

CRANIAL NERVE ASSESSMENT AND DYSFUNCTION



BASICS

OVERVIEW

- Causative lesions can be localized using the principles outlined below
- Diagnostic rule-out lists are generated based on neuroanatomic localization, history, and signalment

SYSTEMS AFFECTED

- Nervous

PATHOPHYSIOLOGY

Cranial nerve(s) arising from each location is/are listed after the name of each anatomic division

- *Forebrain* – *Cerebrum*, I – olfactory; *Diencephalon*, II – optic
- *Brainstem* – *Diencephalon*; *Midbrain*, III – oculomotor, IV – trochlear; *Pons*, Vs – trigeminal, sensory, Vm – trigeminal, motor, VI – abducens; *Medulla oblongata*, VII – facial, VIII – vestibulocochlear, IX – glossopharyngeal, X – vagus, XI – spinal accessory, XII – hypoglossal

Selected functional units relating to cranial nerves are listed below

- *Vestibular system* - This special proprioceptive system maintains orientation of the animal against gravity. It comprises the sensory organ in the bony labyrinth of the petrous temporal bone, cranial nerve VIII, vestibular nuclei in the pons and medulla, and connections to the cerebellum, nuclei controlling eye movement (III, IV, VI), and to the lower motor neurons (LMN) of the limbs via the vestibulospinal tracts.
- *Autonomic control of pupil diameter* – Pupillary diameter reflects parasympathetic constrictor and sympathetic dilator actions. The 2-neuron lower motor neurons for each of these systems arise in the gray matter of the CNS and pass via autonomic ganglia to the smooth muscles of the iris. Parasympathetic LMN originate in the midbrain and travel in the oculomotor nerve (III); sympathetic LMN come from the T1 to T3 spinal cord segments and travel within the carotid sheath as the cervical sympathetic trunk. Sympathetic LMN activity is influenced by brainstem upper motor neurons (UMN).

PHYSICAL EXAMINATION FINDINGS

Possible location(s) of neurologic lesions causing indicated clinical signs is/are listed after each sign or set of signs

- *Blindness* – normal pupillary light reflex (PLR) - forebrain; abnormal PLR - II
- *Menace defect* – with blindness - II, forebrain; without blindness - cerebellum, medulla, VII
- *Absent PLR* – with blindness - II; without blindness - midbrain, III
- *Abnormal eye position (strabismus)* – corrects with head positioning (*vestibular* strabismus) - VIII, mid-brainstem, cerebellum; uncorrectable (*true* strabismus) - III, IV, VI, mid-brainstem
- *Abnormal eye movements* – spontaneous or positional nystagmus - VIII, mid-brainstem, cerebellum; absent physiologic nystagmus - VIII, mid-brainstem, cerebellum; tremors or oscillations – idiopathic
- *Dilated unresponsive pupil (mydriasis)* – midbrain, III (unilateral or bilateral); II (bilateral only)

- *Abnormally constricted pupil (miosis)* – sympathetic LMN - T1 to T3, sympathetic trunk; UMN – brainstem or cervical spinal cord.
- *Horner's syndrome* – miosis, ptosis, reduced nasal sweating (C), +/- prolapsed nictitans, enophthalmos – sympathetic LMN to face (see above for miosis)
- *Reduced sensitivity to facial touching (hypoesthesia)* - Vs, brainstem, forebrain)
- *Atrophy of chewing muscles, dropped jaw, deviated jaw* - Vm, pons
- *Ear, eyelid, lip weakness, dry eye* - VII, medulla
- *Head tilt, body lean and concavity, staggering gait* - VIII, mid-brainstem, cerebellum
- *Head bob, intention tremor, limb hypermetria, delayed limb protraction, ataxia* - cerebellum
- *Inability to swallow, incoordinated feed regurgitation, drooling saliva* - IX, X, XI, medulla
- *Tongue weakness, atrophy, deviation* - XII, medulla
- Additional signs associated with brain disorders causing cranial nerve dysfunction are described in “Brain Assessment and Dysfunction” section

CAUSES AND RISK FACTORS

Listed in the “Brain Assessment and Dysfunction” section



DIAGNOSIS

- Assess behavior and level of consciousness before handling animal
- Look for abnormal behavior (forebrain) or reduced alertness (RAS in rostral brainstem)
- Note seizure activity (forebrain)
- Examine cranial nerve function as follows:
 - Use hand to provoke eyelid closures (menace responses; II, central pathways, VII)
 - Assess pupil symmetry and pupillary light reflexes (PLR; II, rostral brainstem, III)
 - Look for abnormal nystagmus in neutral and extended head positions, noting direction of fast phase; elicit normal nystagmus by moving head side-to-side (VIII, medulla, cerebellum)
 - Assess position of eyeballs within bony orbits. Vestibular strabismus if eye deviations resolved by rotation of the head, true strabismus if uncorrectable (III, IV, VI, mid-brainstem)
 - Look for impaired ear movement, and ear, eyelid, deviation of nose to normal side (sheep, goat, camelid), lip drooping (VII, medulla); corneal ulceration from exposure (VII to orbicularis oculi) and/or dry eye (VII to lacrimal glands)
 - Elicit blink by below and above eye (palpebral reflex; V, mid-brainstem, VII)
 - Assess reaction to touching nasal septum (V, brainstem, forebrain)
 - Withdraw tongue and assess size and strength (XII, medulla)
 - Assess swallow (IX, X, medulla) by looking for drooling, or regurgitated ingesta. Test ability to swallow esophageal tube
- Examine gait (brainstem)
- Hopping – in small, cooperative animals hold up a limb and push the animal laterally to hop on the opposite limb (brainstem, cerebellum). Note that camelids usually cush when hopping is attempted

DIFFERENTIAL DIAGNOSES

Cranial nerve disorders may be classified according to the modified MIIND system - malformation/genetic, injury, inflammation, neoplasia, degeneration, idiopathic

CBC/BIOCHEMISTRY/URINALYSIS

- N/A

OTHER LABORATORY TESTS

- CSF analysis - described in “Brain Assessment and Dysfunction” chapter

Imaging

- Radiography
- Cross-sectional imaging (CT, MRI)

OTHER DIAGNOSTIC PROCEDURES

- Brainstem Auditory Evoked Response (BAER) is a highly specialized technique wherein electrical potentials are evoked in the brain by trains of clicks delivered to each ear in turn. In practice, it may be used to evaluate vestibular and mid-brainstem function in animals with peripheral vestibular disorders.



TREATMENT

- See specific disorders



MISCELLANEOUS

ABBREVIATIONS

- PLR = Pupillary light reflexes
- CSF = cerebrospinal fluid
- UMN = Upper motor neurons
- LMN = Lower motor neurons
- RAS = Reticular activating system

Suggested Reading

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