Diagnostics and Ancillary Tests of Neurologic Dysfunction in the Ruminant

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KEYWORDS

• Cerebrospinal fluid analysis • Radiography • Myelography • Computed tomography • MRI

KEY POINTS

- Cerebrospinal fluid is good for helping determine the broad category of disease but will rarely provide a definitive diagnosis in ruminants with neurologic dysfunction.
- Animal size and financial limitations often limit our use of diagnostic imaging modalities.
- Radiography, myelography, computed tomography, and MRI have all been used successfully to aid in lesion localization and diagnosis of ruminant neurologic diseases.

DIFFERENTIATING NON–CENTRAL NERVOUS SYSTEM LESIONS

Symptoms associated with neurologic disease can occur from lesions within the central nervous system (CNS) or peripheral nervous system or several conditions that originate outside of the nervous system. Therefore, a variety of diagnostics can be used to help further characterize the disease process. Complete blood count and serum chemistry panel have little utility in diagnosis of CNS lesions. However, animals with hypocalcemia or metabolic acidemia may have changes in mentation consistent with cortical neurologic disease. In these cases serum calcium concentration, total carbon dioxide, or blood pH may help diagnose these conditions. Serum sodium concentrations may aid in the diagnosis of sodium chloride intoxication, depending on the stage of disease. Serum magnesium concentrations may help diagnose animals with hypomagnesemic tetany.

In addition, some deficiencies and toxicities may lead to structural lesions within the CNS but not reliably change the composition of the cerebrospinal fluid (CSF). In these cases specific assays for the compound of interest, such as vitamin A, copper, or lead, may aid in the diagnosis of disease.

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DIAGNOSTICS FOR CENTRALLY LOCATED LESIONS

Cerebrospinal Fluid

Analysis of CSF is one of the most commonly performed ancillary diagnostic tests in ruminant species when investigating the cause of neurologic symptoms. It is rarely diagnostic, but, in conjunction with history and examination findings, aids in the differentiation of the broad category of diseases and narrowing of the differential diagnosis list. Changes in protein concentration, cell count, and differential can help differentiate inflammatory/infectious, neoplastic, parasitic, metabolic, and degenerative disease processes. In addition, some disease conditions with primary lesions outside of the CNS can mimic neurologic disease. Changes in CSF composition can help the veterinary practitioner remove these diseases from the differential list.

Collection

Collection of CSF is most often attempted at the lumbosacral (LS) space. The atlantooccipital (AO) space can be used in ruminants but typically requires general anesthesia to achieve the head position necessary for a blind tap. In addition, the potential to damage vital structures is far greater at the AO space. Recently, AO CSF collection under sedation on a tilt table using ultrasound guidance has been described.[1] This study found the procedure to be quick and effective at obtaining high-quality AO samples for analysis. Despite this advance, in most instances, there is not a significant enough difference in sample composition based on collection site to warrant the increased risk associated with an AO tap. Studies that have compared LS with AO CSF composition in sheep have found no significant difference in CSF composition.[2,3] The main exception is in cases of spinal or epidural abscess whereby protein from the LS collection site is significantly higher than that from the AO site.

Collection of CSF at the LS space can be done standing in most animals, given that an adequate chute or stock is available for restraint. In recumbent animals or small ruminants that cannot be adequately restrained standing, sternal recumbency with the hips flexed forward is an alternative for positioning. The hip flexion expands the LS space, making access easier. This position also limits kicking and the need to specifically restrain the hind legs.[4] Successful collection of CSF from any location requires appropriate understanding of and attention to the bony landmarks.

The LS space is located along the dorsal midline caudal to L6, cranial to the sacrum, and medial to the cranial point on the sacral tuberosities. A depression along the dorsal midline can typically be palpated at the LS space. In mature cattle, a 4-in spinal needle will be required, whereas in small ruminants and camelids, a 2-in needle should provide adequate depth. Lambs and kids should only require a 1-in needle in length.[5] Ideally, the needle hub will be close to the skin during collection. This location will allow for better stabilization and less risk of trauma during the collection.

The animal should be clipped and prepared in surgical fashion. Sterile gloves should be used. Local analgesia can be provided using 1 to 2 mL lidocaine. In fractious animals, light sedation using xylazine or a low-dose ketamine/xylazine/butorphanol combination can be used to improve patient compliance.[6]

The needle is passed perpendicular to the spinal cord at a slight angle with the bevel facing the head. The needle will pass through skin and subcutaneous tissue followed by the interarcuate ligament and finally the meninges. Slight changes in resistance can be felt as the needle passes into different tissue planes. A pop is sometimes appreciated as the needle moves out of the interarcuate ligament. Some animals will move slightly or swish their tail when the meninges is penetrated. When the needle is in the subarachnoid space, CSF will well into the hub of the needle once the stylet is