pred acetate 1%
    - Diclofenac 0.1%
  - Oral steroids
  - Posterior segment? Drops won’t work!

- Atropine – q12-24
  - Reduces pain, stabilizes BAB, prevent synechia

- Oral antibiotics
  - Doxycycline, Azithromycin – Bartonella suspect cats

Chronic Uveitis

- Chronic sequelae
  - Cataracts
  - Lens luxation
  - Synechiae
  - Phthisis bulbi
  - Retinal detachment
  - Metastasis?
  - Secondary glaucoma

- Enucleation
  - Diagnostic, therapeutic
Uveitis Summary
- Idiopathic / immune-mediated is most common
- Infectious, neoplastic
- Miotic pupil, iris color changes
- Aggressive therapy to prevent sequelae
- Enucleation – secondary glaucoma, masses

Ocular Anatomy Review

Aqueous Humor Dynamics
- Ciliary body → pupil → anterior chamber → ICA

Intraocular Pressure
- Balance between formation & drainage

Glaucoma Defined
**False:**
Glaucoma is an elevated intraocular pressure
- “Ocular hypertension”
- Excessive restraint
- Jugular vein compression
- Temporary post-surgical spikes

**True:**
Glaucoma is a neurodegenerative disease caused by an elevated IOP
- Ganglion cell / optic nerve death
- Loss of visual function

Elevated Intraocular Pressure
- ALWAYS due to decreased drainage of AH
  - Never increased production
- “Closed angle” glaucoma
  - Malformation
  - Obstruction
- “Open angle” glaucoma
  - Humans, beagles (research)
  - Metabolic derangements
Glaucoma Classification

- **Etiology**
  - Congenital
  - Primary
  - Secondary

- **Duration**
  - Acute
  - Chronic

Etiology: Congenital Glaucoma

- Uncommon in dogs & cats
- Developmental malformation of ICA
  - PPM’s, cataract, retinal dysplasia
- IOP elevates by 3-6 months old
- Unilateral or bilateral
  - Rapid buphthalmos
  - Lagophthalmos
  - Corneal disease

Etiology: Primary Glaucoma

- Inherited malformation of ICA
  - "Goniodysgenesis"
- Very common in dogs – Cocker, Bassets, Chows, Bostons
- Rare in cats – Burmese, Siamese, Persian

Etiology: Secondary Glaucoma

- Very common in dogs & cats
- Obstruction of ICA
  - Red blood cells
  - White blood cells
  - Tumor cells
  - Lens

Feline Diffuse Iris Melanoma

- Melanocytic proliferation (melanosis)
- Neoplastic transformation (melanoma)
  - Variable time frame
    - Slow to metastasize (LN, lung, liver)
  - Minimal uveitis, minimal pain

Feline Diffuse Iris Melanoma

- Glaucoma is common sequelae
- When to enucleate?
  - Rapid progression in pigmentation, mass-like lesions
  - Younger cats
  - Free-floating pigment cells in anterior chamber
  - Glaucoma
- Submit the globe!!
Glaucoma Duration

ACUTE GLAUCOMA
- Elevated IOP < 6-24 hours
- Vision salvageable?
- ~50% regain sight

CHRONIC GLAUCOMA
- Elevated IOP days - weeks
- Permanent vision loss
- IOP reduction for pain relief
- Almost all cats present in chronic stage

Glaucoma: Clinical Signs

DOGS
- Pain
- Blepharospasm
- Epiphora / discharge
- Head-shyness
- Elevated 3rd eyelid
- Lethargy anorexia
- Episcleral injection
- Corneal edema
- Dilated pupil / neg PLR
- Vision loss

CATS
- Minimal pain
- Minimal corneal edema
- Dilated pupil / neg PLR
- Vision loss

Making the Classification

- Primary glaucoma
  - Minimal intraocular inflammation

- Secondary glaucoma
  - Corneal vascularization
  - Aqueous flare / hyphema / hypopyon
  - Iris color change / synchia / swelling
  - Cataract
  - Chorioretinal lesions

Glaucoma: Diagnosis

- Tonometry
  - Estimation of IOP

- Techniques
  - Indentation = Schiotz
  - Applanation = TonoPen
  - Rebound = TonoVet

Glaucoma: Therapy

- Therapeutic goals
  - Reduction of IOP
  - Emergency?
  - Regain / preserve vision
  - Alleviate pain
  - Treat underlying cause
**Glaucoma: Therapy**

- **Carbonic anhydrase inhibitors**
  - Reduces formation of aqueous humor
  - **ORAL:** Methazolamide
    - Cats: 0.5-2 mg/kg q8-24h
    - Side effects
      - GI, hypokalemia, metabolic acidosis – cats very susceptible
  - **TOPICAL:** Dorzolamide 2%
    - 38% reduction of IOP @ TID dosing
    - Side effects
      - Irritation / hypersensitivity, salivation

- **Beta-blockers**
  - Reduces formation of AH by CB
  - Supplement to other medications
  - Side effects – bradycardia, bronchoconstriction
    - Contraindicated in asthma, cardiac disease
  - Timolol maleate 0.5%
    - Mild reduction in IOP
  - Dorzolamide / Timolol (Cosopt®)
    - No greater IOP reduction vs. Dorzolamide alone

- **Prostaglandin analogs are ineffective in cats**
  - Latanoprost, Bimatoprost, Unoprostone
  - Cats lack PGF<sub>2alpha</sub> receptors in ciliary body

**Glaucoma: Summary**

- **DOGS**
  - Primary or Secondary
  - Acute or Chronic
  - Medical options
    - Timolol
    - Dorzolamide
    - Latanoprost
  - Surgical options
    - Enucleation
    - Evisceration / Prosthetic

- **CATS**
  - Secondary, Chronic
  - Medical: Dorzolamide
  - Surgical: Enucleation

**Glaucoma: Surgery**

- **DOGS**
  - Visual eyes
    - Anterior chamber shunt
  - Trans-scleral laser
  - Endoscopic laser
  - Blind eyes
    - Enucleation
    - Evisceration
    - Chemical ablation

- **CATS**
  - Enucleation

**Glaucoma: Surgery**

- **Enucleation**
  - Removal of globe, 3<sup>rd</sup> eyelid, conjunctiva, eyelid margins
  - Simple procedure, minimal complications
  - Minimize tension on globe – shorter optic nerves
  - Allows for histopathology!
  - 3 layer closure
    - Orbital rim mesh, SQ, skin
  - Post-Op care
    - Oral antibiotics x 2 weeks
    - Pain control (Buprenex)
    - E-collar
Retinal Detachment

- Very common in elderly cats
- Systemic hypertension (>250 – 270 mmHg)
- Renal, cardiac, thyroid disease
- Acute anisocoria, vision loss
- Hyphema possible, not always present

Exam Findings

- Subretinal bullae
- Retinal vessels visible in pupil
- Negative menace, negative PLR
- “Red haze” through pupil
- Retinal hemorrhages

Diagnostics

- Systemic BP (doppler)
  - Note size, location - monitoring
- IOP
- CBC/Chemistry/T4

Treatment

- Blood pressure control
  - Amiodipine 0.625 mg SID-BID
- Treat any anterior uveitis
  - Topical Pred acetate
  - Atropine

Prognosis for visual return

- Acute bullous detachments – fair to good
- Chronic / torn retinas / extensive bleeding – poor

Take Home Points

1. Antivirals are the mainstay of therapy for FHV-1
2. NeoPolyDex should NOT be used in cats
3. Uveitis is often idiopathic, hunt for infection/cancer
4. Glaucoma in cats is secondary, chronic
5. Retinal detachments are commonly hypertensive
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