Lacrimal System

- Production of tears
- Drainage of tears

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- **Tear functions**
  - Optically smooth surface
  - Corneal metabolism: nutrition
  - Corneal immunity

- **Tri-layered tear film**
  - Lipid: meibomian glands
  - Aqueous: lacrimal and TE glands
  - Mucin: conjunctiva

- **Keratoconjunctivitis sicca (KCS, “dry eye”):** Deficiency of the aqueous portion of the tear film.

- **Clinical signs**
  - blepharospasm, conjunctivitis, mucoid discharge, corneal ulcers, dry appearance
  - "chronic eye infection", dull cornea with vascularization, pigmentation of cornea,
  - slight improvement with any topical medication.
- **Schirmer tear test:**
- **Horse:** 24 +/- 5 mm wetting/minute
- **Small Animals**
  - Dog Normal 21.9 +/- 4.0 mm wetting/minute
  - Cat Normal 20.2 +/- 4.5 mm wetting/minute
  - Suspicious = 8-10 mm/minute
  - Low = <8 mm/minute
    - First 30 sec is faster than last 30 sec
- **Rose Bengal stain** – mucin layer integrity
- **USE FLUORESCEIN TO LOOK FOR ULCERS.**
Rose bengal stains mucous and the cornea when the mucin layer is absent or unstable.
Breed at Risk for KCS
- English Bulldogs,
- West Highland White Terriers, Lhasa Apso, Cocker Spaniels, Pugs, Pekinese, Yorkies, Shih Tzu, Miniature Schnauzers, Boston Terriers, Dachshunds

Burmese Cats
KCS Etiologies

- **Congenital/inherited:** breeds: Yorkies
- **Drug related:**
  - Atropine: Topical and systemic (reversible)
  - Sulfonamides: sulfadiazine, Tribrissin® (permanent in small breed dogs; < 12 kg)
  - salicylazosulfapyridine (Azulfidine®), Phenazopyridine (Azo Gantrisin®) (permanent)
  - During anesthesia (reversible)
  - Etodolac (EtoGesic®): Reversible if given < 6 months
  - Betaxolol (Betoptic®)
Edotolac and KCS: “Chica” 1 year post CF and PDT
- **Systemic diseases causing KCS:**
  - Canine distemper virus
  - Hypothyroidism, hyperadrenocorticism, demodectic mange, SLE, RA
  - Diabetes: 28% lower STT; 37% lower corneal sensation; 58% shorter TFBUT
  - Feline herpes: shorter TFBUT (7-10 seconds; normal 12-21 sec.)

- **Trauma to the orbit and eye:** horses

- **Neutering/spaying:** Lack of testosterone causes lacrimal gland feminization

- **Iatrogenic** - removal of the gland of the nictitans.
  - Removal of the lacrimal gland reduced STT to 4 mm in a horse

- **Chronic blepharoconjunctivitis** - scarring of lacrimal ducts

- **Immune mediated** lacrimal gland adenitis is most common cause of KCS in dogs.
  - up to 75-80% of cases.
KCS Treatment:

a. Medical:
   - Always attempt 1-2 months of medical treatment because KCS may be transient.

Goals to remove pain and maintain vision:
   - a. Replace tears – Hypotears, Tears Naturale, Lacrilube, SERUM!!!!
   - b. Stimulate production of tears with CSA topically
1-2% cyclosporine A
- increases tear production in 80% of cases
- has T helper cell inhibitory activity
- also reduces pigmentary keratitis and fibrosis
- dose: BID OU
- may take 3-4 weeks before increasing tear production.

• 0.03% Tacrolimus BID has the same effect and may work in CSA nonresponding cases.
• Pimecrolimus (1%) is a new drug from Novartis that is also very effective for canine KCS.
  • 2% Pilocarpine used orally in CSA nonresponders. Used in a minority of cases!
KCS and CSA

- If initial STT is 0-2 mm/min, fewer animals respond favorably to CSA i.e. 60 vs 80%
- This probably relates to atrophy and fibrosis of glandular tissue and an inability to regain secretory function within the gland.
Other goals of KCS therapy

- c. Control bacterial flora - topical broad spectrum antibiotic BID, eg. triple antibiotic ointment

- d. Control inflammation - topical corticosteroids, may be combined with topical antibiotics; use only if not ulcerated!

- e. Hormonal replacement??
Surgical therapy for KCS:
- 1. Nictitans flap - to protect cornea when ulcerated
- 2. Conjunctival flap - Deep corneal ulcers, to provide corrective tissue and blood vessels.
- 3. Parotid duct transposition
  - Saliva ≠ Tears
  - Calcium deposited in ulcers
- Shi Tzus and Lhasa Apsos
- Normal Schirmer Tear Test with signs of KCS!
- Premature mucin breakup time = Tear Breakup Time <10 seconds.
- Should take longer than 15 seconds before fluorescein clears from cornea.
- Rose Bengal positive
- Rx: Lacrilube ointment
Lacrimal System Disease - Outflow System:
Most common clinical sign is epiphora.

- A. Imperforate puncta or punctal membranes:
  - 1. Congenital - Cocker Spaniel, Poodles
  - Diagnosis -
    - cannot cannulate duct
    - ballooning of area where puncta should be when flushed from upper duct
    - ddx from simple obstruction
  - 2. Obstructed puncta: Flush lacrimal puncta

- 2. Obstructed puncta: Flush lacrimal puncta
Nasolacrimal System Flush

- fluorescein dye passage as a guide to patency
- The upper punctum is cannulated with a 22g blunt lacrimal cannula. Cats don’t like it.
Dacryocystorhinography evaluates nasolacrimal duct

Tortuosity in a boxer

Diverticula
Dacryocystorhinography
Epiphora - Causes in small breed dogs and brachycephalic cats:

- A. Excessive tear production from irritation
- B. Lower punctum atresia/displacement
- C. Congenital absence of lower canaliculus
- E. Nasolacrimal obstruction
- F. Entropion at medial canthus
- G. Hair from medial caruncle acting as wick
- H. Prominence of eye with a shallow lacrimal lake (especially in brachycephalic breeds)
Treatment of “Poodle” Epiphora

- Keep clean
- Bleach
- Systemic antibiotics
  - Tetracycline 25-50 mg PO daily
  - Tylan 40: “sprinkle on food”
  - Metronidazole 100 mg daily
- “Angles’ Eyes”
CONJUNCTIVA AND NICTITATING MEMBRANE

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1. Gland
2. Ligament
3. Cartilage
The conjunctiva swells (chemosis) and/or turns red (hyperemia) when injured.
The TE Moves
Protrusion of the TE

- Decreased orbital mass - bilaterally.
- Decreased ocular mass - microphthalmia or phthisis bulbi
- Increased orbital mass or pressure - retrobulbar neoplasia, cellulitis or abscess; usually unilateral
- Denervation - Horner's syndrome
- Ocular pain - corneal ulcers, etc. leads to enophthalmos
- Tetanus- OU
- Conjunctivitis
- idiopathic - especially in young cats, "Haw's Syndrome".
- Generalized illness - the nictitans is essentially a lymph node
Dermoid - Congenital tumor of dermal origin
- May involve conjunctiva, limbus, cornea, nictitans.
- hairs irritate cornea and palpebral conjunctiva with possible epiphora, conjunctivitis and/or keratitis.
- Treatment - surgical removal

Symblepharon - any abnormal adherence of conjunctiva to the globe.
- Primarily seen secondary to Herpes in cats.
Conjunctivitis - most common extraocular problem in practice

1. Signs - vary with duration;
   - nonspecific
   - hyperemia (redness). “RED EYE”
   - chemosis (swelling)
   - follicles - usually chronic response
   - discharge-serous = mild
   - mucoid = chronic, KCS
   - purulent = bacterial
   - pain - variable, usually mild
2. Diagnostic tests
   - a. STT - routine on all conjunctivitis cases
   - b. Culture/sensitivity - fornix, not routinely done
   - c. Cytology - topical anesthetic, spatula
   - d. IFA and PCR tests for herpes and chlamydia in cats
3. Etiologies

- a. Bacterial = purulent discharge
  - Bartonella, Staphylococci and Streptococci
  - *Bordatella bronchiseptica* in cats
  - *Chlamydophila felis* (no keratitis)
  - mycoplasma (??)
  - May also have an underlying cause i.e. foreign body, eyelid disease, etc

- Cytology - neutrophils + bacteria

- Treatment: antibiotics - broad spectrum initially; based on C and S if non-responsive
b. Viral - frequently OU

1. Canine - Adenovirus I & II; distemper virus (may have KCS associated with distemper virus)

2. Cats

- herpes (conjunctivitis + keratitis)
  - 95% cats exposed
  - life-long carrier state within the trigeminal ganglia (80%)
  - Cytolosis in epithelium and immune mediated stromal disease types
  - Sequestra (55% +; EK 76%+; uveitis 14% + PCR)
  - Rx: TFU>IDU>GCV>Vira A>ACV

- calicivirus (acute)

- Cats with chronic conjunctivitis may be FeLV or FIV positive
c. Mycotic – rare; blastomycosis, histo

d. Parasitic - uncommon in small animals
Conjunctivitis: most common cat eye problem

- Herpesvirus
  - hyperemia
- Chlamydia psittaci
  - chemosis
  - Zithromax 5 mg/kg SID PO
- Mycoplasma felis
  - ulcers
- calicivirus
- various types of bacteria
- allergic/environmental
Chlamydia

Mycoplasma
Herpesvirus

- 80% of cats have it
  - Most do not have disease
- Early acute signs of infection
  - sneezing, fever, lethargy, inappetance
    - Systemically ill
  - serous ocular discharge, hyperemic conjunctivitis
- Chronic (recurrent) signs of infection
  - mucopurulent ocular discharge, dendritic corneal ulcers, stromal ulcers, corneal vascularization/scarring, KCS
Cobalt blue filter
Stromal Herpes Keratitis

Stromal large ulcers occur following dendritic ulcers.
Herpesvirus-diagnosis

- best to test during active disease
  - Lots of viral shedding
- IFA testing of conjunctival scrapings
  - fluorescein stain after collecting samples to avoid false positives
    - Not accurate
- PCR is best and detects virus DNA in corneal and conjunctival scrapings but results vary according to the lab
- Tests are less reliable in chronic cases
- Dendritic ulcers are pathognomonic (acute stages)
- Clinical signs are important in the diagnosis.
Herpesvirus-therapy

- **topical antiviral medications**
  - idoxuridine (0.5%) five times/day or vidarabine (3%) are best topically
  - cidofovir 0.5% BID

- **topical antibiotics**
  - controls secondary bacterial infections

- **recurrent herpesvirus**
  - rule out FeLV and FIV co-infections
  - Oral famciclovir 7.5 mg/kg BID for 3 weeks
  - oral lysine (500 mg BID PO); VIRALYS for cats
  - interferon alpha-2 (300 units/day PO)
  - topical Alomide 0.1% (Lodoxamide): mast cell and eosinophil stabilizer
Herpes
e. Allergic/Immune-mediated
   - seasonal occurrence
   - associated with atopy
   - cytology - eosinophils, basophils
   - Treatment: remove allergen (if possible)
   - topical anti-inflammatory

f. Physical irritation - wind, dust, foreign bodies, eyelid disease, frequent causes

g. KCS: STT on all cases of conjunctivitis.
Necrotizing conjunctivitis due to sinus osteomyelitis

Topical steroids
Ligneous Conjunctivitis

- Dobes
- Thick membranes
- Topical
  - CSA
  - Steroids
  - Plasma
- AMT
Medial canthal pocket syndrome:
- Dogs with large orbits to globe size (labs, dobes).
- The nasal fornix is large and traps debris leading to conjunctivitis.
- Mucous at medial canthus in the morning.
Conjunctivitis is present with many eye problems! An eye with blinding glaucoma or uveitis or KCS will be red and mimic simple conjunctivitis!!!!!!

Primary conjunctivitis is a diagnosis made by excluding secondary causes of conjunctivitis.
Nodular Granulomatous Episcleritis (NGE), nodular fasciitis, fibrous histiocytoma

- Nodular, nonpigmented mass from limbus, TE.
- May be OU
- Frequently seen in Collies
- Diagnosis - histology
- Treatment:
  - Systemic and topical corticosteroids
  - Azathioprine (Drug of choice)
  - Surgical excision with cryotherapy
Conjunctivitis masquerades…….

- Lymphoma
Eversion of TE cartilage
- Cartilage is abnormally formed, causes nictitans to roll inward or outward. Seen in Basset Hounds, Briards, Filas, and Weimaraners.
Abnormal cartilage is removed
TE neoplasia: adenomas and SCC
- Hypertrophy and prolapse of nictitans gland (cherry eye).
  - Young dogs. Common in Cocker Spaniels and brachycephalics. Many breeds that are predisposed to Cherry Eyes are KCS breeds!
  - Gland protrudes above free border of the TE, becomes inflamed and enlarged.
Follicular conjunctivitis
5. Treatment
   a. Medical - topical corticosteroids - frequently recurs.
   b. Surgical
      - Repositioning of gland to normal location. Gland can be "tacked" into normal position by anchoring it to the periosteum of the inferior orbit, or inserted into a subconjunctival pocket.
      - Excision of the gland - the TE itself should not be removed.
        - Use the STT as a guide for tacking vs amputation
      - May predispose to KCS.
Treatment of Prolapsed Gland of TE

- Posterior nictitans anchoring
  - To ventral periorbital fascia (Blogg)
  - To ventral equatorial sclera (Gross)
  - To ventral oblique muscle (Albert, Garrett, Whitley)

- Anterior nictitans anchoring
  - To ventral orbital rim (Kaswan & Martin, modifications by Peterson-Jones)

- Conjunctival mucosal techniques
  - Envelope (Moore)
  - Pocket (Morgan)
Pocket Technique
Periosteal Tackdown
Intra-nictitans tacking of prolapsed gland of the third eyelid
Intra-nictitans tacking
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Post-operative treatment

- Topical antibiotics + steroids TID for one week or more
- E-collar for 10-14 days
- +/- oral anti-inflammatory
- Warn owner swelling may take days to several weeks for swelling to subside, especially in chronic cases
Case 2