SOP 3.02 Neurological Examination of the Dog (*Canis familiaris*)

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Written by: Esther Callcott
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Purpose

(1) The objective of this standard operating procedure is to provide guidance to Charles Sturt University staff on how to perform a neurological examination of a dog (*Canis familiaris)* with the objective of:
   a. Confirming the existence of a neurological condition; and/or
   b. Localising the lesion (i.e., to facilitate veterinarian in making a neuroanatomical diagnosis.

Scope

(2) This procedure applies to any person who is involved in AEC approved projects involving canines requiring basic neurological assessment.
(3) All researchers and teaching staff using animals for scientific purposes must be competent. For definition of competency refer to Charles Sturt University's procedure on Animal Care Competency Training and Assessment

Preparation

(4) A neurological examination is best performed in a quiet environment with a non-slippery surface to detect subtle defects. An assistant by the patient's head prevents the patient from leaning or turning.
(5) A neurological exam is performed in seven parts, including:
   a. Mentation (Visual assessment) (cl 11)
   b. Posture and gait (Visual Assessment) (cl 13)
   c. Cranial nerve examination (cl 19)
   d. Postural reaction assessment (cl 23)
   e. Spinal reflexes (cl 40)
   f. Palpation (cl 62)
   g. Pain perception (cl 64)
(6) All findings are reported on the Neurological Examination Form as indicated in Appendix 1.
(7) For teaching purposes the maximum student ratios are:
   a. Students to dog – 4:1
   b. Students to teacher – 9:1
(8) This procedure is written to articulate best practice in a professional setting. In professional practice a neuro exam would only be conducted by a qualified Veterinary Scientist or Veterinary Technician. In this procedure University students will conduct Sections 1 – 6 of the exam under the supervision of a suitably qualified person.
(9) Section 7, pain perception, is an important aspect of the neurological examination, but it is not appropriate for this aspect to be conducted by students in a teaching session where it is not otherwise clinically required.

Equipment

(10) The equipment required for this procedure is:
   a. Reflex hammer
   b. Cotton-tip applicator
   c. Transilluminator or pen light
   d. Haemostats
   e. Cotton ball
   f. Lens

S1 - Mentation (Visual assessment)

(11) While taking the patient's history, allow the patient to become familiar with the examination room. In doing so, perform a mentation evaluation. This evaluation requires some knowledge of the patient's normal behaviour and should be conducted in consultation with the owner and other clinical staff familiar with the patient. See Appendix 2 for routine questions that should be asked during a neurological examination.

(12) Mentation can be described as follows:
   a. **Normal**: Bright, alert, responsive or quiet
   b. **Obtunded**: Reduced response to the environment
      - Mild obtundation may be mistaken for lethargy or systemic illness and only noticed by the owner (who is familiar with the pet's normal behaviour); a mild decrease in response to auditory stimulus is present.
      - Moderate obtundation results in an animal that is still responsive to voices (such as its name being called) and noises; however, stronger stimuli may be required, and the animal's response may not be normal.
      - Severe obtundation usually causes the patient to become non-ambulatory but the animal is still responsive to loud noises and hand clapping.
   c. **Comatose:** Unconscious; patient cannot be aroused despite stimulus
   d. **Other changes:** includes compulsive behaviour, agitation, aggression, and dementia.

S2 - Posture and gait (Visual assessment)

(13) Posture is the orientation of the patient when they are at rest. The following conditions may be noted:
   a. **Kyphosis** (dorsal curvature of the spine)
   b. **Lordosis** (ventral curvature of the spine)
   c. **Head tilt**
   d. **Head and neck turn**
   e. **Wide-based stance**.

(14) The following postures are rare but can help in lesion localisation:
   a. **Decerebrate posture:** Extension of all limbs
   b. **Decerebellate posture:** Extension of thoracic limbs; flexion of pelvic limbs
   c. **Opisthotonus**: Dorsiflexion of head and neck
   d. **Schiff-Sherrington posture:** Increased tone in forelimbs; paralysis in hindlimbs

(15) Gait is assessed where the patient can be walked. The patient should be walked in a straight line with you standing behind and then in front to assess the gait. The use of stairs may be

required to detect subtle gait abnormalities. Gait abnormalities are often a mix of weakness, paresis and ataxia.

(16) The following key words should be used to describe gait:

a. Ambulatory/non-ambulatory

- An ambulatory patient should be able to walk on all 4 limbs, supporting its body weight and advancing without assistance.
- A non-ambulatory patient is not able to support its weight or walk; non-ambulatory can refer to all limbs or only the pelvic limbs (See **Motor Function Assessment** for information on evaluating non-ambulatory patients).

b. **Ataxia**

- Proprioceptive ataxia: Symmetric; lack of coordination can be mild.
- Vestibular ataxia: Asymmetric; patient tends to drift or fall to one side of midline. Note: Metronidazole toxicity may manifest in a mix of vestibular and cerebellar signs, including ataxia.
- Cerebellar ataxia: Symmetric; no loss of strength in the limbs; a "bouncy" gait with hypermetria (overreaching the intended object or goal) of the limbs is present.

c. **Paresis & Plegia**:

- Paresis describes reduced voluntary motor function.
- Plegia describes loss of motor function.
- Patients may be mono-, hemi-, para-, or tetra– paretic or plegic, depending on how many and which limbs are involved.
- With paresis, there is often a certain degree of weakness as well. Weakness can be *neurogenic*, if the lesion is located in the central nervous system or peripheral nerves, or *true muscular weakness*.

d. **Lameness** can be neurologic or orthopaedic in origin.

(17) Other abnormalities that provide a more precise description of the quality and degree of the paresis include:

a. **Discombobulate or 2-engine gait:** Short choppy gait in the thoracic limbs with a long stride in the pelvic limbs

b. **Knuckling, stumbling, or falling** when walking.

(18) Note that **Paresis** describes reduced *voluntary motor function*, while **weakness** describes a *loss of muscle strength*.

S3 - Cranial nerve examination

(19) A cranial nerve assessment should be conducted using the procedure described in Appendix 3. Neurological examination in dogs and cats

(20) If the patient is non-ambulatory, a motor function assessment should be performed in conjunction to a cranial nerve assessment. To do this:

a. Support the patient under the pelvis (or under the pelvis and chest for tetra paretic/plegic patients).

b. Encourage the patient to move forward.

c. This momentum sometimes helps the practitioner see voluntary movement.

(21) Motor function can also be assessed by:

a. Calling the patient.

b. Then encouraging the patient to walk with you.

c. Voluntary movement may be seen as the patient tries to sit up and move forward.

(22) Note that movements elicited when touching the patient may be reflex movements rather than actual voluntary movement.

S4 - Postural reaction assessment

Paw placement

(23) Support the patient under the chest to prevent loss of balance when assessing thoracic limbs (Fig 1. A).
(24) Flex the paw so the dorsum of the paw is on the floor; do not let the patient put weight on the paw (Fig. 1B).

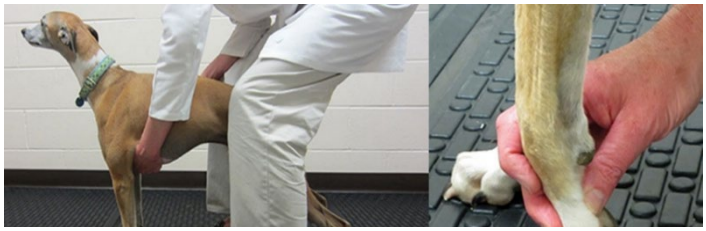


Figure 1:
A *The patient is supported under the chest to prevent loss of balance.*
B *Place a hand above the paw and only use a few fingers to flex the toes; then the patient will be less likely to pull the foot away when touched.*

(25) Support the patient under the pelvis or caudal abdomen when assessing pelvic limbs (Fig. 2)
(26) The patient should return the paw to a normal position.
(27) A non-slippery surface and good support of the animal are essential to detect subtle deficits

Figure 2: *The patient is supported under the pelvis or caudal abdomen for pelvic limb assessment.*

Visual and tactile placing

(28) With the patient in your arms, slowly (so that you do not elicit a vestibular response), approach the table or surface and allow the dorsum of the paw to gently touch the table.
(29) A normal response is the immediate placement of the paws on the surface of the table in a position that will support the patient's weight.
(30) Normal tactile placing with absent visual placing indicates a lesion in the visual system. Normal visual placing with abnormal tactile placing suggests a sensory pathway lesion.
(31) Note to always assess the paw "away" from your body

Hopping

(32) To assess the thoracic limb(s), place one hand under the abdomen to lift the pelvic limbs up from the ground, simultaneously, use your other hand to fold a thoracic limb gently back along the chest while pushing the patient toward the standing limb (Fig. 3).

Figure 3: *Hopping (thoracic limb): The patient is supported at the abdomen and the pelvis is lifted off the ground when assessing hopping of thoracic limbs.*

(33) To assess hind limb(s), one is placed under the chest to lift the thoracic limbs off the ground, simultaneously, the other hand placed by the femur, lifts one pelvic limb off the ground and pushes the patient toward the standing limb (Fig.4).

(34) A normal response is that the patient will support their entire weight on the tested limb and hop as the patient is moved medially or laterally. Poor initiation of hopping suggests proprioceptive deficits. Poor movement suggests motor deficits.

Figure 4: *Hopping (hind limb): The patient is supported under the chest and lifted off the ground when assessing hopping of hind limbs.*

Wheel barrowing

(35) Wheel barrowing (Fig. 5) is performed by having the animal bear weight on its thoracic limbs while being supported under the abdomen. Normal animals walk forward with co-ordinated movement.

(36) To make the test more challenging, visual compensation can be removed by gently extending the neck with the head elevated.

(37) Removing visual capabilities may allow the detection of subtle abnormalities

Figure 5: *Wheelbarrow: Lift the pelvic limbs from the ground and move the patient forward, just as you would push a wheelbarrow.*

Extensor postural thrust

(38) Extensor Postural Thrust (Fig. 6) is performed by supporting the animal under the thorax while lowering it to the floor. When the pelvic limbs touch the floor, they should move caudally in symmetric walking movements to achieve a position of support. The patient should not be walked backwards (i.e., reverse wheelbarrowing).

Figure 6: *Elevate the patient from the ground by wrapping arms around chest; then lower animal until pelvic limbs touch the ground.*

Hemi-walking

(39) Hemi-walking (Fig. 7) is performed by elevating the front and rear limbs of one side so that all of the animal's weight is supported by the opposite limbs. Lateral walking movements are then evaluated.

Figure 7: *Hemi-walking: Lift the limbs on the same side from the ground and push the patient toward the other side, which forces the animal to hop with the limbs on the ground*

S5 - Spinal reflexes

(40) Spinal reflexes (myotatic reflexes) test the integrity of sensory and motor components of the reflex arc and the influence of descending motor pathways on the reflex. An absent or depressed reflex indicates complete or partial loss of either the sensory or motor nerves responsible for the reflex (lower motor neuron [LMN]).

(41) A normal reflex indicates that sensory and motor nerves are intact. An exaggerated reflex indicates an abnormality in the descending pathways from the brain and spinal cord that normally inhibit the reflex (upper motor neuron [UMN]). In general, forelimb reflexes are not as reliable for localising lesions as rear limb reflexes.

Biceps reflex

(42) To perform the biceps reflex (Fig. 8 A, below), the index finger of the examiner's hand that is holding the animal's elbow is placed on the bicep's tendon cranial and proximal to the elbow. The elbow is slightly extended, and the finger is struck with the reflex hammer. Normal response is slight flexion of the elbow.

(43) The biceps brachii is innervated by the musculocutaneous nerve which arises mainly from spinal cord segment C7. The reflex is difficult to attain in normal animals.

a. absent or decreased reflexes suggest a lesion involving spinal cord segments C6-T2 (LMN).

b. An exaggerated reflex indicates a lesion cranial to spinal cord segment C6 (UMN).

Triceps reflex

(44) The triceps reflex (Fig. 8 B) is performed with the animal in lateral recumbency. The limb is supported under the radius. The triceps tendon is struck with a reflex hammer just proximal to the olecranon. Normal response is slight extension of the elbow.

(45) The triceps muscle is innervated by the radial nerve, which originates from spinal cord segments C7-T2. The reflex is difficult to attain in normal animals

a. absent or depressed reflexes may not indicate an abnormality.

b. An exaggerated reflex, if elicited, indicates a lesion cranial to C7 (UMN).

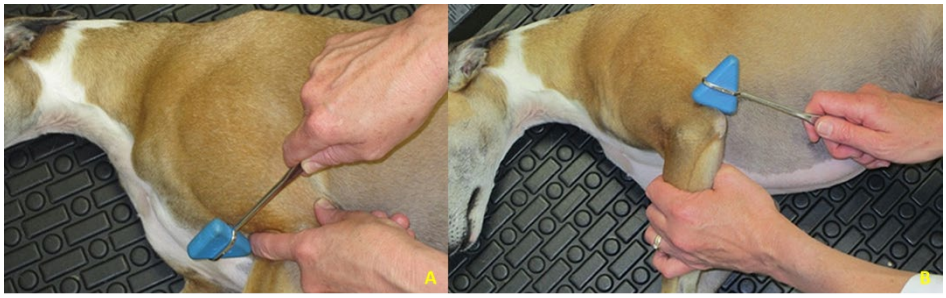


Figure 8: ***A*** *Biceps reflex: While pulling the limb slightly caudally, place a finger over the tendon and tap the finger with the pleximeter. In large-breed dogs, the reflex is easier to see if the limb is held parallel to the floor.* ***B*** *Triceps reflex: Flex and abduct the elbow by holding the limb over the radius/ulna. Tap the triceps tendon with the hammer.*

Patella reflex

(46) The patella reflex (Fig. 9) is the most reliable pelvic limb reflex. It is performed with the animal in lateral recumbency. The uppermost leg is supported by holding the hock with the stifle slightly flexed. When the patella ligament is struck briskly with a reflex hammer, the response is a single, quick extension of the stifle.

(47) Absence or depression of the patella reflex (hypo-patella reflex) and decreased muscle tone (flaccidity) indicate a lesion of the sensory or motor component of the reflex arc (LMN).

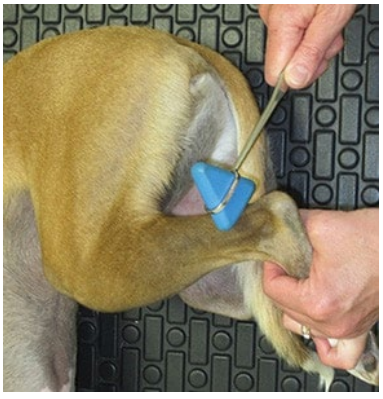
(48) Unilateral loss of the reflex suggests a femoral nerve lesion, whereas bilateral loss suggests a segmental spinal cord lesion involving spinal cord segments L4-L6.

(49) Exaggerated reflexes (hyperpatella reflex) and increased muscle tone (spasticity), when associated with other signs of UMN dysfunction, suggest a lesion cranial to the L4 spinal cord segment (UMN).

(50) Alternatively, loss of the sciatic nerve can result in an exaggerated patella reflex.

Figure 9: *Patella reflex: Slightly flex the stifle and tap the patella tendon with the pleximeter. A normal response is forward movement of the tibia and extension of the stifle.*

Gastrocnemius reflex



(51) The gastrocnemius reflex (Fig. 10) is performed with the animal in lateral recumbency. The uppermost leg is supported by placing a hand under the metatarsal bones with the hock slightly flexed.

(52) When the gastrocnemius tendon is struck briskly with a reflex hammer, the response is extension of the hock followed by flexion.

(53) The gastrocnemius reflex is mediated via the tibial branch of the sciatic nerve, and cord segments L5 to L7 and S1.

Figure 10: *Gastrocnemius reflex: Flex and abduct the hock by holding the limb over the metatarsus; keep the hock flexed, which keeps the tendon tense.*

Withdrawal reflex

(54) To assess the thoracic limbs, the animal is in lateral recumbency. The least harmful stimulus possible is applied to the foot; the normal response is flexion of the entire limb. The forelimb withdrawal reflex primarily involves spinal cord segments C6-T2.
   a. Absent or depressed reflexes indicate a lesion of these spinal cord segments or of the peripheral nerves (LMN)
   b. Exaggerated reflexes, when associated with other signs of UMN dysfunction, indicate a lesion cranial to spinal cord segment C6 (UMN).

(55) To assess the pelvic limbs the animal is again in lateral recumbency. The least harmful stimulus possible is applied to the foot; the normal response is flexion of the entire limb. Note the examiner pinches both medial and lateral web of the toes. The rear limb withdrawal reflex primarily involves spinal cord segments L6 to S1 and the sciatic nerve.
   a. Absence or depression of the reflex indicates a lesion of these spinal cord segments or nerves (LMN).
   b. Unilateral absence of the reflex is most likely the result of a sciatic nerve lesion, whereas bilateral absence or depression is more likely the result of a spinal cord lesion.
   c. An exaggerated withdrawal reflex indicates a lesion cranial to spinal cord segment L6 (UMN).

Cutaneous trunci reflex

(56) Cutaneous trunci reflex (Fig. 11) is elicited by pin-prick stimulus to the skin over the back, beginning at the lumbosacral region and continuing cranially.

(57) Normal response is twitching of the cutaneous trunci muscle on both sides of the dorsal midline, at the point of stimulation and cranially.

(58) Absence of a response occurs one or two segments caudal to the spinal cord lesion.

(59) This reflex must be interpreted with some caution; it may be unreliable with the exception of brachial plexus avulsion injuries, in which it is consistently absent only on the side of the avulsion.

Figure 11: *Cutaneous trunci reflex: This reflex is present cranial to the L4 spinal cord segment, which approximately correlates to the wings of the ilium.*

Anal sphincter reflex

(60) The perineal or anal sphincter reflex is elicited by gentle perineal stimulation with blunt forceps. A normal response is contraction of the anal sphincter muscle.

(61) Sensory and motor innervation for the anal sphincter reflex occurs through the pudendal nerve (perineal nerve is sensory; caudal rectal nerve is motor) and spinal cord segments S1-S3.
   a. Absence or depression of the reflex (failure of the anus to contract) indicates a sacral spinal cord or pudendal nerve lesion (LMN).
   b. An exaggerated response indicates a lesion above the S1 spinal cord segment.

S6 - Palpation

(62) The last step in the neurological examination is palpation along the spine and muscles for pain; muscle tone and atrophy can also be evaluated.

(63) Assess whether the neck is painful and check range of motion (in all directions). Neck flexion is usually not performed postoperatively or if an atlantoaxial subluxation (instability between C1 and C2) or fracture is suspected (Fig. 12). Avoid aggravating pain in limb joints by palpating the patient in lateral recumbency.

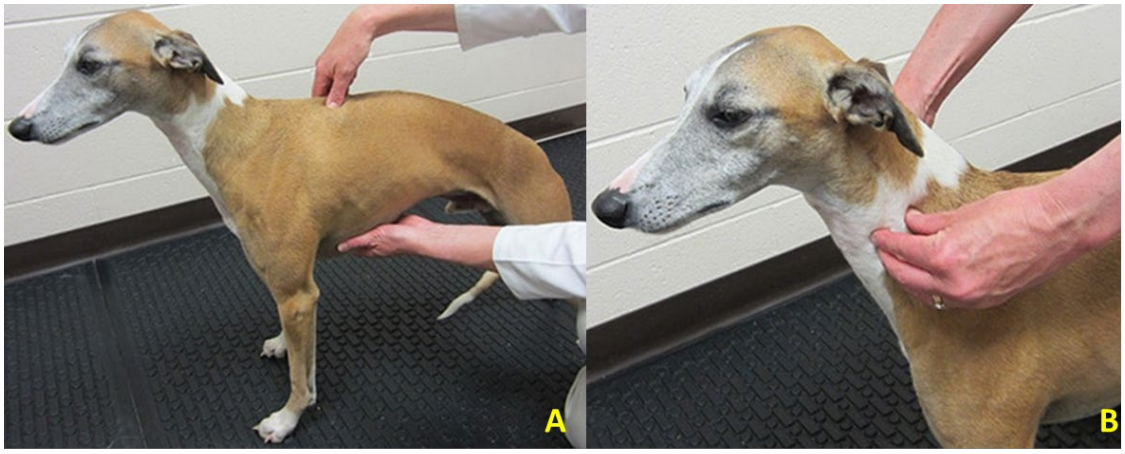


Figure 12: ***A*** *Palpation: When palpating the spine, use the free hand to support the area being palpated and prevent the patient from falling or sitting down.* ***B*** *Palpation: When palpating the neck, palpate over the transverse processes of the vertebrae.*

S7 - Pain perception

(64) Pain perception is only assessed in patients with loss of motor function; however, young patients presenting with signs of a sensory neuropathy are an exception.

(65) Evaluation of superficial pain perception is assessed by pinching the toe web using a haemostat to pinch. A conscious response from the animal indicates pain (i.e., vocalising, trying to bite, turning the head, whining, dilating pupils, increased respiratory rate).

(66) Lack of deep pain perception carries a guarded to poor prognosis.

(67) Note that a withdrawal reflex can be elicited in animals with loss of pain perception; this reflex should not be mistaken for voluntary motor function or pain perception.

Conclusion

(68) Once the neurological examination has been completed, a neuroanatomic diagnosis can be made.

Drugs, chemicals, or biological agents

(69) No drugs, chemicals, or biological agents are required for this procedure.

Impact of procedure on wellbeing of animals

(70) The neurological exam will not cause any physical harm. Mild discomfort may be experienced by the animal during the use of the reflex hammer and slight pain when pain perception test is undertaken using haemostats. The animal may become distressed due to being handled during the exam or due to the use of the reflex hammer and haemostats.

Animal care

(71) Low stress handling techniques need to be employed when performing the procedure. The procedure should take place in a quiet room with limited personnel and distractions.

Pain relief

(72) Not required for this procedure

Reuse and repeated use

(73) This procedure only needs to be used when assessing an animal for neurological lesions. This is a diagnostic procedure for animal health purposes only.

Qualifications, experience or training necessary to perform this procedure

(74) Only a qualified Veterinary Scientist – BVetBiol/BVetSci or Veterinary Technician - BVetTech can perform this procedure. A diagnosis can only be made by a fully qualified registered Veterinarian.

Record requirements

(75) A neurological examination form can be found at Appendix 1. This details the record requirements for this procedure. Clinical notes may be taken at the discretion of the clinician.

Associated documentation (including pictures if available)

(76) None additional.

Glossary

(77) Not applicable

References and relevant links

(78) This procedure has been adapted from the following resources:

a. Rylander,H. 2013a. The Neurological Examination in Companion Animals Part 1. Today's Veterinary Practice. https://todaysveterinarypractice.com/the-neurologic-examination-in-companion-animals-part-1-performing-the-examination/

b. Rylander,H. 2013b. The Neurological Examination in Companion Animals Part 2: Interpreting Abnormal Findings. Today's Veterinary Practice. https://todaysveterinarypractice.com/the-neurologic-examination-in-companion-animals-part-2-interpreting-abnormal-findings/
c. https://vetmed.illinois.edu/demo-sa-orthopedics/postural-exam/
d. Bartner, L. (2020). The Neurologic Examination. Canine Lameness, 41-66.

Appendix 1 Neurological examination form

NEUROLOGICAL EXAMINATION FORM

DEMOGRAPHICS

DATE:	PATIENT:	DOCTOR:

PRESENTING COMPLAINT:

VISUAL OBSERVATIONS (check all that apply)

MENTAL STATUS
Normal ○ Sedate ○ Obtunded ○ Stuporous ○ Comatose

BEHAVIOR
Normal ○ Aggressive ○ Excited ○ Anxious ○ Apathetic
Circling: L or R

POSTURE
Normal ○ Head Tilt: L or R ○ Schiff-Sherrington ○ Decerebrate
Decerebellate ○ Torticollis ○ Kyphosis ○ Wide-based

GAIT
Normal ○ Lameness ○ Hemiparesis ○ Monoparesis
Paraparesis ○ Paraplegia ○ Tetraparesis ○ Tetraplegia
Ataxia: ○ General Proprioceptive ○ Vestibular ○ Cerebellar

PHYSICAL EXAMINATION NOTES

POSTURAL REACTIONS (0-absent, 1-decreased, 2-normal)

Proprioception	_____ LF	_____ RF
	_____ LH	_____ RH
Hopping	_____ LF	_____ RF
	_____ LH	_____ RH
Wheelbarrow	_____ LF	_____ RF
	_____ LH	_____ RH
Hemiwalking	_____ LF	_____ RF
	_____ LH	_____ RH
Visual placing	_____ LF	_____ RF
	_____ LH	_____ RH
Tactile placing	_____ LF	_____ RF
	_____ LH	_____ RH
Stairs	_____ LF	_____ RF
	_____ LH	_____ RH
Extensor postural thrust	_____ LH	_____ RH

SPINAL REFLEXES (0-absent, 1-decreased, 2-normal, 3-increased, 4-clonic)

Flexor (front)	_____ L	_____ R
Biceps	_____ L	_____ R
Triceps	_____ L	_____ R
Patellar	_____ L	_____ R
Flexor (rear)	_____ L	_____ R
Gastrocnemius	_____ L	_____ R
Cranial tibial	_____ L	_____ R
Crossed extensor	_____ L	_____ R
Cutaneous trunci	_____ L	_____ R

LUMBOSACRAL REFLEXES (L6-S3) (0-absent, 1-decreased, 2-normal, 3-increased, 4-clonic)

Anal tone/Perineal sensation	_____
Tail tone	_____

CRANIAL NERVES (0-absent, 1-decreased, 2-normal)

Olfactory (I)	_____ L	_____ R
Menace Response	_____ L	_____ R
Optic (II)	_____ L	_____ R
PLR (III) - direct	_____ L	_____ R
PLR (III) - consensual	_____ L	_____ R
Palpebral (V, VII)	_____ L	_____ R
Facial symmetry (VII)	_____ L	_____ R
Jaw tone/Temporalis m (V)	_____ L	_____ R
Oculocephalic (III, IV, VI, VII)	_____ L	_____ R
Strabismus (VII) + / -	_____ L	_____ R
Nystagmus (VII) + / -	_____ L	_____ R
Gag (IX, X)	_____ L	_____ R
Spinal Accessory (XI)	_____ L	_____ R
Tongue (XII)	_____ L	_____ R

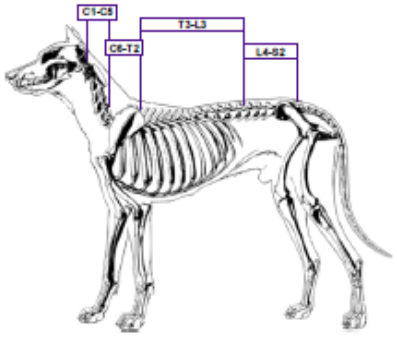
PALPATION

Cervical Spine:
Thoracic Spine:
Lumbar Spine:
Sacral Spine:
Musculature:
Hyperesthesia:

SENSATION

Superficial Pain:
Deep Pain:

NEUROANATOMIC LOCALIZATION



Neuroanatomic Localization Notes:

DIFFERENTIAL DIAGNOSIS

○ Vascular
○ Inflammatory, infectious, immune-mediated
○ Traumatic/Toxic
○ Anomalous/Congenital
○ Metabolic
○ Idiopathic/Iatrogenic
○ Neoplastic/Nutritional
○ Degenerative

PLAN

○ CBC/Chem
○ Radiographs: _____ Spine _____ ABD _____ THX
○ CT: _____ Brain _____ Spine
○ MRI: _____ Brain _____ Spine
○ CSF Analysis: _____ AO _____ LS
○ EMG
○ Other:
○ Other:
○ Other:
○ Other:
○ Other:

Please see the accompanying VNC Neuro Card for helpful information for examining and treating your neurologic patient

Courtesy of VETERINARY NEUROLOGICAL CENTER

4302 E. Raymond St. Phoenix, AZ, 85040 | (602) 437-1488 | vncmail@vetneuro.com | www.vetneuro.com

Appendix 2

Questions to ask when taking a history during a neurological exam

- How did the clinical signs occur (acute versus insidious onset)?
- Have the signs progressed and how have they done so?
- Has the patient been treated previously?
- If so, what was the response to treatment?
- Does the patient seem to be in pain?
- What behaviour/signs are believed to indicate this pain?

Appendix 3 Neurological examination in dogs and cats

Adapted from Rylander (2013a).

THE NEUROLOGIC EXAMINATION IN DOGS & CATS

Part 1: Performing the Examination

Helena Rylander, DVM, Diplomate ACVIM (Neurology)

CRANIAL NERVE ASSESSMENT

There are 12 cranial nerves:

- **Cranial nerve (CN) I:** Olfactory nerve*
- **CN II:** Optic nerve
- **CN III:** Oculomotor nerve
- **CN IV:** Trochlear nerve
- **CN V:** Trigeminal nerve
- **CN VI:** Abducens nerve
- **CN VII:** Facial nerve
- **CN VIII:** Vestibulocochlear nerve
- **CN IX:** Glossopharyngeal nerve
- **CN X:** Vagus nerve
- **CN XI:** Accessory nerve
- **CN XII:** Hypoglossal nerve

* Rarely evaluated in clinical practice

The following tests are done to assess cranial nerves and nerves involved in the ***response*** or ***reflex***; ***afferent*** (A) and ***efferent*** (E) nerves are listed.

- **Menace response (Figure 1):** A: **CN II** (retina); E: **CN VI, CN VII**; in addition, the thalamus, cerebrum, and cerebellum are involved in the response and its pathway
- **Palpebral reflex (Figure 2):** A: **CN V**; E: **CN VII**
- **Vibrissae (and maxilla) response (Figure 3):** A: **CN V** (maxillary branch); E: **CN VII**; this response also involves the cerebrum
- **Mandibular touch:** A: **CN V** (mandibular branch); E: **CN VII**
- **Auricular réflex (Figure 4):** A: **CN VII**; E: **CN VII**
- **Corneal reflex:** A: **CN V** (ophthalmic branch); E: **CN VI**
  - » The cornea is touched lightly with a moist cotton tip applicator; the eye should retract.
- **Pupillary light reflex (PLR):** A: **CN II**; E: **CN III**
  - » Performed in a dark room to assess anisocoria (unequal pupil size)
  - » Dark and light environments can help determine which pupil is miotic/mydriatic (constriction/dilation)
  - » Indirect PLR is usually not as strong as direct PLR
- **Oculocephalic reflex, normal physiologic nystagmus (Figure 5):** A: **CN VIII**; E: **CN III, IV, & VI**
  - » Palpation of the head for symmetry: Muscles of mastication are innervated by **CN V** (mandibular motor branch); muscles of facial expression are innervated by **CN VII**
  - » Assess for asymmetry, muscle atrophy, and droopy lips
- **Gag reflex (Figure 6):** A: **CN IX**; E: **CN X**
- **Palpation of the neck to assess muscle atrophy:** E: **CN XI** (difficult to assess)
- **Tongue movement & symmetry (Figure 7):** E: **CN XII**

Figure 1. **Menace response:** *Move the hand slowly toward the eye in a menacing movement, without touching the face or pushing air onto the cornea; dropping a cotton ball in front of the eye helps assess vision.*
Figure 2. **Palpebral reflex:** *Touch the medial canthus of the eye with a finger, cotton tip applicator, hemostat, or pen; the blink should be complete.*

Figure 3. **Vibrissae response:** *Touch the upper lip; the patient may move the lip only or turn the head away.*
Figure 4. **Auricular reflex:** *The inner pinna is innervated by CN VII; the response should be twitching of the ear, blinking, or shaking of the head.*

Figure 5: **Oculocephalic reflex:** *Eye movement is easier to see if the sclera is exposed. Movement should be steady with moderate speed; before turning the head the other direction, wait and look for any postrotational nystagmus (more than a few beats is abnormal).*

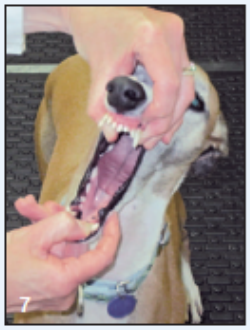


Figure 6: **Gag reflex:** *Touch the larynx with a finger to induce the reflex.*

Figure 7. *Inspect the tongue for asymmetry or muscle atrophy, indicating a lesion affecting the hypoglossal nerve.*