Objectives

- Cranial Nerve Dysfunction
  - Blindness
  - Horner’s Syndrome
- Sleep Disorders

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Olfactory</td>
<td>Sensory: smell</td>
</tr>
<tr>
<td>II</td>
<td>Optic</td>
<td>Sensory: vision</td>
</tr>
<tr>
<td>III</td>
<td>Oculomotor</td>
<td>Motor: most extraocular muscles, upper eyelid, and ciliary &amp; constrictor pupillae muscles</td>
</tr>
<tr>
<td>IV</td>
<td>Trochlear</td>
<td>Motor: dorsal oblique muscle</td>
</tr>
<tr>
<td>V</td>
<td>Trigeminal</td>
<td></td>
</tr>
<tr>
<td>V.1</td>
<td>Ophthalmic</td>
<td>Sensory: medial canthus of eye, most of upper eyelid, part of forehead and nose</td>
</tr>
<tr>
<td>V.2</td>
<td>Maxillary</td>
<td>Sensory: lateral canthus of eye, most of lower eyelid, part of nose, nasal cavity, hard/soft palate Parasympathetic: lacrimal gland</td>
</tr>
<tr>
<td>V.3</td>
<td>Mandibular</td>
<td>Sensory: part of lateral face, external ear, lower mandible, mandibular teeth, ventral oral cavity, rostral tongue Motor: muscles of mastication (masseter, temporalis)</td>
</tr>
<tr>
<td>Number</td>
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<td>Function</td>
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<tr>
<td>VI</td>
<td>Abducens</td>
<td><strong>Motor:</strong> retractor bulbi; lateral rectus muscle</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sensory:</strong> taste to rostral 2/3 of tongue</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Parasympathetic:</strong> lacrimal gland, salivary glands</td>
</tr>
<tr>
<td>VII</td>
<td>Facial</td>
<td><strong>Motor:</strong> muscles of facial expression</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sensory:</strong> taste to rostral 2/3 of tongue</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Parasympathetic:</strong> lacrimal gland, salivary glands</td>
</tr>
<tr>
<td>VIII</td>
<td>Vestibulocochlear</td>
<td><strong>Sensory:</strong> hearing, balance/equilibrium</td>
</tr>
<tr>
<td>IX</td>
<td>Glossopharyngeal</td>
<td><strong>Motor:</strong> muscles of pharynx</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sensory:</strong> caudal 1/3 of tongue (sensation, taste)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Parasympathetic:</strong> salivary glands</td>
</tr>
<tr>
<td>X</td>
<td>Vagus</td>
<td><strong>Motor:</strong> intrinsic muscles of larynx</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sensory:</strong> pharynx</td>
</tr>
<tr>
<td>XI</td>
<td>Accessory</td>
<td><strong>Motor:</strong> trapezius; other neck muscles</td>
</tr>
<tr>
<td>XII</td>
<td>Hypoglossal</td>
<td><strong>Motor:</strong> intrinsic and extrinsic tongue muscles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olfactory</td>
<td>Detection of hidden treat</td>
</tr>
<tr>
<td>Optic</td>
<td>Menace response, pupillary light reflex, dazzle reflex</td>
</tr>
<tr>
<td>Oculomotor</td>
<td>Pupillary light reflex, eye position, movement</td>
</tr>
<tr>
<td>Trochlear</td>
<td>Eye position</td>
</tr>
<tr>
<td>Trigeminal</td>
<td>Cutaneous sensation, tone of mastication muscles, ability to chew</td>
</tr>
<tr>
<td>Abducens</td>
<td>Eye position, movement</td>
</tr>
<tr>
<td>Facial</td>
<td>Facial symmetry, rostral tongue sensation</td>
</tr>
<tr>
<td>Vestibulocochlear</td>
<td>Head tilt/turn, circling/leaning, response to environmental sounds</td>
</tr>
<tr>
<td>Glossopharyngeal</td>
<td>Ability to swallow</td>
</tr>
<tr>
<td>Vagus</td>
<td>Laryngeal abduction (&quot;slap&quot;) test</td>
</tr>
<tr>
<td>Accessory</td>
<td>Cranial neck muscle symmetry</td>
</tr>
<tr>
<td>Hypoglossal</td>
<td>Tongue tone</td>
</tr>
</tbody>
</table>

Mayhew; EVJ 2010
THO Prognosis

- 15 horses undergoing ceratohyoidectomy
- 8 of 10 horses that were used athletically returned to previous levels of use
- Persisting clinical signs included:
  - Mild facial nerve paralysis (3/14; 21.4%)
  - Head tilt (6/14; 42.8%)
- Prognosis good for resolution of ataxia but some cranial nerve deficits may persist.

Oliver and Hardy, Canadian Vet J 2015
Blindness

• Central blindness
  – Forebrain (cerebrum and thalamus)
  – Depressed menace
  – Intact PLR
  – Eye contralateral to lesions:
    • Optic tract
    • Dorsal thalamus (Lateral geniculate nucleus)
    • Optic radiation (Internal capsule)
    • Visual cortex (Occipital lobe of cerebrum)

• Eye or optic nerve lesion
  – Blindness
  – Suppressed menace response
  – Dilated pupil
  – Poor PLR
    • Can be present, likely because visual path fibers are more readily damaged than pupilomotor fibers
  • Dazzle response can be present in centrally blind horse with no CN III and no PLR

Equine Horner’s Syndrome

• Collection of clinical signs
• Pathology of the sympathetic nerve supply to the head

• UMN ➔ LMN
  – Somatic: 1 LMN
  – Autonomic: Pre- and post ganglionic LMN
Equine Horner’s Syndrome

• Sympathetic activity of smooth muscles in the head
  – Dilation of the pupil (midriasis)
  – Increased tone in eyelids and eyelashes
  – Peripheral vasoconstriction
  – Increased sweat gland activity

• UMN
  – Cervical SCI
  – Brainstem lesion
  – Sweating whole side of body
  – Ataxia
  – Other CN signs
  – Depression

Mayhew, EVJ 2010
Equine Horner's Syndrome

- Preganglionic LMN
  - Brachial plexus
  - Cranial thoracic lesions
  - Sympathetic trunk trauma
  - Sweating whole side of neck
  - Lameness
  - Neurogenic muscle atrophy
  - Exercise intolerance
  - Respiratory distress
  - Local reaction

Equine Horner’s Syndrome

- Post ganglionic LMN
  - Orbital trauma / tumor
  - Guttural pouch disease
  - Non-neurogenic strabismus
  - Epistaxis
  - Nasal discharge
  - Other CN signs

Equine Horner’s Syndrome

- Pre- and post ganglionic LMN
  - Grass sickness
  - Bilateral Horner’s
  - Dysphagia
  - Colic
Equine Horner’s Syndrome

• Clinical signs of denervation
  – Ptosis
  – Miosis
  – Enophthalmus

Equine Horner’s Syndrome

• NOT what is necessarily seen in the horse
  – Miosis
    • Mild
  – Enophthalmos
  – Protrusion of nictating membrane

Equine Horner’s Syndrome

• Sweating
  – Most prominent sign of acute denervation
  – 24 – 48 hours
  – Patchy sweating induced by excitement
  – Cutaneous vasodilation – more adrenaline surrounding sweat glands
  – More pronounced with proximal lesions
**Equine Horner’s Syndrome**

- At or distal to cervical ganglion (guttural pouch)
  - Sweating from head extending caudally to atlas
- Preganglionic lesions proximal to ganglion and neck lesions:
  - Sweating further down the neck to C2 and C3
- Cranial thoracic lesions (origin of sympathetic trunk)
  - Sweating over whole neck and head
- Lesion in brainstem or cervical spinal cord
  - Sweating on the whole side of the trunk, neck, head
  - Eye signs

**Sleep**

- Complex of metabolic and adaptive needs
  - Developed and dependent on the niche the species fills in evolution
- Restorative function
  - Result of increased convective exchange of interstitial and CSF
  - Enhance removal of potential neurotoxic waste products
    - Increased rate of β-amyloid clearance

**Sleep**

- Period of immobility
- Unresponsive to the environment
- Behavior with clear physiologic necessities
- When lacking: dysfunctional impacts
Sleep

• Estimation for the horse:
  – 4 hours of total sleep time
  • 2 hours of drowsiness
  • 3 hours of slow-wave sleep
  • < 1 hour of paradoxical / REM sleep
Sleep

• Wild ponies:
  – 16% of time: recumbent resting behavior
  – Peak midnight – 4 am.
  – Never lying down simultaneously
    • Other herd was seen to do this once daily

Sleep Disorders

• 24-hour sleep cycle is likely not appropriate for the horse / herd animals
• Can go much longer periods without sleep

• When moved to an uncomfortable environment sleep is affected for several days at minimum
• Social habituation

Sleep Disorders

• Recumbent sleep deprivation
• Frequent partial collapse
• Environmental and Physical Factors
• ACVIM 2016: Dr. Bertone
  – 420 client Internet-referred cases
  – Video / Images
  – Case details
Sleep Disorders

- Environmental insecurity
  - Stall location
  - Stall size
  - Loss of other horses
  - Light changes
  - Blankets
  - Windows
  - Weather
- Monotony
  - Forced to stand quietly for long periods of time
  - Cross ties
- Aggression displacement
  - Excessive or continuous aggression
  - Alpha female
- Sleep terror
  - Recent finding