

The Neurological Assessment

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A Neurological Assessment

- Subjective History:
 - History of Present injury
 - Course of Progression
 - Aggravation / Ease
 - Abilities at present
 - 'Job' of the dog
- Veterinary Intervention
 - Diagnosis & Recommendations / Medications
 - Tests: X-rays, U/S, Myelograms, MRI, Blood Tests
 - Always call the attending vet



A Neurological Assessment

- Past Medical History:
 - as per owner and vet
- Other Pertinent Questions:
 - Stairs
 - Bowel & Bladder (B & B)
 - Licking & Chewing
 - Signs & Symptoms (S & S) AM vs PM & with activity
 - Appetite, Hair Coat, Depression, Thirst
 - Clumsiness
 - Changes in Behaviour / Likes & Dislikes
 - Anything else the owner has noticed



A Neurological Assessment

- ON EXAMINATION
 - General Observations: temperament, condition & activity level
 - Gait Examination: Stance, Sitting, Ambulation
 - Walk & Trot
 - Crossing Over?
 - Lying / Sit to Stand and back again
 - Turns in both direction
 - Familiarize before you start to poke around!



A Neurological Assessment

- Extremity Scan:
 - Run your hands down the limbs assessing for muscle tone and bulk.
 - Check the joints and muscles for any obvious signs of heat, swelling and tenderness
 - Check for other NEURO clues such as scuffed toes and toe nails
 - Check for dermatitis, granulomas or ulcers



A Neurological Assessment

- R.O.M. Scan
 - Just to make sure there is no other complicating orthopedic factors
 - Full Flexion of a limb
 - Full Extension of a limb
- Caution with hip extension when looking at spinal problems.



A Neurological Assessment

- Neurological Testing
 - Balance on displacement
 - A displacement force is normally withstood and will not cause an animal to go off balance



A Neurological Assessment

- Neurological Testing
 - Paper Slide Test
 - In standing, place the animal's foot on a piece of paper. Now slowly pull the paper to slide the foot out sideways. The animal should notice the displacement of the limb and replace the leg into a normal stance position before the foot is an unnatural standing distance away from the body.



A Neurological Assessment

- Neurological Testing
 - Placing Reflex
 - (should have a less than 2 second return): flip the paw over so that the dorsal surface is in contact with the ground. A normal animal should 'right' the position immediately.

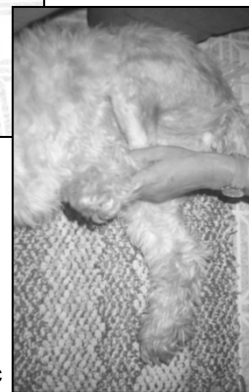


A Neurological Assessment

- Neurological Tests
 - Crossed Extensor Reflex
 - Positive (neurological)
 - Negative (normal)
 - An abnormal reflex where the full flexion of one leg causes rigid extension of the opposite leg.



Normal



Neurologic

A Neurological Assessment

- Pain Perception vs Flexor Withdrawal
 - Pain perception: Hair pulling or hard squeezing of a digit should be felt and acknowledged by a normal animal.
 - Flexor withdrawal: Full leg withdrawal from a noxious stimulus is considered normal. It is a spinal cord mediated reflex.



A Neurological Assessment

- Tendon Reflexes & Muscle Reflexes



A Neurological Assessment

- Perineal Reflex
 - A noxious stimulus at the side of the anus will Normally cause a contraction of the sphincter



A Neurological Assessment

- Hopping Reflex
 - An animal should hop to support itself if made to weight bear on one leg when displaced in an oblique direction



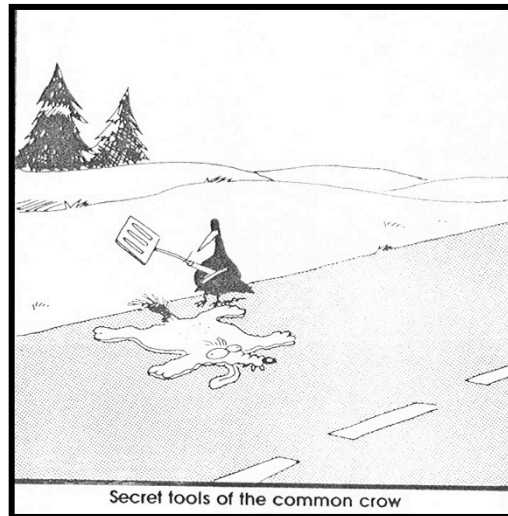
A Neurological Assessment

- Para-Walking / Hemi-Walking
 - When two legs on the same side are lifted up and the animal is displaced sideways (towards the side with the legs down), the animal should 'walk' one leg followed by the other on the same side (i.e. front leg steps sideways, then the back leg steps sideways)



A Neurological Assessment

- Neurological Testing
 - Babinski Reflex
 - Clonus



A Neurological Assessment

- Was anything revealed on your orthopedic scan?
 - Do you need to further evaluate the extremity joints for specific orthopedic problems?



A Neurological Assessment

- Spinal Evaluation:
- For general localization of the lesion (if spinal cord based)
 - Palpate muscle bulk and tone
 - Palpate the spinous processes for pain and adjacent paraspinal muscle reactivity



A Neurological Assessment

- A Spinal Evaluation
 - Dorsal – Ventral Pressures?
 - Rotations?
 - Cervical Spine Side Glides?
 - Tail ROM & Pulls



A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - **LMNL** (lower motor neuron lesions):
 - (the grey matter in the ventral horn of the spinal cord) nerve root or peripheral
 - **SIGNS OF A LMNL**
 - Muscle Weakness
 - Hyporeflexia / Areflexia
 - Hypotonia or Atonia
 - Neurogenic atrophy appears within 3 – 7 days (up to half of the muscle volume can be lost in this time with a severed nerve lesion)
 - Owner observations are very valuable for assessing incomplete LMNLs



A Neurological Assessment

- NERVES
- CUTANEOUS INNERVATION



A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - NERVE ROOT DISTRIBUTION

- FRONT LIMB: C6 – T2

WHAT DO THE FOLLOWING NERVES DO?

- Radial Nerve
- Musculocutaneous Nerve
- Ulnar and Median Nerves
- Suprascapular / Axillary / Subscapular Nerves
- Pectoral Nerve
- Thoracodorsal Nerve



A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - NERVE ROOT DISTRIBUTION

- HIND LIMB: L4 – S1

WHAT DO THE FOLLOWING NERVES DO?

- Femoral Nerve
- Sciatic Nerve
- Obturator Nerve
- Gluteal Nerves



A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - NERVE ROOT DISTRIBUTION

- BOWEL AND BLADDER: S1 – S3

WHAT DOES THE FOLLOWING NERVE DO?

- Pudendal



A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - Relevant Anatomy as it Relates to the LMNL
 - The C/S has 7 vertebra and 8 spinal cord segments & nerve roots
 - The spinal cord can end at L4 in large dogs or L6 in smaller dogs
 - Relevance: disc lesions below the end of the spinal cord will display as LMNLs
 - Cord Segments L5 to S3 extend from the middle of the L3 vertebra down to L6 (raise these levels by one segment for large breed dogs)

A Neurological Assessment



- Deductive Reasoning in the Neurological Patient
 - LMNL: Nerve Root Impingement
 - Etiology
 - Compression or traction of nerve root due to spinal or pelvis dysfunction / misalignment
 - Bone Spurs near the facet joint encroaching upon the nerve roots
 - Central disc lesions affecting the cauda equina (or compression of the cord segments that correspond to the limbs)
 - Lateralized disc lesions in the C/S or L/S
 - Fibrocartilaginous embolism
 - Nerve sheath tumors

A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - Signs & Symptoms of Nerve Root Impingement

- Extrapolation from Humans

1. Pins & Needles: (animal might chew or lick the limb or off weight the limb in a tippy toe kind of manner)
2. Pain: (root signature stance or may attack the leg or act as if he was suddenly pinched / poked)
3. Motor Impairment: (after pain, where the motor functioning is problematic...and the animal may not be able to perform a task)

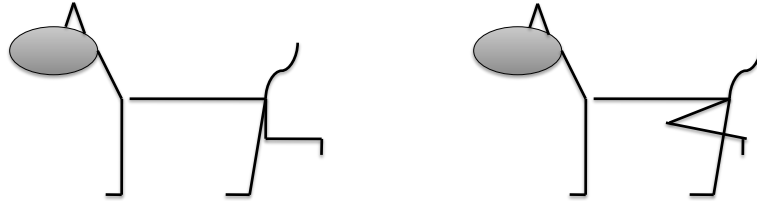


A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - Signs & Symptoms of Nerve Root Impingement
 - Spine is tender on palpation
 - Facilitated muscle spasm bilaterally / unilaterally
 - Joint Mobility:
 - May have spinal or pelvis misalignment / dysfunction
 - A disc herniation would not have the above problems, the pelvis and facet joint mobility would be equal bilaterally. Spasm may impede testing.
 - Bone spurs: Perhaps unilateral stiffness depending upon where the spurs were encroaching
 - If Pelvis: piriformis muscle tension with compression or traction of the nerve roots
 - Off weighting / root signature stance

A Neurological Assessment

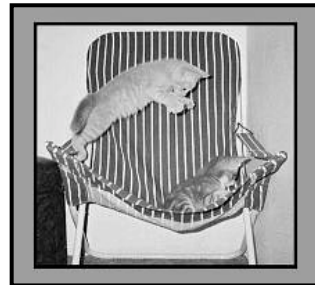
- Which one has a Root Signature stance?



- What does the other one have?

Neurological Assessments

- Deductive Reasoning in the Neurological Patient
 - Cranial Nerves
 - The cranial nerves are in effect the nerve roots of the brainstem (medulla, pons & midbrain)
 - These are good to understand as a reference, but of little clinical use in Rehab practice.
 - Trigeminal Nerve (CN 5)
 - Facial Nerve (CN 7)
 - Vestibulocochlear (CN 8)
 - Accessory (CN 11)



A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - Clinical Signs of an UMNL (upper motor neuron lesion)
 - UMN refers to the spinal cord and brain.
 - Paresis to Paralysis
 - Hyper-reflexia
 - Hypertonia
 - Disuse Atrophy



A Neurological Assessment

- Deductive Reasoning in the Neurological Patient
 - Spinal Cord Anatomy as it relates to the UMNL
 - The Ascending tract sends info from the receptors to the brain
 - The Descending tract sends info from the brain to the LMN
 - The Sensory Tract
 1. The Fasciculus Gracilus & Cuneatus: (conscious perception)
 2. Dorsal / Ventral Spinocerebellar: (proprio. in hind legs)
 3. Rostral Spinal: (front leg conscious proprio.)
 4. Spinothalamic: (pain perception)
 - The Motor Tract
 - Is deeper (Rubrospinal, Reticulospinal, Vestibulospinal)
 - WHY DO WE CARE???



The Spinal Cord

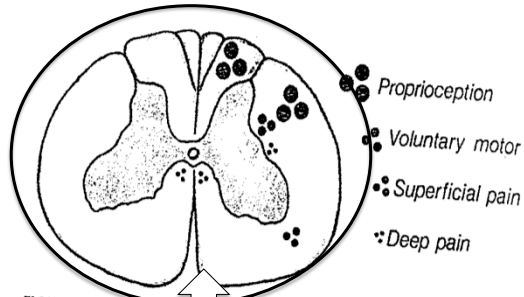
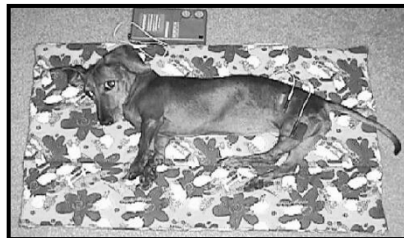
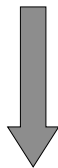


FIGURE 75-3. Cross-sectional view of a canine spinal cord showing the location and diameter of different fiber types. (Adapted from Oliver JE, Lorenz MD. *Handbook of Veterinary Neurologic Diagnosis*. W.B. Saunders Philadelphia, 1983, p 16.) Purdue University, School of Veterinary Medicine, Department of Medical Illustration, © 1990.

A Neurological Assessment

- Why do we care???
- LIFO & FILO
 - Conscious Perception
 - Conscious Proprioception
 - Motor
 - Deep Pain



So it's a Neuro Case?

- Assess Function
- Treat the root of the problem
- Neuro-Rehab to retrain FUNCTION



C/S: The Spinal Nerves

Table 2.2. Segmental Nerve Roots, Peripheral Nerves and Thoracic Limb Muscle Innervation

Nerve	Nerve Roots	Muscles
Suprascapular N.	(C5), C6, C7	Supraspinatus, Infraspinatus
Subscapular N.	C6, C7	Subscapularis
Axillary N.	(C6), C7, C8	Teres Major, Teres Minor, Deltoideus, (Subscapularis)
Pectoral N.	C7, C8	Superficial and Deep Pectorals
Musculocutaneous N.	C6, C7 , (C8)	Biceps Brachii, Brachialis, Coracobrachialis
Radial N.	C7, C8, T1 , (T2)	Triceps brachii, Extensor carpi radialis, Ulnaris lateralis, Common digital extensor, Lateral digital extensor
Median N.	C8, T1 , (T2)	Flexor carpi radialis, Superficial digital flexor, (Deep digital flexor)
Ulnar N.	C8, T1 , (T2)	Flexor carpi ulnaris, Deep digital flexor
Thoracodorsal N.	(C7), C8 , (T1)	Latissimus Dorsi

T/S: Anatomy & Biomechanics

Table 3.1. Branches of the Spinal Nerves

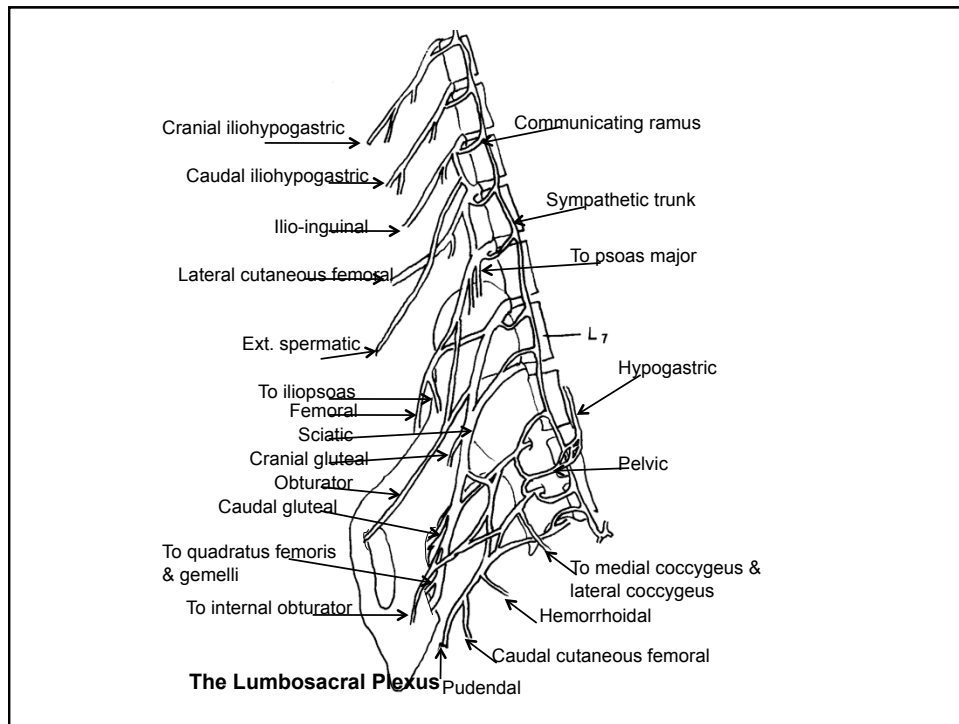
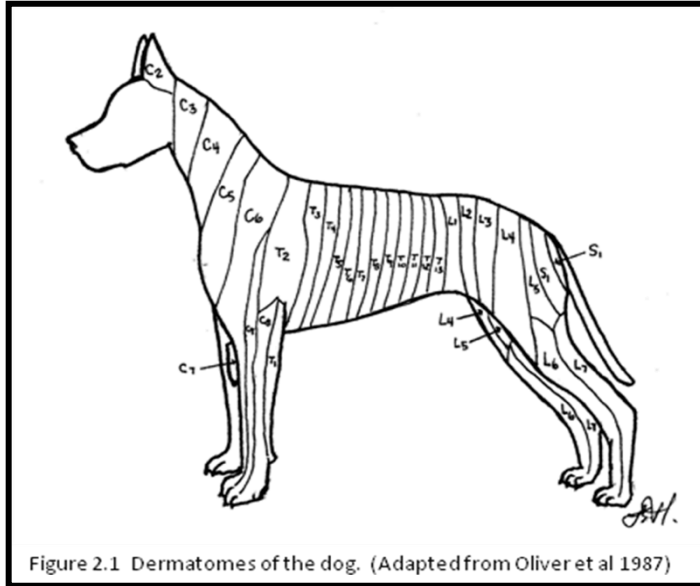
Meningeal Branch	Supplies the dura mater, the dorsal longitudinal ligament, the vertebral venous sinus and other blood vessels in the canal. Each annulus fibrosus of the disc is supplied by meningeal branches from two or more spinal nerves.
Dorsal Branch	Divided into medial and lateral branches. Supply the epaxial muscles and skin over the dorsal aspect of the body wall.
Ventral Branch	Also called intercostals nerves. These are also divided into medial and lateral branches except in the region of the brachial plexus and lumbosacral plexus or the supply to the tail. The intercostals nerves supply the hypaxial muscles of the body wall and give off lateral and ventral cutaneous branches to supply the skin of the lateral and ventral aspects of the body wall.
The Visceral Branch	Carries only general visceral sympathetic fibers to and from visceral structures.

L/S Anatomy & Biomechanics

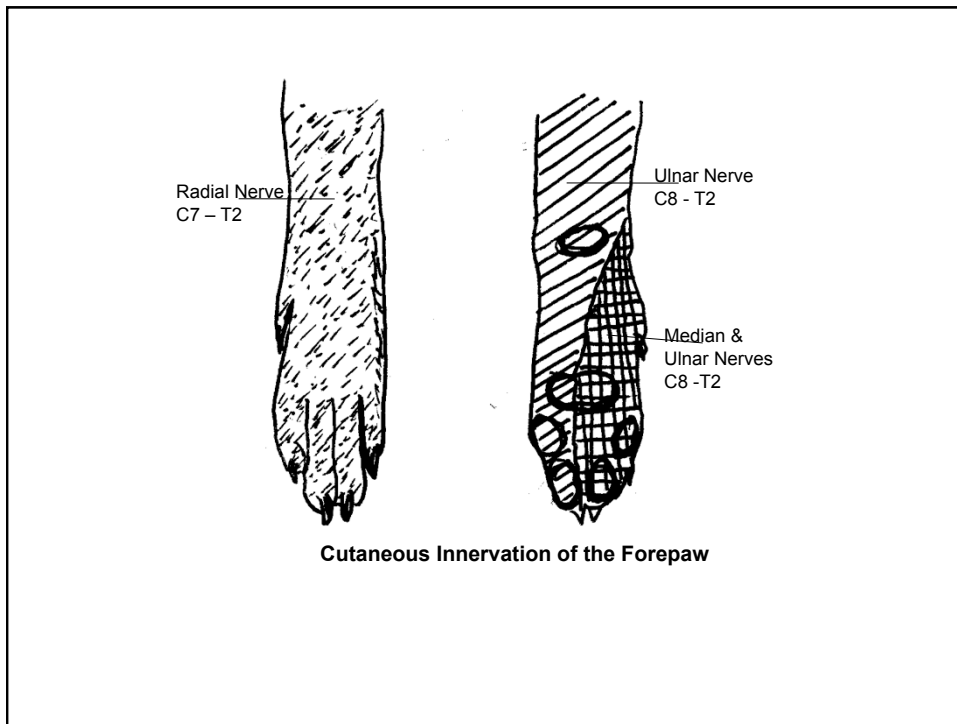
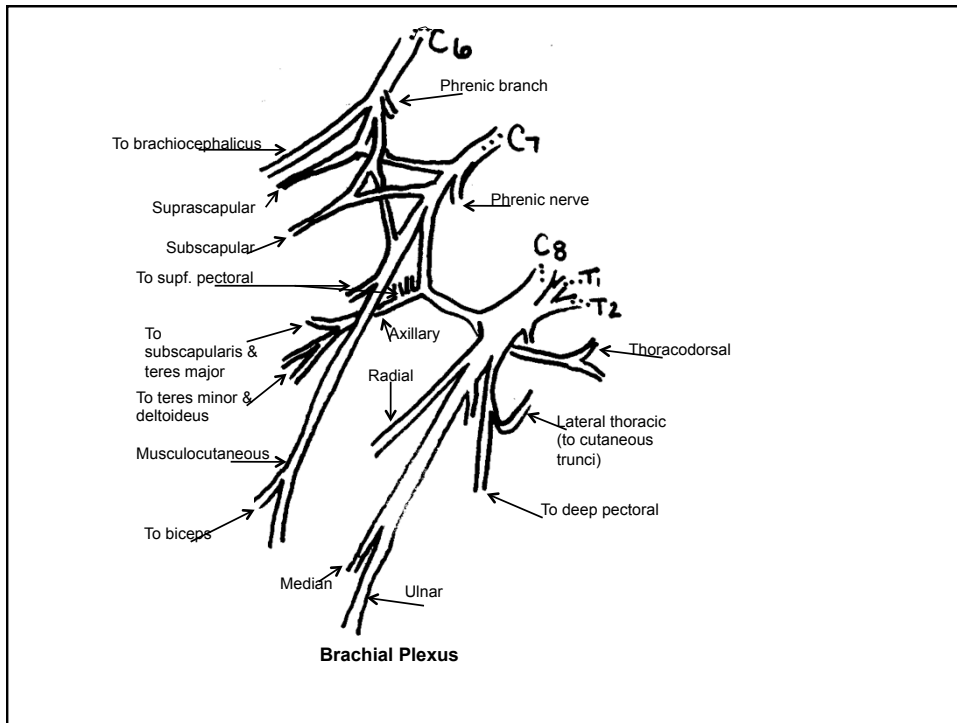
Table 4.3. Segmental Nerve Roots, Peripheral Nerves and Thoracic Limb Muscle Innervation (Sisson & Grossman 1953; Evans 1993; Messonnier 2000)

Nerve	Nerve Roots	Muscles
Femoral Nerve	L4, L5, L6	Iliopsoas, Quadriceps complex, Sartorius
Obturator Nerve	(L4), L5, L6	External obturator, Pectineus, Gracilis, Adductor
Cranial Gluteal Nerve	L6, L7, S1	Middle Gluteal, Deep Gluteal, Tensor Fascia Lata, Piriformis
Caudal Gluteal Nerve	L7 (S1, S2)	Superficial gluteal, (Middle gluteal), (Biceps Femoris), (Semitendinosus)
Sciatic Nerve	L6, L7, S1 (S2)	Biceps Femoris, Semimembranosus, Semitendinosus, Obturator internus, Quadratus femoris, Gemelli
Common Peroneal Nerve	a/a	Peroneus longus, Lateral digital extensor, Long digital extensor, Cranial tibial
Tibial Nerve	a/a	Gastrocnemius, Popliteus, Superficial digital flexor
Pudendal Nerve	S1, S2, S3	External anal sphincter, the external genitalia

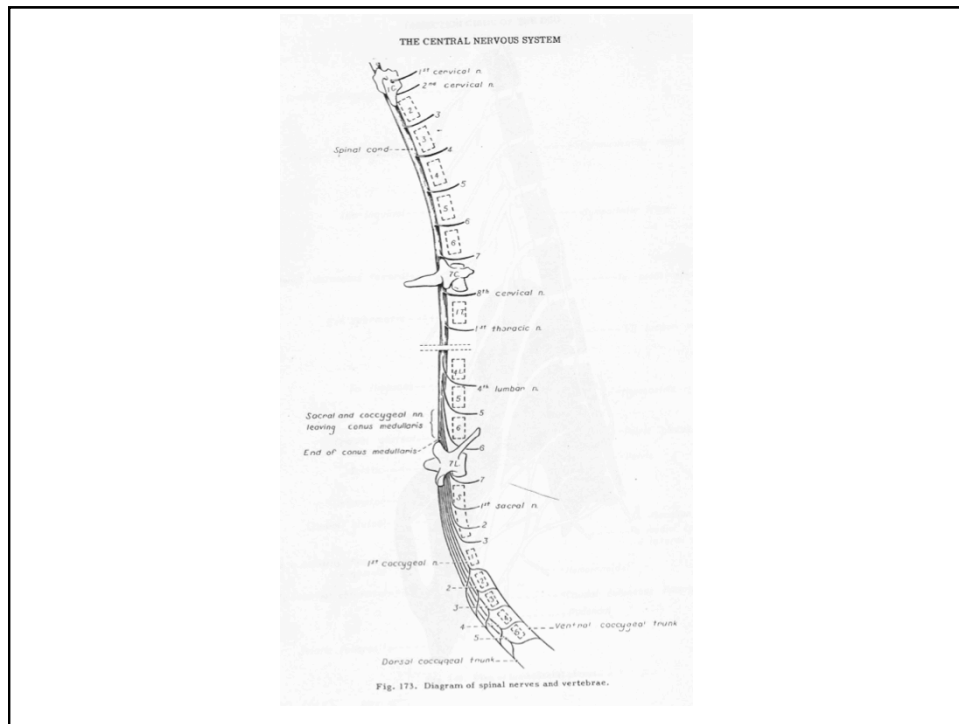
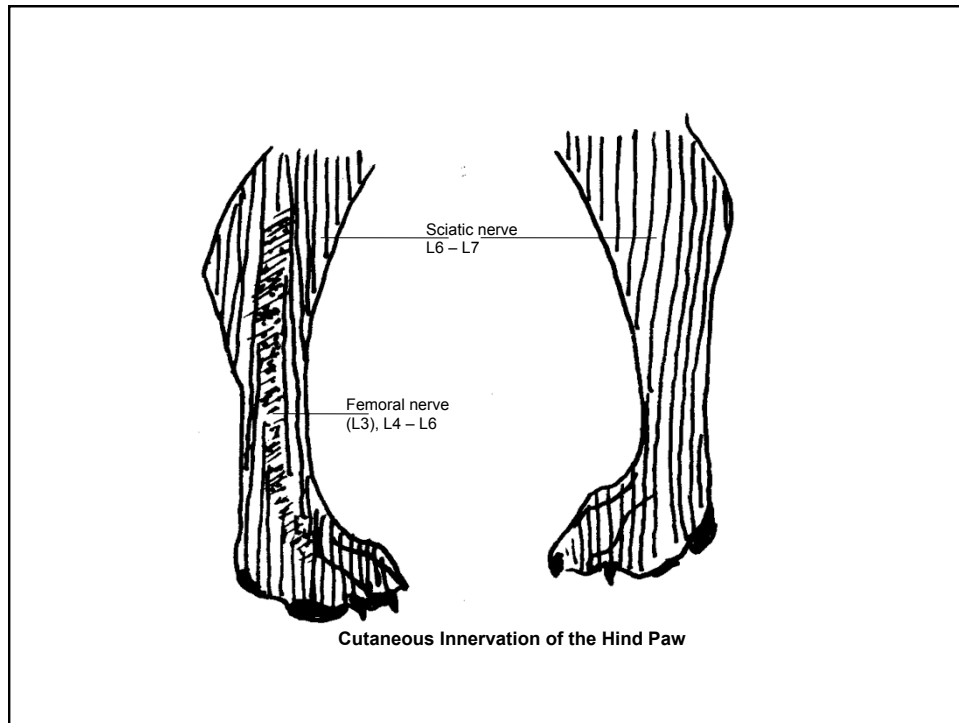
Dermatomes



Neurological Assessments



Neurological Assessments



CRANIAL NERVES:

The cranial nerve signs indicate a LMNL in the brainstem (medulla, pons and midbrain)

Nerve	Dysfunction
CN1 Olfactory	Loss of sense of smell
CN2 Optic	Blindness and pupil dilation
CN3 Oculomotor outwards)	Reduced ability to move the eye Lateral strabismus of the eye (ipsilateral eye looks Ptosis of the eye lid (droopiness)
CN4 Trochlear	Dorsomedial strabismus of the eye
CN5 Trigeminal	Asymmetric chewing, bilateral jaw drop (acute) Inability to open jaw (chronic) Hypalgesia or hyperesthesia of one side of face

CRANIAL NERVES

CN6 Abducens	Medial strabismus of the eye
CN 7 Facial	Asymmetry of <u>facial expression</u> , ear droop, Muzzle deviates to contralesional side, Food collects in cheek Partial dry mouth and dry eye
CN 8 Vestibulocochlear	Disequilibrium, head tilt, spontaneous nystagmus, Circling, ataxia Weakness of ipsilateral extensor muscles, +/- Deafness
CN 9 Glossopharyngeal tongue	Partial dysphagia to pharyngeal paralysis Partial dryness of mouth Loss of taste, touch, and pain in caudal 1/3 of Tachycardia, Increased blood pressure

CRANIAL NERVES

CN 10 Vagus
dysphagia

Hoarseness, dysphonia,
Tachycardia, decreased peristalsis
Inhalation pneumonia

CN 11 Accessory
draw shoulder cranially,
scapula

Atrophy of neck muscles, Inability to
Abduction of dorsal part of

(trapezius & sternomastoideus)

CN 12 Hypoglossal

Ipsilateral:

Acute: tongue deviates to
contralateral side

Chronic: tongue deviates to
ipsilateral side

Bilateral:

Paralysis of tongue