

Bovine neurologic examination

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Abstract

Physical examination is the cornerstone of the diagnosis of neurologic disease. Cattle with neurologic disease can be dangerous to themselves and others. However, failure to adequately examine the patient is a direct path to empirical treatment. Examination at a distance followed by a cranial nerve examination, postural reactions, spinal reflexes, and palpation can provide the information necessary to determine a gross anatomical diagnosis.

Key words: bovine, CNS, nervous system, exam

Résumé

L'examen physique est la pierre angulaire du diagnostic de la maladie neurologique. Les bovins avec une maladie neurologique peuvent être dangereux pour eux-mêmes et pour les autres. Toutefois, l'examen physique inadéquat du patient ouvre la voie au traitement empirique. L'examen à distance suivi de l'examen des nerf crâniens, les réactions posturales, les réflexes spinaux et la palpation peuvent fournir l'information nécessaire pour un diagnostic macroscopique anatomique.

Lesion Localization

Excessive numbers of anatomical pathways can lead to frustration with developing an appropriate anatomic diagnosis and list of differential diagnoses. The result is often that no diagnosis is made and empirical treatment regimens are instituted. This limits the potential for intervention in herd problems and improvement of management practices on the farm. Decreasing the number of anatomical pathways to 4 major compartments of the nervous system simplifies lesion localization, while allowing adequate definition to develop a reasonable list of differential diagnoses (Figure 1).

Examination at a Distance

The animal should be observed to rise and walk if they can. This will give the opportunity to observe gait and posture. During this time behavior and interaction with herd mates and environmental stimuli can be evaluated.

Cranial Nerve Examination

Vision

- Menace - a positive menace response requires function of the retina, optic nerve, lateral geniculate body,

Anatomic site	Highly specific clinical signs
Cortex	Abnormal interaction/response to environmental stimuli - depression, coma, or other changes in mentation, head pressing, compulsive walking, convulsions, opisthotonus
Cerebellum	head tremor, abnormal gait – ataxia with normal strength and proprioception, truncal sway, hypermetria
Brainstem	Cranial nerve deficits - head tilt, anisocoria, mydriasis, miosis, ptosis, strabismus, nystagmus, flaccid tongue, facial paralysis, assorted cranial nerve deficits, circling
Spinal cord	Abnormal spinal reflexes, dysuria, flaccid tail and/or anus, paresis, paralysis

Figure 1.

cerebral cortex, facial nerve, and orbicularis oculi muscle. The pons and cerebellum also provide motor input. Lesions anywhere in the reflex arc may result in an absent menace response. An absent menace response does not rule out intact vision, and a positive menace response does not guarantee vision. A normal response is the closure of the palpebral fissure.

- Pupillary light responses – the reflex measures the integrity of a pathway involving retina, optic nerves, optic chiasm, and oculomotor nuclei, oculomotor nerve, ciliary ganglia, and the constrictor pupillae muscle. In a dark, quiet environment a point light source is shined into the eye. Ipsilateral and contralateral pupillary constriction are normal responses.

Eye position and movement

Eye position is governed by the oculomotor (CN III), trochlear (CN IV), and the abducens nerves (CN VI). Loss of nerve function will result in a deviation of the eyeball (strabismus) that is independent of head position and constant.

- Oculomotor dysfunction – constant ventral lateral strabismus on the same side as the lesion.
- Trochlear dysfunction – constant dorsomedial strabismus, may present on either or both sides.
- Abducens dysfunction – constant medial strabismus with protuberant globe.
- Cerebellar – ventrolateral strabismus, changes with movement of head.
- Vestibular – ventrolateral strabismus, changes with movement of head, rotatory or dorsal nystagmus.

Trigeminal Nerve Function

The trigeminal nerve (CN V) is sensory to the face and

motor to the muscles of mastication. Commonly performed tests include:

- Tactile stimulation of the face
- Inserting a straw or finger in the external nasal meatus
- The palpebral reflex
- Jaw tone assessment

Normal responses to the first 2 will involve movement of the head and neck. Normal response to the palpebral reflex will involve rapid closure of the eye. The palpebral reflex requires intact motor function (facial nerve, CN VII).

Facial Nerve Function

Clinical signs associated with facial nerve (CN VII) dysfunction include drooped ear, drooped eyelid, poorly coordinated chewing, drooling, and retention of food in the cheek pouch on the same side as the lesion. Deviation of the philtrum is not observed in cattle because they have a fibrous muzzle.

Vestibular Function

The vestibular system consists of the inner ear, auditory nerve (CN VIII), and frontal lobe. Clinical signs of vestibular dysfunction include head tilt, leaning, and ventrolateral strabismus on the same side as the lesion, dorsomedial strabismus contralateral to the lesion, recumbency with the affected side down, and hypertonic and hyperreflexic limbs. Nystagmus varies with the site of the lesion.

Glossopharyngeal (CN IX), Vagus (CN X), and Spinal Accessory Nerve (CN XI) Dysfunction

Clinical signs include dysphonia, snoring, roaring, dysphagia, and atrophy of cricoarytenoideus, trapezius, sternocephalicus, and brachiocephalicus muscles. Clinical examination includes palpation of the listed muscles, passing a stomach tube, laryngoscopy, and bronchoscopy.

Hypoglossal Nerve Function

The hypoglossal nerve supplies motor innervation to the tongue. Function can be checked by pulling the tongue out of the mouth laterally. With unilateral lesions the tongue will hang out on the same side as the lesion.

Postural Reactions

Wheelbarrowing, hopping, hemi-walking, hemi-standing, placing, and proprioception are all evaluated with the animal standing and lightly restrained if possible. Due to their size, proprioceptive deficits are the only ones that can be evaluated in adult cattle.

Spinal Reflexes

- Biceps brachii tendon reflex – performed on uppermost leg with patient in lateral recumbency.

The leg is flexed at the carpus and supported with a hand over the extensor tendons. The biceps muscle is struck with a plexor and any increase in extensor tension is noted. This reflex is subtle and difficult to detect in normal cattle. Measures musculocutaneous nerve function (spinal cord segments C6-C8).

- *Triceps brachii tendon reflex* – patient is positioned as above and the triceps tendon is percussed. Measures radial nerve function (spinal cord segment C6T2).
- *Forelimb withdrawal test* – the upper leg is extended and a painful stimulus is applied to the leg or foot. Observed outcomes should include a rapid withdrawal, axillary, median, and musculocutaneous nerves (spinal cord segment C5T2), and conscious perception of pain as evidenced by attempts to right, bellowing, or flailing of limbs (also assesses ascending spinal pathways and cerebral cortex). Motor function of withdrawal mediated by axillary, median, musculocutaneous, ulnar, and long thoracic nerves. Sensory function mediated by either median (cranial, palmar, and medial aspects of foot) or ulnar nerves (craniolateral aspect of the digit).
- *Patellar tendon reflex* – performed by percussing the medial patellar ligament with the stifle flexed. Both sensory and motor innervation is via the femoral nerve (spinal cord segments L4L6).
- *Cranial tibial reflex* – performed by percussing the belly of the cranial tibial muscle with the hock flexed. Mediated by the peroneal nerve (spinal cord segments L6S2).
- *Perineal reflex* – performed by provoking the anus with a painful stimulus. The normal response is a tightening of the anus and lowering of the tail contraction of the ventral tail muscles. Innervation is by the pudendal nerve (spinal cord segments S1-S5).
- *Muscle denervation* – a muscle will begin to show fasciculation 5 days following the loss of sensory innervation (detectable by EMG). Atrophy will be noted 7 to 14 days following denervation.
- *Panniculus reflex* – localized twitch of the cutaneous trunci muscle most noticeable along the dorsum, thorax, and flanks elicited by tactile stimulus. Equivocal in sheep, goats, and Bos taurus, but easily elicited in Bos indicus cattle. Spinal cord segments C8T2.

Suggested Reading

1. Constable PD. Clinical examination of the ruminant nervous system. *Vet Clin North Am Food Anim Pract* 2004; 20:185-214.
2. Fecteau G, Parent J, George LW. Neurologic examination of the ruminant. *Vet Clin North Am Food Anim Pract* 2017; 33:1-8.