In any patient with a suspected neurologic condition, a complete neurologic examination should follow the physical examination.

The purpose of the neurologic examination is to:
1. Confirm the existence of a neurologic condition
2. Localize the lesion (ie, make a neuroanatomical diagnosis).

Repeat neurologic examinations are helpful to detect subtle changes or progression of signs.

This article will discuss how to perform the neurologic examination; Part 2 will discuss how to interpret findings and localize lesions.

NEUROLOGIC EXAMINATION OVERVIEW

The neurologic examination can be divided by evaluation of:
1. Mentation;
2. Posture and gait;
3. Cranial nerves;
4. Postural reactions;
5. Spinal reflexes;
6. Pain on spinal palpation;

1. MENTATION

While taking the patient’s history (see Taking a History: Questions to Ask), allow the animal to explore the examination room, which provides an opportunity to perform a mentation evaluation. This evaluation requires some knowledge of the patient’s normal behavior.

Mentation can be described as follows:
• Normal: Bright, alert, responsive or quiet
• 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 behavior); 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 nonambulatory but the animal is still responsive to loud noises and hand clapping.
2. POSTURE & GAIT

Posture describes the animal at rest; the following conditions may be noted:
• Kyphosis (dorsal curvature of the spine)
• Lordosis (ventral curvature of the spine)
• Head tilt
• Head and neck turn
• Wide-based stance.

The following postures are rare but can help in lesion localization:
• Decerebrate posture: Extension of all limbs
• Decerebellate posture: Extension of thoracic limbs; flexion of pelvic limbs
• Opisthotonus: Dorsoflexion of head and neck
• Schiff-Sherrington posture: Increased tone in forelimbs; paralysis in hindlimbs

Gait is assessed both in the examination room and in an area where the patient can be walked; stairs may be useful for detection of subtle gait abnormalities. Gait abnormalities are often a mix of weakness, paresis, and ataxia.

The following key words should be used to describe gait:
• Ambulatory/Nonambulatory:
  » An ambulatory patient should be able to walk on all 4 limbs, supporting its body weight and advancing without assistance.
  » A nonambulatory patient is not able to support its weight or walk; nonambulatory can refer to all limbs or only the pelvic limbs. See Motor Function Assessment for information on evaluating nonambulatory patients.
• Ataxia:
  » Proprioceptive ataxia: Symmetric; lack of coordination can be mild.
  » Vestibular ataxia: Asymmetric; patient tends to drift or fall to one side of mid line. 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.
• 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.
• Lameness can be neurologic or orthopedic in origin.

Other abnormalities that provide a more precise description of the quality and degree of the paresis include:
• Discombobulate or 2-engine gait: Short choppy gait in the thoracic limbs with a long stride in the pelvic limbs
• Knuckling, stumbling, or falling when walking.

Paresis versus Weakness
Paresis describes reduced voluntary motor function, while weakness describes a loss of muscle strength.

3. CRANIAL NERVE EXAMINATION

Cranial nerve evaluations are either reflexes or reactions:
• Reflexes include cranial nerve reflexes and spinal reflexes. These reflexes involve the:
  » Sensory, afferent peripheral nerves or cranial nerves
  » Interneurons in the spinal cord or brainstem (Note: While some monosynaptic reflexes do not rely on any interneurons, very few fall into this category)
  » Efferent motor neurons.
• Responses involve the:
  » Afferent sensory pathways
  » Efferent motor pathways
  » Cerebrum.

Several of the tests to assess cranial nerve function rely on responses; for example, when the patient moves its head away when sensation of the face is tested. See Motor Function Assessment for information on evaluating nonambulatory patients.

MOTOR FUNCTION ASSESSMENT

To assess motor function in a nonambulatory patient:
• Support the patient under the pelvis (or under the pelvis and chest for tetraparetic/plegic patients)
• Encourage the patient to move forward.
• This momentum sometimes helps the practitioner see voluntary movement.

Motor function can also be assessed by:
• Calling the patient.
• Then encouraging the patient to walk with you.
• Voluntary movement may be seen as the patient tries to sit up and move forward.

Note: Movements elicited when touching the patient may be reflex movements rather than actual voluntary movement.
POSTURAL REACTION ASSESSMENT

Paw Replacement (Figures 1 and 2)
- Flex the paw so the dorsum of the paw is on the floor; do not let the patient put weight on the paw.
- The patient should return the paw to a normal position.
- A nonslippery surface and good support of the animal are essential to detect subtle deficits.

Visual & Tactile Placing
- With the patient in your arms, slowly (so not to induce a vestibular response) approach a table or other surface and let the dorsum of the paw touch the table; the paw “away” from your body is tested.
- In visual placing, the patient is allowed to see the table; in tactile placing, the patient’s eyes are covered.

Hopping (Figures 3 and 4)
- Push the patient over toward the foot that is on the ground.
- Poor initiation of the hopping reaction suggests sensory ( proprioceptive) deficits; poor follow-through suggests a motor system abnormality (paresis).

Wheel Barrowing (Figure 5)
- Wheel barrowing can be done with or without extending the neck.
- By extending the neck and elevating the head, visual compensation is removed, making the test more challenging and allowing detection of subtle abnormalities.

Extensor Postural Thrust (Figure 6)
- The patient is lifted straight up; then lowered to the ground.
- As the pelvic limb paws touch the ground, the patient extends the hocks and takes a few steps backwards to find its balance.
- The patient should not be walked backwards (ie, reverse wheel barrowing).

Hemiwalking (Figure 7)
- Hemiwalking is similar to hopping, but 2 ipsilateral (same side) limbs remain on the ground.
- In severely affected patients, hopping and hemiwalking should either be done carefully or not at all, as these patients can fall, which may result in injury.
Cranial Nerve Assessment for a description of cranial nerve assessment tests, available at todaysveterinarypractice.com (Resources).

4. POSTURAL REACTIONS

Postural reactions are complex responses that maintain an animal in its normal, upright position. An abnormality indicates a lesion anywhere along the ascending or descending pathways in the peripheral or central nervous systems. A lesion in the cerebral cortex may cause marked abnormalities in postural reactions without any change in gait.

Postural reaction tests are challenging to perform well and require good technique and a cooperative patient. The paw replacement test (previously called conscious proprioception) and hopping test are the assessments most frequently performed.

If results are equivocal due to poor technique or an uncooperative patient, other tests can be performed to confirm findings. In patients that are weak from systemic illness or sedated with drugs, the paw replacement test may be delayed or absent.

See Postural Reaction Assessment for a list of tests and descriptions on how to perform them.

5. SPINAL REFLEXES

Examination of spinal reflexes assesses the:
- Integrity of the sensory and motor components of the reflex arch
- Influence of descending motor pathways on the reflex.

The reflex hammer (percussion hammer) is used to hit the tendon of the muscle tested. Keep the muscle and tendon slightly stretched. Repositioning of the limb may be required several times to find a reflex.

Myotatic reflexes for the thoracic limbs:
- Biceps reflex evaluates C6 to C8 spinal nerves and, peripherally, the musculocutaneous nerve (Figure 8).
- Triceps reflex evaluates C7 to T1 spinal nerves and, peripherally, the radial nerve (Figure 9).

Myotatic reflexes for the pelvic limbs:
- Patellar reflex evaluates L4 to L6 spinal nerves and the femoral nerve (Figure 10).
- Gastrocnemius reflex evaluates L7 to S1 spinal nerves and, peripherally, the tibial branch of sciatic nerve (Figure 11).

Withdrawal reflex:
- The withdrawal reflex engages all nerves in the thoracic (C6-T2) and lumbar (L4–S3) intumescences, respectively (Figures 12 and 13).

**AFFERENT NERVES:** Carry impulses from receptors to the central nervous system  
**EFFERENT NERVES:** Carry impulses away from the central nervous system to effectors
• This reflex is induced by touching or pinching the skin of the toe web. A stronger stimulus may be required in a tense patient with increased muscle tone.
• It is important to assess the quality of the entire reflex and watch for full flexion of all joints.

Perineal reflex: Evaluates S1 to S3 spinal nerves and, peripherally, the pudendal nerve.

Cutaneous trunci reflex: The sensory pathway from the skin enters the spinal cord and ascends bilaterally to the C8 to T1 spinal cord segment, where it synapses with the lateral thoracic nerve, resulting in a contraction of the cutaneous trunci muscles bilaterally (Figure 14).

6. PALPATION
The last step in the neurologic examination is palpation along the spine and muscles for pain; muscle tone and atrophy can also be evaluated.
• 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 (Figures 15 and 16).
• Avoid aggravating pain in limb joints by palpating the patient in lateral recumbency.

7. PAIN PERCEPTION
In general, 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.
• Evaluate superficial pain perception by pinching the toe web; evaluate deep pain perception by pinching the periosteum of the toe. Use a hemostat for pinching.
• A conscious response from the animal indicates pain (ie, vocalizing, trying to bite, turning the head, whining, dilating pupils, increased respiratory rate).
• Lack of deep pain perception carries a guarded to poor prognosis.
• 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.

Once the neurologic examination has been completed, a neuroanatomic diagnosis can be made. Read Part 2 of The Neurologic Examination in Companion Animals, which discusses localizing lesions and making a diagnosis, in the March/April 2013 issue of Today’s Veterinary Practice.

Suggested Reading