Pathology in Practice

History

An 18-month-old approximately 320-kg (704-lb) Braunvieh-cross heifer was evaluated at the Oklahoma State University Boren Veterinary Medical Teaching Hospital because of a 3-day history of inability to rise from a recumbent position.

Clinical and Gross Findings

At the initial evaluation, the heifer was in lateral recumbency and unable to maintain a sternal position or to lift its head. Physical examination revealed a body condition score of 3/9. Rectal temperature, heart rate, and respiratory rate were within reference limits. A large, firm mass was present on the ventral aspect of the neck at the level of the thoracic inlet, and the jugular veins were markedly distended. A complete neurologic examination revealed increased patellar, cranial tibial, triceps brachii, and extensor carpi radialis reflexes. Conscious pain perception was reduced to absent in all limbs. The heifer was alert and aware of its surroundings. The clinical signs of hyperreflexia, tetraparesis, and apparent normal mentation indicated upper motor neuron disease or a cervical spinal cord lesion. Electrolyte abnormalities included mild hypokalemia (2.9 mEq/L; reference interval, 3.4 to 5.5 mEq/L) and hypomagnesemia (1.6 mEq/L; reference interval, 2.2 to 3.4 mEq/L). Hypomagnesemic tetany was not considered a likely cause of the abnormal findings because low circulating magnesium concentrations were routinely reported at this laboratory for animals that did not have clinical signs of hypomagnesemia and the heifer had not been grazing on forages that would typically induce hypomagnesemic tetany. Results of fecal flotation indicated the presence of a large *Eimeria* spp burden and a low number of *Moniezia* spp. A fecal egg or oocyst count was not performed.

Considering financial constraints, the heifer was treated once with amprolium (10 mg/kg [4.5 mg/lb], PO), thiamine (15 mg/kg [6.8 mg/lb], SC), oxytetracycline (20 mg/kg [9.1 mg/lb], SC), dexamethasone (0.5 mg/kg [0.23 mg/lb], IM), and sulfadimethoxine (55 mg/kg [25.0 mg/lb], IV). The heifer did not respond to treatment and was euthanized via IV injection of a pentobarbital-based solution. The carcass was submitted for necropsy.

At necropsy, a mass (17 × 9 × 9 cm) expanded the subcutaneous tissue at the thoracic inlet and surrounded the trachea and esophagus (Figure 1). The mass was multilobulated and tan and bulged on sectioning. Surrounding connective tissue was markedly edematous. In the center of the spinous process of the axis, there was a red, gelatinous focus (approx 3 cm in diameter); the surrounding cortical bone was thin and discontinuous. Portions of the mass protruded approximately 1 cm ventrally into the vertebral canal. In this area, the spinal cord was compressed and malacic, with red, gelatinous material in the surrounding epidural space. Along the length of the vertebral column, several other spinous processes were similarly affected, although changes did not extend into the vertebral canal. Examined lymph nodes, including the superficial cervical nodes, were enlarged and mottled red and white.

Figure 1—Photographs of a mass in the neck (A) and a sagittal section of the axis (B) of a heifer that had a 3-day history of inability to rise from a recumbent position. In panel A, the incised mass (arrowhead) extends cranially through the thoracic inlet and displaces the trachea dorsally (cranial is to the right of the image). In panel B, a mass is present in the spinous process (arrow) of the axis with extradural extension into the vertebral canal and associated spinal cord compression (arrowhead). The red material on the surface of the spinal cord corresponds to areas of hemorrhage. Because the vertebral column was stored in a cooler for several days pending results of a test for rabies, the gross lesion may have been somewhat altered by autolysis.

Formulate differential diagnoses from the history, clinical findings, and Figure 1—then turn the page →
Histopathologic Findings

Tissue samples of the mass at the thoracic inlet, lymph nodes, spinous process of the axis, and associated portion of the spinal cord were processed for histologic examination. Histologic examination of the mass at the thoracic inlet revealed sheets of neoplastic lymphocytes supported by a fine fibrovascular stroma (Figure 2). The trabecular arrangement of the stroma suggested thymic origin of the tissue, but intact Hassell corpuscles were not present. Neoplastic cells ranged in diameter from 7 to 10 µm with a centralized nucleus and variably clumped chromatin. There were 6 mitotic figures/10 hpf. Cells were moderately pleomorphic with moderate cytomegaly and occasional multinucleated forms. Examined lymph nodes were partially effaced by a similar neoplastic infiltration.

The marrow cavity of the spinous process of the axis was infiltrated by a similar neoplastic cell population. Surrounding cortical bone was variably replaced and effaced by neoplastic cells with few, thin remnants of bony trabeculae scattered among the neoplastic cells. Occasional remnant bony trabeculae were necrotic, characterized by pyknosis of osteocytes within bony lacunae. A variable periosteal response surrounded portions of the neoplastic infiltrate, with formation of perpendicular spicules of bone radiating from the cortical surface. Examination of the associated spinal cord revealed moderate Wallerian degeneration of the ventral luniculi. The red gelatinous material on the spinal cord surface corresponded to areas of hemorrhage.

Morphologic Diagnosis

Thymic lymphoma with vertebral bone marrow involvement, spinal cord compression, and Wallerian degeneration.

Comments

During the initial evaluation, the heifer of this report was tetraparetic and hyperreflexic with decreased pain response and alert mentation. These signs suggested a lesion in the cervical spinal cord. Differential diagnoses for the clinical signs included cervical spinal cord trauma, abscess, or neoplasia; nervous coccidiosis; rabies virus infection; or toxic insult. Differential diagnoses for the mass at the thoracic inlet included neoplasia (including thymoma), hemotoma, or abscess.1 Differential diagnoses for the mass at the thoracic inlet included neoplasia (including multiple myeloma), inflammation, or serous atrophy of fat.

Histopathologic findings confirmed that the mass at the thoracic inlet was consistent with lymphoma in the thymus, which also affected the vertebral bone marrow and induced associated spinal cord degeneration. Immunohistochemical staining of sections of the mass and the vertebral bone marrow was subsequently performed. The results indicated that the neoplastic cells were positive for CD3 and negative for CD79a, thereby confirming that the neoplastic cells were of T-cell origin. Thymic lymphoma has been reported to be of either T- or B-cell origin but is most typically of T-cell origin.2 In addition, cytokeratin immunostaining of the thymic mass yielded negative results, confirming that the mass was not a thymoma. The case of this report is unusual because although bone marrow is often affected during the development of thymic lymphoma, vertebral bone marrow involvement with bony lysis and periosteal response resulting in neurologic damage is not as commonly identified.

Classification of bovine lymphoma is currently grouped into 2 forms on the basis of clinical signs and etiology; these forms are enzootic bovine lymphoma and sporadic bovine lymphoma. Enzootic bovine lymphoma is caused by infection with bovine leukemia virus (BLV), usually affects older animals, and causes lymphoma most commonly in lymph nodes, heart, uterus, abomasum, duodenum, retrobulbar space, kidneys, liver, spleen, and the epidural space.3,4 In contrast, sporadic bovine lymphoma develops in young animals (often < 3 years old).4,5 Sporadic bovine lymphoma is not currently associated with a specific cause,6 although BLV infection has been identified in a heifer with sporadic bovine lymphoma.2 A genetic origin is also possible because familial thymic lymphoma has been reported.6 There are 3 forms of sporadic bovine lymphoma, including a calf form, cutaneous form, and thymic form.3,5 The calf form affects animals < 6 months old and results in lymph node enlargement with neoplastic infiltration of hematopoietic tissues in the bone marrow, liver, thymus, and spleen.3,7 The cutaneous form results in multiple cutaneous to subcutaneous nodules and enlarged peripheral lymph nodes.3 The thymic form affects bovids that are 6 months to 2 years old. Affected animals...
have massive thymic involvement, with variable bone marrow infiltration and lymph node enlargement. There are multiple reports of cases that are transitional between the calf and thymic forms.

The lesions in the heifer of this report were most consistent with the thymic form of sporadic bovine lymphoma, considering the extensive thymic infiltration and the animal’s age. Because thymic lymphoma is only rarely associated with BLV infection, testing of the heifer for BLV infection was not performed.

In general, current veterinary medical textbooks do not refer to CNS or vertebral column involvement in animals with thymic lymphoma. However, one of the first published articles on thymic lymphoma describes 2 of 14 affected cattle that had vertebral bone marrow involvement with neurologic signs consistent with spinal cord disease. In those 2 animals, lymphoma infiltrated and thinned the cancellous bone of vertebral bodies with evidence of subperiosteal extension. In both cases, cervical, thoracic, and lumbar vertebrae were affected. Practitioners should be aware that thymic lymphoma may involve the vertebral bone marrow and that affected animals may have neurologic signs.

References