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Imaging Features of Solitary Spinal Plasmacytoma in a Dog

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Abstract : A 12-year-old, intact, female Alaskan malamute presented with severe spinal pain and hind limb lameness. On radiographs, a round, demarcated lytic lesion was identified in the central fifth lumbar vertebra. On magnetic resonance imaging (MRI), the lesion involving the spinal cord appeared hypointense on T1 weighted, hyperintense on T2 weighted, heterogeneously enhanced on post-contrast T1 weighted, and hypointense on GE images. A focal, small, ill-defined, lytic lesion was also observed radiographically in the sixth lumbar vertebra, it appeared as a focal hyperintense lesion on T1 weighted, T2 weighted, and GE images and showed focal enhancement on post-contrast T1 weighted images. She was euthanized owing to extreme pain and severe and progressive clinical signs; a plasmacytoma was histopthologically diagnosed. This report presents an unusual type of spinal tumor, plasmacytoma. MRI is a useful modality to evaluate the anatomic location and extension of spinal lesions.

Key words **:** spinal tumor, solitary plasmacytoma, dog, radiography, MR imaging.

Introduction

Plasma cell tumors occur in two forms: a solitary form known as solitary plasmacytoma and a disseminated form known as multiple myeloma. Solitary plasmacytoma is further subdivided into the extramedullary plasmacytoma, which originates from nonosseous tissue, and the solitary plasmacytoma of bone, arising from osseous tissue (11). In humans, solitary plasmacytomas of bone are uncommon and account for less than 5% of all plasma cell tumors; they usually arise in the spine and skull (9). Solitary plasmacytomas of bone have also been reported infrequently in dogs within the spine and zygomatic arch (3,6,7,10,11).

A few cases of canine spinal solitary plasmacytomas have been reported, including clinical and histopathologic findings of a solitary myeloma in the first lumbar vertebrae in a Doberman Pinscher; clinical features of two solitary plasma cell myelomas in a study of sixty-one vertebral tumors; clinical, radiologic, and histopathologic findings of four solitary plasmacytomas among eight vertebral plasma cell tumors; and the magnetic resonance (MR) features of two plasmacytoma among twenty-one spinal tumors most recently (3,6,7,10,11).

This case report describes the radiographic and magnetic resonance imaging features of a lumbar vertebral solitary plasmacytoma in a dog.

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Case

A 12-year-old, intact, female Alaskan malamute presented with hind limb lameness and pain. Intermittent weight-bearing lameness began one year previously. Two days prior to presentation, she was reluctant to move, and was experiencing severe pain of unknown origin; on admission, she was paraplegic with severe pain. Hematological and serum biochemical examinations showed no significant abnormalities except a two-fold increase in alkaline phosphatase increase (552 u/L; reference range, 23-212 u/L). On physical examination, the hind limb muscle tone was decreased, and she was in severe pain at the lumbosacral region when the tail was raised or dropped. On neurologic examination, the forelimbs were normal, but the spinal reflexes, including the patellar tendon reflex, withdrawal reflex, and anal sphincter tone, revealed lower motor neuron deficits. The lesion was localized to the lumbosacral spine and a L4-S1 myelopathy was diagnosed. The differential diagnosis included degenerative myelopathy, intervertebral disk disease, lumbosacral stenosis, neoplasia, fibrocartilaginous embolism (FCE), and arterial thromboembolism. Lumbosacral radiography and MRI were performed to confirm and diagnose the lesion.

On radiographic examination, a radiolucent, rounded lesion with smooth margins measuring 3.5 × 1.4 cm was identified in the central fifth lumbar vertebra. The region was more easily observed on lateral and oblique ventrodorsal views than the ventrodorsal view. On the lateral view, a focal radiolucent lesion was also detected in the sixth lumbar vertebra, but

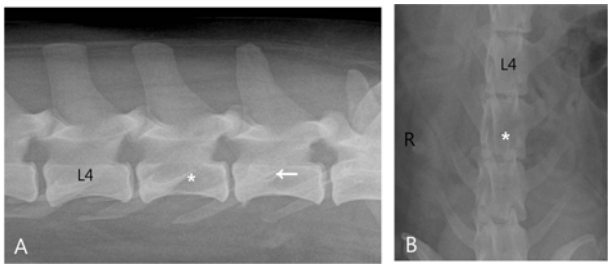

Fig 1. Right lateral (A) and right oblique ventrodorsal (B) radiographs of the lower lumbar spine. A 3.5 × 1.4 cm oval radiolucent lesion is observed in the fifth lumbar vertebra center (asterisk). A focal, small radiolucent lesion is also present in the sixth vertebra (A, arrow).

it was less apparent in oblique VD view. There were no remarkable findings on thoracic radiographs (Fig 1).

An MRI was performed using a 0.3 T MR scanner (AIRIS Vento, Hitachi Medical Corporation, Tokyo, Japan) with a large head coil. Sagittal, axial, and coronal spin-echo T2 weighted, gradient echo (GE), and pre- and post-contrast T1 weighted images were obtained. Gadoterate meglumine (Dotarem®, Guerbet, Milton Keynes, UK) at 0.1 mmol/kg was administered during the contrast study. A 3.3 × 1.8 cm mass was identified on the fifth lumbar vertebral body involving the spinal cord; it appeared uniformly hypointense on T1 and partially non-uniformly, hyperintense on T2 weighted images. There was moderate heterogeneous enhancement on post-contrast T1 weighted images and a hypointense signal on GE images. The mass was smooth with a demarcated margin elevating the fifth lumbar vertebral subarachnoid space, resulting in severe spinal compression (Fig 2). Based on the MRI findings, a primary extradural neoplasia with spinal cord compression was suspected. The severity of compression was consistent with the clinical signs. In addition, an ill-defined, mildly hyperintense signal was observed on T1 weighted, T2 weighted, and GE images, as well as mild contrast enhancement in the sixth lumbar vertebral body without spinal compression.

The owner elected to euthanize the patient because of the

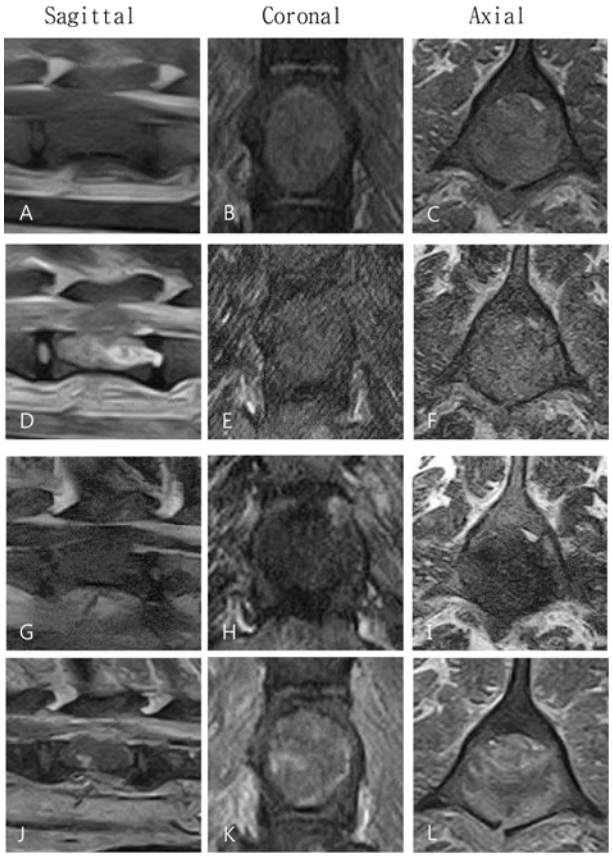

Fig 2. A large, oval mass is identified in the fifth lumbar vertebral body with uniform hypointense signal on T1 weighted (A-C) and non-uniform hyperintense signal on T2 weighted images (D-F). The lesion appears hypointense on GE images (G-I). The mass shows moderate heterogeneous contrast enhancement (J-L). The central vertebral body mass severely compresses the spinal cord dorsally.

extremely severe pain. The lesion was fluoroscopically biopsied using a bone curette without a necropsy and diagnosed as a plasmacytoma histopthologically (IDEXX Laboratories, Westbrook, United States) (Fig 3).

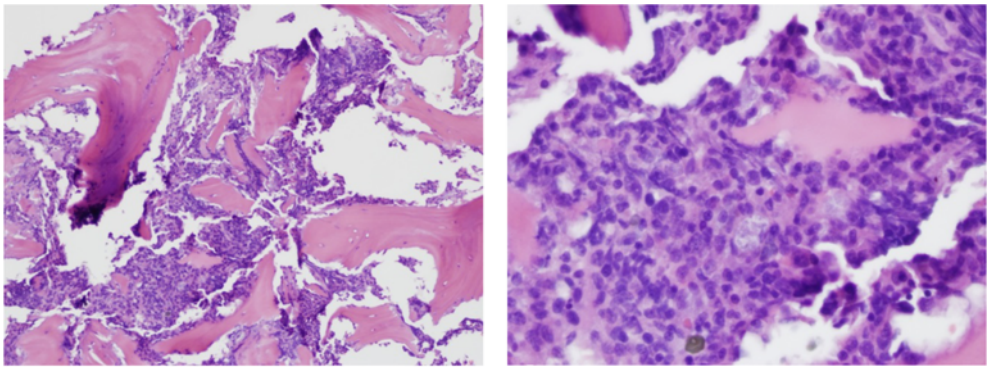

Fig 3. Histopathologic sections of the fifth lumbar vertebral body mass. (A: × 100, B: × 400, H & E). There is extensive infiltration of plasmacytoid cells within the inter-trabecular spaces.

Discussion

Spinal tumors may involve the spinal cord, dura mater, peripheral nerve, or perispinal tissue, such as vertebra. They are classified into three groups, intramedullary, intradural-extramedullary, or extradural, based on the tumor location relative to the dura mater and spinal cord. Spinal tumors are also classified as either primary or metastatic (1). The typical clinical signs are pain or neurologic deficits caused by spinal cord invasion or compression, but similar signs occur in any myelopathy including intervertebral disk disease, vertebral fracture or luxation, discospondylitis, myelitis, meningitis, and FCE (1,2,10,13). This particular patient showed hind limb lameness and pain, and the lesion was localized to the lumbosacral region based on physical and neurological examinations. However, further differentiation from other similar spinal diseases was difficult. Thus, imaging is the most important clinical aid to diagnose spinal cord disease (13).

A spinal tumor is presumptively diagnosed using a combination of survey radiography, myelography, CT, or MR (1,5, 6,13). The lesion cannot be recognized radiographically unless osteolytic or osteoproliferative vertebral lesions are present. Moreover, variable vertebral shape, overlying rib and soft tissue structures, and improper positioning make radiographic diagnosis difficult (10). Myelography elevates the accuracy of radiography by outlining the subarachnoid space and revealing potential spinal cord compression or expansion. Advanced imaging such as CT and MR is becoming increasingly common in veterinary medicine. The major advantage of CT and MR techniques lies in the more detailed visualization of the spinal cord and surrounding tissue. CT provides excellent spatial resolution to evaluate bone, but myelography is necessary to evaluate the subarachnoid space. CT can be invasive due to the administration of iodinated contrast material and serial scans (1,6). MR is the preferred modality when assessing spinal disease in humans (4,6). MR is noninvasive, yet is able to detect spinal cord compression or expansion similar to myelography and provides superior anatomic evaluation of the spinal soft tissues (1,6).

In this case, after undergoing radiography and MR examinations, the patient was diagnosed with an extradural spinal plasmacytoma. A large radiolucent, central lesion in the fifth lumbar vertebra and a focal radiolucent lesion on the sixth lumbar vertebra were observed radiographically. There was no cortical destruction or proliferation, and the vertebral endplates were unremarkable. In a previous review describing the radiologic features of sixty-one vertebral tumors, several radiographic characteristics were reported, including bone destruction, bone production, collapse of an adjacent disc space, and presence of soft tissue mass, but none of these characteristics enabled differential diagnosis of a specific tumor (10). Another review describing the radiographic features of four vertebral solitary plasmacytomas, reported clear lytic lesions in the vertebral body, transverse process, spinous process, and lamina (11); this differs from the present case, which had only vertebral body lysis. Myelography confirmed spinal cord compression caused by an extradural mass at a single site in three dogs of the previous study, but the procedure was not performed in this case.

Canine spinal tumor MR characteristics have been reviewed by several investigators (1,5). In an article reviewing the MR images of twenty-one spinal tumors, two plasmacytomas were T1 hypo or hyperintense, T2 iso- or hyperintense, and showed mildly homogenous or moderately heterogeneous contrast enhancement relative to the spinal cord (6). In the present case, an extradural spinal mass at the fifth vertebral body with severe spinal cord compression was identified based on a hypointense signal on T1 weighted, hyperintense signal on T2 weighted, and a moderate heterogeneous contrast enhancement. These MR findings are consistent with previous reports. The lesion was also hypointense on GE images.

In one human case, MR imaging of a solitary spinal plasmacytoma showed multiple curvilinear low signal structures on T1 and T2 weighted images in the vertebral body, referred to as “mini-brain” lesions resembling brain sulci. This characteristic appearance is presumably a stress phenomenon secondary to bone lysis and compensatory bone proliferation (8). These same MR findings were also found in other cases (12,14). In this case, the hyperintense signal on T2 weighted images was non-uniform with a few curvilinear low signal structures, but the lesions were not completely consistent with the “mini-brain” sign reported in humans. The lesion was uniform on both T1 weighted and GE sequences. Larger scale reviews of MR imaging in canine solitary spinal plasmacytoma are needed for comparison to the pathognomonic features of human lesions and to identify specific imaging features in dogs.

The clinical presentation, radiographic, MR, and pathologic findings were consistent with osseous solitary plasmacytoma. Typically, additional tests including a normal bone marrow biopsy at a separate site (< 5% plasma cells), normal protein electrophoresis, and the absence of other lesions on skeletal radiography are required to rule out multiple myeloma (11). In this case, an additional focal vertebral lesion was observed near the primary lesion, which can indicate early multiple myeloma. In humans, a solitary plasmacytoma has been described by some studies as an unusual early form of multiple myeloma. A dog with a solitary plasmacytoma developing multiple myeloma five years later reported according to a prior review (11). The final diagnosis was made only based on biopsy, which remains as a limitation.

Conclusion

A lytic spinal lesion was evaluated in our canine patient presenting with hind limb lameness and pain. MR revealed a lesion that was hypointense on T1 weighted, hyperintense on T2 weighted, heterogeneous contrast enhancement on post T1 weighted, and hypointense on GE images in the fifth lumbar vertebral body involving the spinal cord. An additional

focal hyperintense lesion on T1 weighted, T2 weighted, GE, and post contrast enhancement on T1 weighted images was detected in the sixth lumbar vertebral body. A plasmacytoma was confirmed histopthologically and was consistent with the primary clinical sign of peracute paralysis.

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개 척추에서 발생한 고립성 형질세포종의 자기공명영상 증례

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요 약 : 12살령의 암컷 알라스칸 말라뮤트가 후지 파행과 통증으로 내원하였다. 방사선 검사에서 요추 5번 추체 내 방사선 투과성 병변이 확인되었다. MR 영상에서 요추 5번 추체에서 T1 저신호, T2 고신호, GE 저신호 및 조영 후 T1 영상에서 이질적인 조영 증가 병변이 확인되었고, 병변은 척수까지 침입하여 척수 실질을 심하게 압박하고 있었다. 요추 6번 추체 내에서도 국소적인 방사선 투과성 병변이 확인되었으며, MR 영상에서 T1, T2 및 GE 고신호 및 조영 후 국소적인 조영 증가 병변이 관찰되었다. 심한 통증으로 안락사 후, 생검을 통해 형질세포종이 진단되었다. 척수 질환 환자에서 종양은 반드시 고려되어야 하며 영상 검사가 병변의 위치와 범위를 평가하는데 도움이 된다. 이 증례는 개 척추에서 발생한 고립성 형질세포종의 영상에 대한 유용한 정보를 제공할 것이라 생각한다.

주요어 : 척추 종양, 고립성 형질세포종, 개, 방사선검사, 자기공명영상