Look Into the Window to the Soul: Ophthalmic Exam Basics

Jacqueline W. Pearce, DVM, MS, DACVO
Lecture Outline

- History
- Neurophthalmic Exam
- Minimum Database
  - Schirmer Tear Test
  - Fluorescein Stain
  - Tonometry
- Ophthalmic Exam
  - Anterior Segment
  - Posterior Segment
Diagnostic Approach to the Eye for Veterinarians

- Identify problems
- Minimum ophthalmic database
- Clinical diagnosis
- Differential diagnosis
- Diagnostic plan
- Treatment
Eye Exams: The Technicians Role

- History
- Case
- Medications
- Minimum ophthalmic database
Minimum Ophthalmic Database

- Neuroophthalmic assessment
- Schirmer tear test
- Tonometry
- Fluorescein stain
History: Questions to Ask

- What signs made you think eye problem?
  - Vision problem?
    - Lighting?
    - Different environments?
  - Onset and duration?
  - Relatives with ocular disease?
History: Questions to Ask

- What signs made you think eye problem?
  - Comfort problem?
    - Squinting or rubbing eye?
    - Red eye?
    - Discharge?
    - Progressive, static or improving?
    - Response to medication?
History: Questions to Ask

- Systemic status
  - Decreased activity?
  - Appetite changes?
  - Drinking normally?
  - Urination?
  - Defecation?
Medication History: Questions to Ask

- What medications?
  - Frequency
  - Compliance
  - When last given
Minimum Ophthalmic Database

- Neuroophthalmic assessment
- Schirmer tear test
- Tonometry
- Fluorescein stain
**Neuroophthalmic Assessment**

**OPHTHALMOLOGY EXAMINATION**

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pupillary Light Reflexes:</td>
<td>direct</td>
<td>consensual</td>
</tr>
<tr>
<td>Vision (menace response):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palpebral Reflex:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schirmer Tear Test:</td>
<td>mm/60 seconds</td>
<td>mm/60 seconds</td>
</tr>
<tr>
<td>Tonometry:</td>
<td>mmHg</td>
<td>mmHg</td>
</tr>
<tr>
<td>Fluorescein Stain:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dilation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gonioscopy:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pupillary Light Reflex (PLR)

- Reflex through midbrain
- CN 2 (afferent)
- CN 3 (efferent)
- May be present with significant retinal dysfunction
- Not a test of vision
  - PLRs still present with cortical blindness
Pupillary Light Reflex (PLR)

- Retina & Optic Nerve (CN 2)
- Pupillo-motor fibers
- Optic Chiasm
- PS Fibers
- Oculomotor Nerve (CN 3)
- Pre-tectal nuclei to PS/ EW Nucleus
- Direct
- Indirect or consensual
Pupillary Light Reflex (PLR)

- Decreased in excited dog
- Iris atrophy causes decreased/a absent PLR
  - Watch for this in older animals!

Watch for this in older animals!
Dazzle Reflex

- Pathway not clearly defined
- Subcortical reflex
- Light stimulus = involuntary blink
- CN 2 (afferent)
- CN 7 (efferent)
- Present significant retinal dysfunction
- Not a test of vision
Dazzle Reflex

Retina & Optic Nerve (CN 2)

Facial Nerve (CN 7)

Midbrain?
Ways to test vision in animals

- Menace response
- Tracking behavior
- Maze test
- Placing reaction
  - Cats
Vision Testing: Menace response

- CN 2 (afferent)
- CN 7 (efferent)
- Learned response
- Complex pathway
- Not in very young animals
- Precocial vs. altricial species
- Testing
  - No air currents
  - Test each eye separately
Menace response

Retina & Optic Nerve (CN 2)

Frontal Cortex

Thalamus

Occipital Cortex

Cerebellum

Facial Nerve (CN 7)
Vision Testing: Tracking behavior

- Eyes follow dropped cotton ball
- May work for cats
- Some cats will not track even if visual
Vision Testing: Maze

- Place objects randomly in front of animal
- Object avoidance?
- Speed of navigation?
- Conduction in
  - Ambient light (photopic)
  - Dim light (scotopic)
Palpebral Reflex

- Touch periocular area = blink reflex
- CN 5 (afferent)
- CN 7 (efferent)
# Localization of Neuroophthalmic Lesions

<table>
<thead>
<tr>
<th>MENACE RESPONSE</th>
<th>IN</th>
<th>OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td></td>
<td>VII</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLR</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PALPEBRAL</th>
<th>V</th>
<th>VII</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Minimum Ophthalmic Database: Diagnostic Tests**

- **Schirmer tear test**
- **Tonometry**
- **Fluorescein stain**

<table>
<thead>
<tr>
<th>Pupillary Light Reflexes:</th>
<th>OD</th>
<th>direct</th>
<th>consensual</th>
<th>OS</th>
<th>direct</th>
<th>consensual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision (menace response):</td>
<td>OD</td>
<td></td>
<td></td>
<td>OS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palpebral response:</td>
<td>OD</td>
<td></td>
<td></td>
<td>OS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schirmer Tear Test:</td>
<td>OD</td>
<td></td>
<td>mm/60 seconds</td>
<td>OS</td>
<td></td>
<td>mm/60 seconds</td>
</tr>
<tr>
<td>Tonometry:</td>
<td>OD</td>
<td></td>
<td>mmHg</td>
<td>OS</td>
<td></td>
<td>mmHg</td>
</tr>
<tr>
<td>Fluorescein Stain:</td>
<td>OD</td>
<td></td>
<td></td>
<td>OS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Schirmer Tear Test

- >15 mm/ min = normal dogs
- 10-15 mm/ 60s = suspect KCS
- <10mm/ 60s = KCS
- Perform first !!!!
- Correct placement
  - Inferior fornix
  - Contacting cornea
- Cats can be lower (<10mm/ min)
  - May be due to stress
  - Use clinical signs to interpret
Schirmer Tear Test (STT)

- Measures
  - Lacrimal lake
  - Basal tear production over 1 min
  - Stimulated tear production over 1 min

STT will be decreased for up to 1 week after general anesthesia or sedation!

STT is NOT affected by Trazodone!
Many Ways to Mess Up STT!

- Forgot to do it!
  - Wait 20 minutes
- It fell out!
  - Put it back in
  - Hold lids closed
- Poor corneal contact!
  - Won’t stimulate tears
Fluorescein Stain

- Moisten strip with eyewash
- Apply 1 drop to eye
  - May need to rinse with eyewash
- Corneal ulceration
  - Stain positive
Tonometry

- **88% of vets** (Martins et al., 2018)
  - Indentation
    - Schiotz
  - Applanation
    - Tono-Pen
    - Avia® Vet
  - Rebound
    - Tonovet
    - Tonovet Plus
The #1 Reason to Measure Intraocular Pressure (IOP)?

- Red Eye!
- Determine IOP every red eye with intact cornea/sclera
Serial IOP Monitoring

- Primary glaucoma
- Genetic reasons
- Uveitis cases
- Intraocular surgery
## Diagnostic Testing for Glaucoma

### Rebound and Applanation Tonometry

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Digital</td>
<td>- More expensive</td>
</tr>
<tr>
<td>- Convenient for small corneas</td>
<td>- May need servicing</td>
</tr>
<tr>
<td>- Simple to use</td>
<td></td>
</tr>
<tr>
<td>- Vertical cornea ok</td>
<td></td>
</tr>
<tr>
<td>- Easy to clean</td>
<td></td>
</tr>
<tr>
<td>- Reproducible</td>
<td></td>
</tr>
</tbody>
</table>

![Tono-Pen Avia® Vet](image1.png)  
![Tonovet Plus](image2.png)  
![Tono-Pen Vet](image3.png)
Applanation Tonometry

- **Tonopen**, **Tonopen Avia® Vet**
- Force to flatten cornea
- Accurate
- Easy to artificially elevate IOP
  - Brachycephalics
- Calibrate prior to use or daily
  - Avia® Vet = no calibration
Rebound Tonometry

- Tonovet and Tonovet Plus
- Electromagnetically propelled probe
  - Bounces off cornea
- Reads slightly higher
- Settings for species
  - Dogs
  - Cats
  - Horses
  - Other
Intraocular Pressure: Getting an Accurate Measurement

- Calm animal
- Trazodone ok
- Central cornea
- Avoid lesions
- Topical anesthesia
  - Tonopen and Avia®
- Avoid pressure
  - Globe, lids, neck

IOP=29
Holding lids too close

IOP=15
Holding lids further away
Applanation Tonometry

- Easy mistakes:
  - Tip cover too tight
  - Tip cover too loose
Intraocular Pressure: When to Trust the Reading?

- Look at patient
- Take lowest measurement
- Consistent readings

my trust

u loses it.
# Normal Canine IOPs

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Range (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tono-Pen</td>
<td>8-15</td>
</tr>
<tr>
<td>Avia® Vet</td>
<td>6-19</td>
</tr>
<tr>
<td>Tono-Vet</td>
<td>7-22</td>
</tr>
<tr>
<td>Tono-Vet Plus</td>
<td>11-25</td>
</tr>
</tbody>
</table>

- All instruments provide useful estimates of IOP
- Interpret IOP based on range for instrument used
- Tono-Vet Plus closer to actual IOP value
- All underestimate actual IOP at high IOPs

(Muirhead et al., 2018)
Normal Feline IOPs

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tono-Pen</td>
<td>10-18 mmHg</td>
</tr>
<tr>
<td>Tono-Vet</td>
<td>14-20 mmHg</td>
</tr>
</tbody>
</table>

- All instruments provide useful estimates of IOP
- Interpret IOP based on range for instrument used
- Tono-Vet Plus closer to actual IOP value
- Tono-Vet Plus calibrated for cats
- All underestimate actual IOP at high IOPs
Tonometry Readings: Acceptable Error

- Coefficient of variation ~5%

Tono-Pen

Avia® Vet

Tonovet

Tonovet Plus
Cleaning the Tonopen

- Perform monthly
- Remove tip cover
- Air canister against tip
- Blow air into top for 3s
- Tip to room temp
- Calibrate
Ophthalmic Examination

Right Eye
- Eyelids
- Cornea/Sclera
- Lens
- Iris
- Fundus

Left Eye
- Eyelids
- Cornea/Sclera
- Iris
- Fundus
- Lens
Proper Restraint Important!

- Handler should restrain gently
  - Especially brachycephalics
- Base of skull & under chin
Ophthalmic Exam

- Bright focal light source
- Dark environment
- Patient at eye level
- Magnification!
- Anterior segment
  - Slit lamp
  - Head loupes/transilluminator
  - Otoscope head
Distance Examination

- Watch animal in room
  - Visually guided behavior?
- Facial symmetry?
- Symmetry in size/shape orbit and glob?
- Eyelid conformation
- Discharge?
- Opacity?
Closer examination

- Retropulse globe
  - Unless ulcer!
- Pain on opening mouth?
General Exam Principles

- Light source
  - Arm’s distance
- Tapetal reflexes
  - Highlight anisocoria
  - Opacities in media
- Bring light closer
  - Direct illumination
  - Retroillumination
  - Anterior lesion back-lit by light
Localization: Object Overlay

- Anterior structures cover posterior ones
Localization: Purkinje Images

- Slit beam creates optical cross-section of eye:
  - Tear film/cornea
  - Black space (AC)
  - Anterior lens capsule
  - Lens (smokey)
  - Posterior lens capsule
Anterior Chamber Flare/Cells
“Tyndall Effect”
Axis of Rotation

- Center axis of rotation of eye is center of lens
- Lesion anterior to center of lens move same direction as front of eye
- Lesion posterior to center of lens move opposite direction as front of eye
Ophthalmoscopy (Funduscoppy)

- From Greek:
  - Ophthalmos = eye
  - Skopeo = to look at
Equipment

- Dilating agent
  - 1% Tropicamide
- Dark environment
- Indirect ophthalmoscopy
  - Light source
  - Lens
- Direct ophthalmoscopy
  - Direct ophthalmoscope
Direct Ophthalmoscopy

- Upright image
- High magnification
- Easy to use
- Equipment readily available
- Shorter working distance
- Narrow field of view
Direct Ophthalmoscopy Localization

- Focusing wheel
  - Common source confusion
- Start on “0”
Indirect Ophthalmoscopy

- Recommended
- Inverted image
- Wider field of view
- Requires practice
- Low magnification
  - View more fundus
  - Less likely to miss lesions
Indirect Ophthalmoscopy: Image Interpretation
Indirect Ophthalmoscopy Tips

- Lens parallel corneal surface
- Metal lens rim towards cornea
- Pupil illumination first, then add lens
- Think “tube”
Indirect Ophthalmoscopy: Lens Selection

- 28 D
- 20D
- 2.2 Panretinal
Direct vs. Indirect Ophthalmoscopy Images

Direct Ophthalmoscope

Indirect (20D) Ophthalmoscope
THANK YOU

- Gia Klauss
- Caroline Betbeze
- Laura Barnes
- Ann Bosiack
- Kevin Donnelly
- Kristina Gronkiewicz
- Todd Marlo
- Dylan Buss
- Cecil Moore
- Denise Lindley
- Elizabeth Giuliano
- Laurence Galle
- Juri Ota
- Samantha Bishop
- Rene Backhouse

Caring For Life’s Greatest Companions
Questions