

**Lesion Localization Key
Forebrain (Cerebrum and Diencephalon)**

Cerebrum (CN 1-2) (Indirect effects on CN3 & CN 5)	Seizures	seizures		
	Behavior	wandering, vocalizing, inappropriate elimination, getting stuck in corners		
	Mental Status	Dull, stupor, obtunded, demented		
	Eye & Ear Exam	Subtle anisocoria, contralateral miosis, contralateral slow PLR. Contralateral loss of vision, causing deficits in contralateral menace, PLR, visual Tracking and contralateral hemi-inattention.		
	Attitude	ipsilateral head turn		
	Posture	Head pressing		
	Postural Reactions	Hemi-walking	subtle, contralateral hemiparesis	
		Proprioceptive Positioning	contralateral deficiency	
			Postural reaction deficits	
	Gait	Stride Length	Increased stride length all limbs	
		Ataxia	Ataxia, movements with lack of purpose all limbs	
		Direction	wide circles ipsilateral	
	PROPRIORECEPTION DEFICITS WITH NORMAL OR NEAR NORMAL GAIT IS HALLMARK OF CEREBRAL DISEASE.			
	Cranial Nerves	CN 1 - olfactory	Not routinely tested. If tested, check nostril patency, then offer food blindfolded. Irritating substances(alcohol, ammonia, etc.) should not be used because they stimulate trigeminal nerve endings and give false results.	
		CN 2 - optic	See Eye exam.	
Spinal Nerves	Normal or UMN to contralateral front and rear limbs, with rear worse.			
Palpation & Pain	Neck pain, contralateral deficiency in sensation of face > body.			
Diencephalon (CN 2-3) (Thalamus, Hypothalamus) (PLR – lateral geniculate, pretectile nucleus)	Diencephalon lesions show lesions for cerebrum above, plus those below			
	General	Poor temperature regulation		
	Behavior	Abnormal appetite		
		PU-PD due to lack of ADH		
	Eye & Ear Exam	No PLR with intact dazzle and lack of vision indicates forebrain blindness.		
Cranial Nerves	CN 3 - oculomotor	No PLR, strabismus.		

Lesion Localization Key
Brainstem (midbrain, pons, medulla)

All Parts (ARAS – Reticular Activating System, red nucleus)	Mental Status	More likely to produce severe stupor or coma compared to cerebral lesions (ARAS).	
	Attitude	Ipsilateral or contralateral head tilt.	
	Posture	Wide based stance, Decerebrate rigidity.	
	Postural Reactions	Deficits can be bilateral and severe.	
	Gait	UMN paresis or plegia (dysmetria, spastic) - ipsilateral (caudal midbrain) contralateral (rostral midbrain) or bilateral.	
	Cranial Nerves	Cavernous Sinus Syndrome	Dysfunction of more than one nerve that travels through the cavernous sinus at the base of the brain – CN 3, 4, 5 (temporal and maxillary branches) & 6.
Mesencephalon (midbrain) (CN 3-4)	Eye Exam	Horner’s Syndrome	Ipsilateral or bilateral Horner’s Syndrome
Ventral Metencephalon (pons)	See CN 5.		
Myelencephalon (medulla oblongata)	See CN 6.		

Brain Assessment – Cerebellum (Dorsal Metencephalon):

Cerebellum	Posture	Decerebellate rigidity with acute cerebellar injury, such as brain stem herniation. Consciousness not impaired due to lack of brain-stem involvement.	
	Gait	Cerebellar ataxia – dysmetria, hypermetria (over-reaching, high stepping gait), intention tremor. May also show signs of vestibular disease, as the cerebellum sends signals to the vestibular center.	

Cranial Nerve Reflex Assessment

CN 1-3 – olfactory, optic, oculomotor	See Forebrain and Brainstem		
CN 3,4,6 – oculomotor, trochlear, abducens	Eye Exam	See also Forebrain and Brainstem. Subtle strabismus can be detected by shining a bright light on the corneas. When the eyes are aligned, the light reflection will be on the same area in each eye. Abducens nerve retracts globe in corneal reflex.	
CN 5 - trigeminal	Motor	Atrophy temporalis and masseter muscles. Unable to close mouth with bilateral.	
	Sensory	Ophthalmic branch	Corneal reflex, tactile sensation medial palpebrum and nostril.
		Maxillary Branch	Tactile sensation upper lip and nostril.
		Mandibular branch	Tactile sensation lower lip.
CN 7 – facial	Motor	Motor responses to testing sensory CN 5 above are by the facial nerve. Lesions also produce asymmetrical eyelid closure, widened palpebral fissure, drooping ear or drooping lip commissure. Facial nerve contributes to tear production, so lesions can contribute to dry eye.	

**Lesion Localization Key
Cranial Nerve Reflex Assessment, cont'd**

CN 8 – vestibulocochlear n.	Cochlear portion	Alert hearing patients will orient head and ears toward a noise. Pets deaf in one ear will orient toward the wall when sound bounced off the far wall.	
	vestibular	Unilateral	Leaning and falling to one side, head tilt, abnormal nystagmus.
		Bilateral	Crouched position, reluctant to move, side-to-side head movement
		Ataxic, broad based stance, positional nystagmus.	
CN 9-11 – glossopharyngeal, vagus, accessory	Touching left or right side of the caudal pharynx with a cotton swab normally causes elevation of the soft palate and contraction of the pharyngeal muscles (gag). Asymmetry more important than bilateral loss, as a gag reflex is difficult to elicit in some normal dogs. In fractious dogs, gag may be elicited by palpating dorsal to the larynx. Accessory nerve also innervates the trapezius muscle.		
CN 12 - hypoglossal	Deficits result in asymmetry, atrophy or deviation of the tongue. Dogs often lick the nose after gagging – asymmetry can be noted at this time, or when drinking water.		

Spinal Nerve Reflex Assessment

General Principles	Lower Motor Neuron (LMN) Lesion	suppress a reflex, cause flaccid weakness and indicate a lesion within the reflex arc. Large bladder easy to express.
	Things that Mimic LMN Lesion	severe muscle or joint rigidity, extreme excitement or muscle stiffness, severe metabolic disease causing weakness, spinal shock
	Upper Motor Neuron (UMN) Lesion	UMN lesions exaggerate a reflex, cause spastic weakness and indicate a lesion anterior to the reflex arc. Large bladder difficult to express. Crossed extensor reflex.
	Things that Mimic UMN Lesion	Extreme excitement, lesion at L6-S1 spinal cord causing pseudohyperreflexia of patellar reflex

Lesions below can be present, but are not present in all cases

Spinal Cord Segment	Posture, Gait	Cranial Nerves	Neck	Front Limb Reflexes	Back Panniculus	Pelvic Limb Reflexes	Perineal Reflexes Bladder
Cervical C1-C5	Wide based stance Recumbent Head Down Stiff Gait	Horner's Syndrome	Pain Respiratory Difficulty With chest excursions	CP deficits Motor deficits Sensory deficits UMN	Normal	CP deficits Motor deficits Sensory deficits UMN worse	UMN bladder
				Hemiparesis and Hemiplegia if unilateral Tetraparesis or Tetraplegia if bilateral Pelvic limbs worse than thoracic limbs			
Brachial Plexus C6-T2	Wide based stance Recumbent Head Down Stiff Gait Rear	Horner's Syndrome	Mild pain Respiratory Difficulty abdominal breathing	CP deficits Motor deficits Sensory deficits LMN	LMN	CP deficits Motor deficits Sensory deficits UMN	UMN bladder
				Hemiparesis and Hemiplegia if unilateral Tetraparesis or Tetraplegia if bilateral Pelvic limbs worse than thoracic limbs			

Lesion Localization Key
Spinal Nerve Reflex Assessment, cont'd

Spinal Cord Segment	Posture, Gait	Cranial Nerves	Neck	Front Limb Reflexes	Back Panniculus	Pelvic Limb Reflexes	Perineal Ref. Bladder
T3-L3	Stiff gait Rear Schiff-Sherrington	Normal	Normal	Normal UMN if Schiff-Sherrington	Pain Termination Panniculus (1-4 segments orad)	CP deficits Motor deficits Sensory deficits UMN Paraparesis Paraplegia	UMN bladder
Pelvic Limb Nerves L4-S2	Rear Weakness Schiff-Sherrington	Normal	Normal	normal UMN if Schiff-Sherrington	Termination Panniculus (1-4 segments orad)	CP deficits Motor deficits Sensory deficits LMN Paraparesis Paraplegia	UMN bladder LS pain
S1-Cd	Rear Weakness	Normal	normal	Normal	normal	CP deficits Motor deficits Sensory deficits LMN Paraparesis Paraplegia Pseudohyper-reflexia	LMN perineal LMN bladder LS pain

Differential Diagnosis Multifocal CNS Disease

Dogs	Cats
<p>Degenerative CNS atrophy of advanced age Lysosomal Storage Disease Leukodystrophy neuronal vacuolation of Rottweilers Abiotrophy of Cocker Spaniels Anomalous Dandy Walker Syndrome Neoplastic Metastatic neoplasia Nutritional Thiamine deficiency Infectious Bacterial meningioencephalitis Fungal meningioencephalitis Canine Distemper Virus <i>Toxoplasma gondii</i> <i>Neospora Caninum</i> <i>Ehrlichia canis</i> Rocky Mountain Spotted Fever – <i>Rickettsia rickettsii</i> Aberrant heartworm - <i>Dirofilaria immitis</i> Raccoon roundworm – <i>Bayliascaris</i> <i>Procyonis</i> Lyme Disease - <i>Borrelia burgdorferi</i> Blue green algae – <i>Prototheca spp.</i> Inflammatory – Immune Mediated GME – granulomatous meningioencephalitis Eosinophilic meningioencephalitis Vascular Ischemic encephalopathy</p>	<p>Degenerative CNS atrophy of advanced age Lysosomal Storage Disease Anomalous Dandy Walker Syndrome Neoplastic Metastatic neoplasia Nutritional Thiamine deficiency Infectious Bacterial meningioencephalitis Fungal meningioencephalitis Feline infectious peritonitis Borna Disease <i>Toxoplasma gondii</i> Aberrant Heartworm - <i>Dirofilaria immitis</i> Raccoon roundworm – <i>Bayliascaris</i> <i>Procyonis</i> <i>Cuterebra spp</i> <i>Taenia serialis</i> – cystic coenurus Blue green algae – <i>Prototheca spp.</i> Feline spongiform encephalopathy Vascular Ischemic encephalopathy</p>