Unique Anatomy

Elliptical pupil
Nasal and temporal ciliary nerves innervate papillary sphincter
Prominent major arterial circle
Deep anterior chamber
Pectinate ligaments visible without gonioscopy

Fundus

Small, round, gray optic nerve head
Unmyelinated, therefore slightly depressed
No vascular anastomosis over the nerve head
Very large yellow tapetum surrounds optic nerve head
3-4 main arteriolar/venule branches

Normal values

Schirmer Tear Tests – Mean = 17 mm +/- 6 mm (range=11-23mm)
   However, sympathetic tone can completely shut down tear production resulting in 0 mm wetting
Intraocular Pressures = 15-20 mmHg
Palpebral fissure length – 28 mm

Diseases

Congenital defects
Adnexal and Orbital Diseases
Corneal Diseases
Uveitis
Cataract
Glaucoma
Retinal Diseases
Neoplasia

Congenital Defects

Eyelid agenesis

Absence of eyelid margin, usually affecting the dorsolateral eyelid margin
Associated with PPM’s and intraocular coloboma of iris and optic nerve in Snow Leopards and some domestic cats
Results in trichiasis and exposure keratitis

Treatment:
Medical management with topical lubricants
Cryosurgery to remove trichiasis hairs
Eyelid reconstruction
Various techniques reported such as rotational pedicle flap

Corneal/conjunctival dermoid

Fleshy mass with hair/hair follicles on corneal &/or conjunctival surface
Congenital Cataract and Microphakia

Usually nuclear cataract that becomes compressed and less significant to vision with age and therefore don’t often require surgery

Dilemma=formation of neural pathways from retina to brain during development
- May preclude functional vision if opacity persists long enough to prevent this development

Persistant Pupillary Membranes

Iris to iris – not clinically significant
Iris to lens or iris to cornea may cause corneal or lens opacity and some vision impairment

Retinal Dysplasia

Vermiform or linear retinal folds

Causes:
- Developmental anomaly
- Heredity
- In-utero panleukopenia infection

Not typically significant to vision
Non-progressive

Adnexa Diseases

Entropion

Medial entropion – common conformational abnormality in brachycephalics
Spastic entropion – seen in intact males and cats w/ FHV-1 related keratoconjunctivitis
Tx: modified Hotz Celcus +/- very conservative lateral canthoplasty (don’t want to shorten lids much as the palpebral fissure length is already small relative to globe size)

Blepharitis

Demodex (rare)
Scabies (Notoedres cati) – very pruitic and contagious
Myiasis (Cuterebra sp.)
Dermatophytosis (M. canis>M. gypseum & T. mentagrophytes)
- Zoonotic potential!!
  Tx: topical miconazole, clotrimazole or thiabendazole or systemic griseofulvin or ketoconazole
  **Must avoid contact of topical preparations with the cornea & conjunctiva
Eosinophilic granuloma complex
  Dx: eosinophils on cytology or biopsy
  Tx: systemic corticosteroid
  Px: excellent response to treatment
Feline herpesvirus
  Blepharitis + multifocal/diffuse dermatologic disease
  Alopecia, lichenification, crusting
  Tx: Interferon-alpha 2a or 2b – 30-1000 IU PO SID x 7 days on, 7 days off, lysine 500-1000 mg PO SID or divided BID, +/- systemic antibiotics for secondary bacterial infection

Corneal and Conjunctival Diseases

Feline eosinophilic keratoconjunctivitis
Feline infectious keratoconjunctivitis
Corneal sequestrum
Bullous keratopathy

Feline Eosinophilic Keratoconjunctivitis

Clinical signs: Conjunctival hyperemia with thickening and a cobble-stoned appearance
  Corneal vascularization extending from the limbus and pink-white stromal infiltrate
White caseous surface exudate
Usually mild to no pain/blepharospasm
Diagnosis: Cytology from conjunctival scrape reveals eosinophils and/or mast cells

Treatment:
1. Topical corticosteroids (careful, because commonly seen associated with FHV-1)
   a. 3-4 times daily initially, then wean over several weeks
   b. May try to discontinue after 4-6 weeks
   c. Consider treating with L-lysine or interferon to reduce risk of FHV-1 recrudescence.
2. Megesterol acetate – 5 mg/cat PO SID x 5 days, then 2.5 mg PO q 48 hours x 5 days, then continue to wean. Can often wean down to 1.25-2.5 mg once weekly and can sometimes wean off completely without recurrence.
   Side effects: diabetes mellitus, pyometra, weight gain, mammary gland hyperplasia, neoplasia, behavioral changes

Feline Infectious Conjunctivitis
4 common infectious etiologies:
1. Herpesvirus
2. Chlamydia
3. Mycoplasma
4. Calicivirus

1. Feline Herpesvirus-1 Keratoconjunctivitis (see VM-612 Conjunctival notes for more)
   Conunctival clinical signs:
   - Conjunctival hyperemia, chemosis
   - Epiphora
   - Classic “herpes discharge” = red-brown
   - Blepharospasm
   - Conjunctivitis is much more common than keratitis

   Corneal clinical signs:
   - Early corneal manifestation: punctate to linear or dendritic ulcers
   - Later, these may coalesce and form larger geographic ulcers

   Diagnosis:
   - Fluorescein staining
   - Rose Bengal staining: a vital stain; therefore, stains devitalized epithelial cells before they have sloughed and created an ulcer. However, this stain can be toxic to epithelial cells, especially in high concentration; therefore, is rarely used.
   - Culture and susceptibility to rule out secondary infection if cornea is ulcerated with stromal loss and/or cellular infiltrate
   - Corneal/conjunctival cytology

   Treatment:
   - Minimize stress in cat’s environment!!!
   - L-Lysine 500-750 mg PO daily in canned food
   - Interferon alpha 2a or 2b
     - 30-100 IU PO daily
     - Can alternate 7 days on therapy with 7 days off therapy
     - 30-1000 IU/ml topical solution: start at 3-4 times daily and wean to lowest possible dose without recurrence of clinical signs
*Topical antivirals should be reserved for cases with corneal ulceration!!
-Not needed for conjunctivitis unless very severe
-Irritating and expensive!
-See VM-612 for list of antivirals
-Idoxuridine and vidarabine are least irritating
-Use ointment form 3-4 times daily until ulcer healed

*Biannual intranasal/topical ocular FHV-1 vaccine
-Provides local IgA immunity to reduce number and severity of flare-ups

*Topical Oxytetracycline (Terramycin®) ou qid for 3 weeks may be used if cornea is ulcerated to prevent secondary infections while the disease runs its course.

Prognosis:
Infection is usually self-limiting and resolves in approximately 21 days
Guarded—herpes is forever!!
-Must inform clients that the disease may be controllable, but is not curable due to latency of virus in trigeminal ganglion.

Sequelae:
Punctate, linear or diffuse corneal scarring
Symblepharon: adhesions of conjunctival to corneal or conjunctival surfaces due to ulceration of the epithelium
Corneal sequestration and/or mineralization
Nasolacrimal obstruction due to conjunctival scarring
Keratoconjunctivitis sicca

2. Chlamydial conjunctivitis
- Clinical signs: begins unilateral, may spread to other eye in 3-7 days unless treated. Chemosis, hyperemia, mucopurulent discharge (pseudomembrane)
- Diagnosis: cytology (intracytoplasmic inclusion bodies between days 7 and 14 of infection, PMN's); IFA on conjunctival scrapings (do not stain before collecting specimen).
- Treatment:
  Oxytetracycline (Terramycin®) or chloramphenicol ointment qid for 3 weeks
  Oral doxycycline 5 mg/kg PO for 3 weeks – clears carriers
- Prognosis: good - usually responds well to treatment
- Zoonotic: causes conjunctivitis in humans ("pinkeye" in children); therefore, advise clients to wash hands after handling and treating affected cats.

3. Calicivirus
- Clinical signs:
  Mild to moderate conjunctivitis
  Oral mucosal ulcers, 7-10 days duration
- Treatment: Supportive. Usually recover without sequela

4. Mycoplasma conjunctivitis
- Clinical signs:
  Usually unilateral, but may spread
  Mild hyperemia, pseudodiphtheritic membrane can be peeled off
  Serous to mucopurulent discharge
- Diagnosis: by signs and cytology (coccoid clusters on epithelial cell wall)
- Treatment: Oxytetracycline or chloramphenicol topically or doxycycline PO

Corneal Sequestrum:
Definition: a desiccated and necrotic region of corneal stroma undermined by inflammatory cells
Clinical signs:
Blepharospasm, epiphora
Light brown-yellow to dark black discoloration of usually the axial corneal stroma
Corneal vessels may extend to the sequestrum and can result in extrusion or sloughing of the plaque
May or may not have associated corneal ulceration

Causes:
- Brachycephalic conformation with lower medial entropion and increased corneal exposure and desiccation
- FHV-1
- Any chronic corneal irritant

Treatment:
- Surgical excision (keratectomy +/- conjunctival pedicle graft) provides the most rapid healing
- Topical antibiotics if ulcerated
- Topical lubricants improve comfort and may help prevent recurrence
  - Genteal
  - Celluvisc
- Topical interferon??
  - Some ophthalmologists use; no scientific reports

Prognosis:
- Fair to good with surgery
- Can recur, but conjunctival grafting and addressing the primary cause may reduce recurrence

Bullous Keratopathy
Clinical signs:
- Rare condition unique to cats
- Acute onset of a focal severe swelling of the corneal stroma

Cause: unknown

Treatment: Third eyelid flap to apply pressure to the swollen stroma

Uveitis
Clinical signs:
- Epiphora, aqueous flare, miosis, conjunctival hyperemia/chemosis, corneal edema, keratic precipitates, iridal neovascularization (“rubeosis irides”), iridal nodules, inflammatory cells in the vitreous (“hyalites”)

Causes:
- Always suspect systemic disease!!! 38-70% are diagnosed with systemic disease!
- FELV, FIV, Toxoplasmosis, FIP, FHV-1, systemic mycosis, bartonellosis
- Idiopathic/immune-mediated
- Young cats & kittens can have recurrent mild-moderate episodes of uveitis
  - No cause determined—viral??
  - Resolve quickly with topical anti-inflammatory treatment

Diagnosis:
- Thorough physical exam is imperative!
- Start with CBC, Profile, UA and choose additional diagnostics based on signalment, history and PE and bloodwork + risk of exposure to infectious diseases.

Treatment:
- Topical anti-inflammatories
  1. Diclofenac 0.1% (Voltaren) – 3-4 times daily, then wean
  2. 1% prednisolone acetate (Econopred or Pred Forte) – 3-4 times daily, then wean
    a. Caution—watch for FHV-1 flare-up
- Atropine 1% ophthalmic ointment!!
  *Don’t use atropine solution in cats—the bitter taste makes them salivate profusely!!

Sequela:
- Posterior synechia and lens capsule pigment deposits
Cataract
Lens luxation
Secondary glaucoma
Retinal degeneration
Blindness

Prognosis:
Guarded, depends on the etiology

Cataracts
Congenital cataracts
Nuclear—usually get smaller with age and usually don’t require surgery
Hereditary cataracts – very uncommon in cats
Most cataracts in cats are secondary to uveitis!!

Glaucoma
Primary glaucoma is rare and is often congenital or neonatal
Siamese
Secondary glaucoma
Causes:
Most glaucoma in cats is secondary to uveitis!!
Aqueous misdirection syndrome
Not well understood
Shallow anterior chamber secondary to anterior displacement of lens
Treatment is lens removal and vitrectomy

Uveal cysts
Not yet reported in scientific literature, but anecdotal reports
Large cysts behind iris result in compromise of iridocorneal angle
Treatment: laser photoablation of cysts is curative

Intraocular neoplasia
Treatment:
Dorzolamide 2% ophthalmic solution (Trusopt) – 1 drop q 8 hours
Timolol 0.5% ophthalmic solution (Timolol) – 1 drop q 8-12 hours
Dorzolamide+timolol (Cosopt) – 1 drop q 8 hours
Ciliary body cyclophotocoagulation

Prognosis:
Poor, especially when secondary to uveitis

Retinal Diseases
Taurine Deficiency
Fluoroquinolone Associated Retinal Toxicity
Progressive Retinal Atrophy
Abyssinians
Hypertensive Retinopathy

Taurine Deficiency/Feline Central Retinal Degeneration (FCRD)
Clinical signs:
Initially tapetal hyperreflectivity due to retinal thinning in area centralis
Progresses to linear region of hyperreflectivity along the tapetal-non tapetal junction
Late stage is diffuse hyperreflectivity

Cause:
Dietary deficiency – 500-750 ppm is recommended requirement to prevent retinal disease
Associated with feeding dog food or home-made diets
Deficiency of taurine uptake

Treatment:

Taurine supplementation

or correct diet

Prognosis: Guarded—the retinal degeneration is permanent, but appropriate dietary change or supplementation may prevent progression

**Fluoroquinolone Associated Retinal Toxicity**

Reported in clinical patients after enrofloxacin use only

Experimentally induced with high doses of other fluoroquinolones

Clinical signs:

- Affects 1 in 122,414 cats (0.0008% incidence)
- Acute onset partial vision impairment or blindness following systemic treatment with enrofloxacin
- Fixed dilated pupils
- Ophthalmoscopic evidence of retinal thinning (tapetal hyperreflectivity, vascular attenuation) apparent within several days to weeks
- Electroretinogram testing: extinguished response confirmed extensive outer retinal disease

Cause:

- Idiosyncratic reaction
- In 16/17 cats, the total daily dosage exceeded 5 mg/kg
- One blind 15-year-old cat received only 4.6 mg/kg
- Age may be a predisposing factor as older cats (>12 year) developed blindness at a lower dose than younger (<9 years).

Treatment: None

Prognosis: Grave—blindness is usually irreversible

**Progressive Retinal Atrophy**

Hereditary retinal degeneration in Abyssinian & Siamese cats

Clinical signs: mydriasis, nystagmus, vision impairment progressing to blindness; tapetal hyperreflectivity and vessel attenuation

Abyssinians:

- Early onset = rod cone dysplasia
  - Onset at 4 weeks and may be blind by 1 year
- Later onset = rod cone degeneration
  - Onset at 1.5-2 years of age with progression to blindness over 2 – 4 years

**Hypertensive Retinopathy**

Signalment: usually cats > 10 years of age

Cause:

Systemic hypertension (usually systolic blood pressure (BP) > 160 mmHg)

- Chronic renal failure – up to 65% of cats with CRF had hypertensive retinopathy in one report
- Hyperthyroidism
- Idiopathic

Clinical signs:

- Dilated pupils, sluggish to absent PLR, blindness
- Hyphema
- Early fundic changes: Multifocal well-demarcated foci of inner retinal and sub-retinal edema
- Later fundic changes: Focal bullous lesions coalesce and progressive to complete bullous retinal detachment with retinal, sub-retinal and vitreal hemorrhage

Treatment:

- Amlodipine 0.625 mg/cat PO q 24 hours lowers BP from 198 to 155 mmHg in one report
- In another report, treatment lowered BP in 31 of 32 cats and resulted in improved vision in 18 of 26 cats
*Furosemide decreases ability of RPE to remove subretinal fluid by 84%; therefore is contraindicated in treatment of retinal detachment!!

Prognosis:
Depends on chronicity and extent of the detachment
With rapid diagnosis and treatment, bullous detachments have 50% or more chance of reattaching and regaining vision

Neoplasia
Uveal melanoma
Squamous cell carcinoma
Trauma-associated sarcoma

Uveal melanoma
Signalment: Any mature cat
Clinical signs:
Progressive pigmentation of the iris over months to years
Changes in pupil shape or motility suggest invasion of iris stroma
Glaucoma secondary to infiltration of iridocorneal angle
Iris nevus or freckly could be a pre-neoplastic change, especially in younger cat
Behavior:
Metastatic rate may be up to 63%
Metastasis may occur up to 1 to 3 years after enucleation
Have much greater concern with metastasis in younger cat than aged cats
Ophthalmologists and pathologists disagree on behavior
In one recent study (Dubielzig et al, 1997), cats with tumor confined to iris and cats with moderate spread (diffuse iridal involvement and spread to iridocorneal angle had survival times similar to cats in the control group.
Cats with advanced melanoma (aggressive iridal infiltration & iris posterior pigmented epithelium and ciliary body) had shorter survival times than control cats and the cause of death usually suggested metastatic disease.

Treatment:
*Diagram or photograph and monitor all iris pigmentation
*Monitor for raised, velvety appearance, dyscoria, decreased PLR, uveitis, extension to iridocorneal angle, rapid progression or obvious mass
*Consider enucleation earlier in younger cat if these changes are noted
*A 15 year old cat with mild changes is unlikely to die of metastatic disease; therefore these can be safely monitored.

Squamous cell carcinoma
Signalment: older white-faced cats, especially those living at high altitudes
Clinical signs:
Slightly raised or ulcerated lesion at or adjacent to eyelid margin
Treatment:
Wide surgical excision + blepharoplasty
Cryosurgery
Radiation (teletherapy or brachytherapy)
Hyperthermia
Prognosis:
Depends on histologic grade of tumor
Well-differentiated tumors treated early=good prognosis for cure
Extensive or poorly differentiated tumors=guarded prognosis for cure
**Trauma-associated sarcoma**

- **Signalment:** 7-15 year old cats
- **Clinical signs:**
  - Chronic uveitis
  - Glaucoma
  - Intraocular hemorrhage
  - Visible intraocular mass
- **Cause:**
  - Trauma to lens
    - Trauma may precede the tumor by average of 5 years
  - Chronic uveitis
  - Intraocular surgery
  - Intravitreal gentocin injection for glaucoma
- **Treatment:**
  - Early enucleation with orbital exenteration
- **Prognosis:**
  - Grave—despite early intervention, most cats die due to extension of tumor along optic nerve to brain or regional lymph node and distant metastasis within several months.

**Other adnexal tumors in cats:** basal cell carcinoma, mast cell tumor, fibrosarcoma

*Additional suggested readings:*
