VET 433A Neuro-Ophthalmology

Review

Pupillary Light Reflex

- Afferent: CN II
    - Interneurons: pretectal and oculomotor nuclei (Edinger-Westphal)
- Efferent: CN III
    - Ciliary ganglion and iris sphincter are also involved

Menace Response

- Afferent: CN II
    - Interneurons – Lateral geniculate nucleus, visual cortex, motor cortex, pontine nucleus, middle cerebellar peduncle & facial nucleus
- Efferent: CN VII
    - Orbicularis oculi is also involved

Palpebral Reflex

- Afferent: CN V
    - Interneurons: Trigeminal sensory nucleus and motor nucleus of facial nerve
- Efferent CN VII
    - Orbicularis oculi is also involved

Pupillary Light Reflex

- Involves CNs II, III and the central visual pathway
- The cortex is NOT involved
- Perform this reflex under bright and dim light conditions for more accurate results
    - False negatives can occur with high sympathetic tone, iris atrophy, and posterior synechiae
- Present at birth
- Intact in the case of cortical blindness
- Consensual PLR is useful for opaque ocular media

Menace Response

- Involves CN II, VII, cortex and the cerebellum
- A LEARNED response to a threatening gesture
- Absent in young animals (<3 months in cats and dogs)

- This is a crude test of vision, they can see hand motion but may not be able to see things clearly, a better test would be tracking an object
- Can be absent in patients that are stressed, stoic or depressed
- Tip: perform the palpebral reflex immediately prior to increase the patient's awareness

Palpebral and Corneal Reflexes

- A reflex following touch of periocular skin (palpebral) or the cornea (corneal)
    - Stimulate the medial and lateral canthi
    - Perform prior to menace
    - CN V (ophthalmic and maxillary branch) and VII

Neuro-ophthalmic anatomy and function

- Eyelid closure
    - Orbicularis oculi muscle
    - CN VII
- Eyelid opening
    - Levator palpebrae superioris
    - CN III
- Sensory innervation to cornea and eyelids
    - CN V

General signs of neuro-ophthalmic disease

- Abnormal pupil size or reactivity
- Abnormal globe position
- Abnormal eyelid position
- Inability to close eyelids > corneal disease
- Third eyelid protrusion

Horner's Syndrome

*Compromise of sympathetic innervation to the eye and its related structures

- Postganglionic sympathetic:
    - Smooth muscle periorbita
    - Müller's muscles of eyelids
    - Iris dilator

    - Iris sphincter
- Normal parasympathetic function
    - Slight protrusion of globe
    - Retraction of third eyelid
    - Opening of palpebral fissure
    - Pupil dilation
- Clinical Signs
    - Miosis
    - Ptosis
    - Enophthalmos
    - Protruded third eyelid
    - *Not a painful dz but due to the appearance, O may think their dog is painful
- Causes
    - #1 cause is idiopathic
    - Head, neck or chest trauma/neoplasia
    - Chronic otitis media
    - Ear cleaning
    - Retrobulbar disease
    - Metabolic disease
        - Diabetes mellitus
        - Hypothyroidism
    - Diagnosis
        - Clinical signs
        - Complete physical exam (and otic exam)
        - Pharmacologic testing
            - Allows for the lesion to be localized pre- vs post-ganglionic
            - Direct sympathomimetic (1% phenylephrine)
            - *after denervation there is increased sensitivity of muscle to neurotransmitters (denervation hypersensitivity)
                - If the pupil dilates within 20 min = lesion is post-ganglionic
                    - These lesions are typically idiopathic and resolve
                - Dilation takes longer/ no dilation = pre-ganglionic
                    - Radiography, advanced imaging, bloodwork
    - Treatment
        - Address underlying cause
        - Topical phenylephrine can relieve signs but this is short-acting
    - Prognosis
        - Depends on the underlying cause
        - Most post-ganglionic cases resolve <6 months

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Facial Nerve Paralysis

- Orbicularis oculi m. is innervated by CN VII
- Loss of function results in the inability to close the eyelids
- The lacrimal nerve runs with CN VII so there is concurrent decrease in tear production
- Clinical signs
    - Widening of the palpebral fissure due to drooping lower lid
    - Increase visible sclera, especially ventrolaterally
    - Drooping of ear and lip
    - Nose "pulled" toward the normal side
    - Loss of palpebral and corneal reflexes
    - Inability to blink resulting in secondary exposure keratitis
    - Ulceration and infection are common
- Causes
    - Idiopathic (cockers and boxers)
    - Iatrogenic (sx to head or neck)
    - Otitis media/interna
    - Neuromuscular disease
    - Intracranial disease *neoplasia
    - Hypothyroidism
    - Trauma to head or neck *HBC
- Diagnosis
    - Clinical signs
    - Complete physical exam
        - Otic and neuro exam
    - Radiography
    - Advanced imaging (CT)
    - Bloodwork
- Treatment
    - Address underlying cause if known/present
    - Exposure keratitis may require the following
        - Temporary tarsorrhaphy
        - Frequent lubrication
        - Corneal ulcer management
- Prognosis
    - Depends on underlying cause
    - Guarded with idiopathic cases (<33% recover)
        - Relapses may occur

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Ophthalmoplegia

- Compromise of CN III
    - Iris sphincter
    - Levator palpebrae superioris
    - Dorsal, Medial, Ventral Rectus
    - Ventral oblique
- Clinical signs
    - Visual
    - Mydriasis (internal ophthalmoplegia) with no ptosis or strabismus
    - Ventrolateral strabismus (external ophthalmoplegia)
    - Ptosis (external ophthalmoplegia)
- Causes
    - Space occupying lesion in the cavernous sinus or orbital fissure
- Diagnosis
    - Advanced imaging, usually MRI
- Treatment and prognosis
    - Variable dependent on cause

Bonus Reflexes!

<u>Dazzle Reflex</u>

- Subcortical reflex in response to bright light
    - Present at birth and with cortical blindness
- CN II, VII and subcortical visual paths
- Useful for opaque ocular media

<u>Oculovestibular (Doll's eye) reflex</u>

- Reflex eye motion in response to head movement
- Vestibular system and CNs III, IV, and VI
- Move head side to side and up and down
- Eyes should more away from the direction of the head motion in unison

Light passing through an eye

1. Tear film
2. Cornea

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3. Aqueous humor
4. Pupil
5. Lens
6. Vitreous
7. Retina
8. Tapetum

Structures the form vision after the globe

1. Optic nerve
2. Optic chiasm
3. Optic tract
4. Lateral geniculate nucleus
5. Optic radiations
6. Visual cortex

How to test vision / visual pathway during an ophthalmic exam

1. Pupillary light reflex
    a. CN II, III
    b. Subcortical
    c. Does not prove vision
2. Dazzle reflex
    a. CN II, VII
    b. Does not prove vision
3. Menace response
    a. CN II, VII
    b. Cortical
    c. Tells us a little about vision
4. Behavioral testing of vision
    a. Cotton balls, laser, obstacle test

Methods of visual impairment

1. Insufficient light reaches the retina
    a. Retroillumination ophthalmic examination *slit lamp
    b. Pannus, cataracts
2. Retina isn't functioning normally
    a. CN Testing
    b. Menace, Dazzle, PLR
    c. Fundic examination
    d. Electroretinogram (ERG)

    e. PRA, SARDS, Hypertensive retinopathy, retinal detachment
3. Brain isn't functioning normally
    a. MRI & CSF
    b. Other findings on neuro exam
    c. Optic neuritis, inflammatory brain disease, hydrocephalus, post anesthetic, toxins