IMAGING DIAGNOSIS – IMAGING AND HISTOPATHOLOGIC CHARACTERISTICS OF A VERTEBRAL HAMARTOMA IN A CAT

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Running head: Vertebral hamartoma in a cat

Abstract

A 9-month-old domestic shorthair cat had progressive ambulatory paraparesis, proprioceptive ataxia, and thoracolumbar hyperesthesia. An extradural mass lesion affecting the left pedicle and lamina of the second lumbar vertebra (L2) causing marked spinal cord impingement was identified in magnetic resonance (MR) images. The mass was predominantly calcified in computed tomographic images. A hemilaminectomy was performed to resect the mass. Clinical signs were greatly improved at 6-month follow-up. The histopathologic diagnosis was vascular hamartoma. To our knowledge, this is the first report describing the MR characteristics of a vascular hamartoma associated with the vertebral column.

Signalment, history, and clinical findings

A 9-month-old male neutered domestic short hair cat had progressive pelvic limb proprioceptive ataxia, ambulatory paraparesis and thoracolumbar hyperesthesia. The cat had an 8-week history of vocalization, aggression on handling, and signs of pain on palpation of the abdomen and thoracolumbar spine. No other clinical signs were reported prior to referral. Treatment with meloxicam initially improved the clinical signs, but 4 weeks prior to referral the cat developed progressive proprioceptive ataxia and paresis of the pelvic limbs.

When referred, the cat had normal vital signs. The cat had ambulatory paraparesis with marked proprioceptive ataxia in the pelvic limbs and repeatable signs of thoracolumbar hyperesthesia on direct palpation. There was voluntary urinary and fecal continence. The cat's demeanor prevented full physical and neurological examination, including assessment of pelvic limb spinal reflexes. The tentative neuroanatomical localization was T3-S3. Hematology, serum biochemistry and urinalysis were within normal ranges.

Imaging, diagnosis and outcome

The cat was anesthetized in dorsal recumbency for MR imaging of the thoracolumbar vertebral column using a 1.5 Tesla scanner (Intera, Philips Medical Systems, Surrey, UK) and a spinal coil. Transverse and sagittal T1-weighted (TR 400–500 ms, TE 8 ms) and T2-weighted (TR 3000–3144 ms, TE 120 ms) images were acquired with slice thickness 1.8–2.5 and 0.25mm interspace. T1-weighted images were acquired before and immediately after manual intravenous injection of gadolinium-containing contrast medium (0.1 ml/kg gadoterate meglumine, Dotarem, Guerbet, Milton Keynes, UK). A solitary focal, extradural mass was identified continuous with

the left pedicle and lamina of the L2 vertebra, extending into the vertebral canal and causing marked spinal cord impingement (Fig. 1). When compared to normal spinal cord parenchyma the periphery of the lesion was predominantly isointense to hyperintense on T2-weighted images and hypointense on T1-weighted images. The center of the lesion was more heterogeneous in appearance and appeared hypointense compared to normal spinal cord parenchyma on T2- and T1-weighted images. At the interface between the lesion and the spinal cord at the cranial and caudal aspects there is a well-demarcated area of tissue that is T2-weighted hyperintense and T1-weighted iso-hyperintense compared to normal spinal cord parenchyma. Postcontrast images revealed moderate, homogenous contrast enhancement of the central zone of the mass and marked contrast enhancement along its interface with the vertebral canal. The spinal cord was markedly displaced to the right and flattened by the mass. No other spinal lesions were observed.

In order to further characterize the lesion, a CT scan was performed of the entire vertebral column, thorax, and abdomen using a 16-slice helical scanner (MX 8000 IDT, Philips Medical Systems). Images were obtained using helical acquisition, 120 kVp, 140 mAs, and 2.0 mm slice thickness. The mass lesion associated with the left pedicle and lamina of the L2 vertebra was densely calcified (mean 1130 HU) with an irregular inner border, and occupied the vertebral canal without any increase in the outer dimensions of the vertebrae (Fig. 2). No other lesions were observed.

Based on its imaging features and the clinical presentation, the most likely differential diagnoses were considered to be neoplastic (e.g. fibrosarcoma, fibroma, osteosarcoma, chondroma), infectious/inflammatory (osteomyelitis), or traumatic (excessive callous formation following previous trauma).

A left-sided hemilaminectomy at L1-L2 was performed. The outer cortical bone had a normal gross appearance but the vertebral cancellous bone of L2 was thickened with an enlarged porous structure (Fig 3A). There inner cortical bone of the pedicle was poorly differentiated from the cancellous bone and there was associated hemorrhagic soft tissue material on its medial aspect. The dura was exposed to relieve the spinal cord compression (Fig 3B). Samples of the abnormal bone were submitted for histopathologic examination and for bacterial culture. Post-operative medications included methadone (0.1-0.2 mg/kg IV every 4 hours for one day; Comfortan, Dechra, Shropshire, UK), buprenorphine (0.01-0.02 mg/kg for two days following methadone; Buprecare, Animalcare, North Yorkshire, UK), meloxicam (0.05 mg/kg orally once daily for 10 days; Metacam, Boheringer Ingelheim, Berkshire, UK) and gabapentin (7 mg/kg orally twice daily for 14 days; Gabapentin Medreich PLC, Feltham, UK). The cat recovered well from surgery and had reduced signs of spinal pain when discharged four days later, although the paraparesis and proprioceptive ataxia in the pelvic limbs were unchanged. Voluntary urinary and fecal continence were retained after surgery.

Tissue samples for histopathological analysis were fixed in 10% neutral buffered formalin, processed routinely and embedded in paraffin wax. Sections (4 μ m) were stained with hematoxylin and eosin (HE). Present within the medullary cavities and extending to the periosteum are variably dense proliferations of endothelial cells forming small caliber blood vessels with and without a mural smooth muscle. These vessels are surrounded by a loose myxoid stroma and extravasated erythrocytes. The surrounding trabecular bone is well organized, with prominent lacunal osteocytes and an overlying single cell layer of osteoblasts. Occasional spicules of necrotic bone are also present. The histopathological findings were

considered to be consistent with a benign vascular hamartoma (Fig 4). [1] Culture of bone from the site revealed no bacterial isolates after 48 hours of aerobic and anaerobic incubation.

At 4-weeks post-surgery the cat tolerated handling without signs of pain. There was mild pelvic limb paraparesis, mild proprioceptive ataxia with no postural reaction delays, and no apparent spinal hyperesthesia on palpation of the thoracolumbar area. At 6-month follow up it was reported that the cat had no recurrence of clinical signs.

Discussion

A hamartoma is an excessive and unorganized growth of normal cells and associated tissue that are intrinsic to the organ in which they occur and is considered to be congenital malformation.[2]

Hamartomas demonstrate minimal growth in the mature animal and are therefore not considered to be neoplastic in origin.[3] The majority of hamartomas are diagnosed in young patients, often before the onset of skeletal maturity. [4-6]

Hamartomas may occur as an incidental finding; however, depending on their location, vascular hamartomas can cause clinical signs secondary to spontaneous hemorrhage, mass effect, or adherence to adjacent tissues.[2, 7-9] There are reports of hamartomas occurring in many different species including humans, dogs, cattle, horses, goats and cats where they are reported to occur at multiple different sites and involve many tissue types.[1, 7-13]

Hamartomas causing myelopathic signs have been reported in veterinary species due to both vertebral and intramedullary lesions.[1, 6, 7] A previous report of a cat with a vascular hamartoma affecting a cervical vertebra described similar clinical features to those described here, including young age (15 months) and signs of progressive ataxia and paresis.[1] Computed tomography

demonstrated an expansile lesion compressing the spinal cord, which was surgically resected, also resulting in a good outcome. Important differential diagnoses for vascular hamartomas occurring within bone include hemangiomas, hemangioblastomas, and arteriovenous malformations, and these can be differentiated on the basis of histopathological features.[14-17]

Previous studies have described MR characteristics associated with intramedullary hamartomas in the cervical and thoracic spinal cord of dogs.[18, 19] In contrast to our case of a vertebral hamartoma, these case reports describe the intramedullary hamartomas as heterogeneously hyperintense compared to normal spinal cord on T2W images, isointense on T1W images, with no evidence of contrast in cervical hamartoma and some peripheral, ventral contrast enhancement in the thoracic hamartoma.[18, 19]

To our knowledge, this is the first report describing the MR characteristics of a vascular hamartoma arising from the vertebrae and the first report of a lumbar vertebral hamartoma in a cat. MR clearly depicted the lesion and its effect of the spinal cord, although the signs were not specific for vertebral hamartoma. The combined findings of MR and CT indicated a solitary, non-aggressive, predominantly osseous lesion, which supported surgical treatment in order to decompress the spinal cord and enable further characterization by histopathology. Based on the presenting case and previous literature the prognosis for a cats with vascular hamartomas associated with vertebral column that can be surgically excised is good.[1]

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Legends

Figure 1: Midline sagittal T2-weighted (A) and transverse T2-weighted (B) and T1-weighted pre- (C) and post-contrast (D) through the mid-body of L2. There is a focal extradural mass lesion associated with the left pedicle and lamina of the L2 vertebra within the vertebral canal causing marked displacement of the spinal cord. The mass is iso-to hypointense to normal gray matter on T2-weighted images (A, B) and hypointense on T1-weighted images (C). There is moderate, homogenous contrast enhancement of the central zone of the mass and marked contrast enhancement along its interface with the vertebral canal (D).

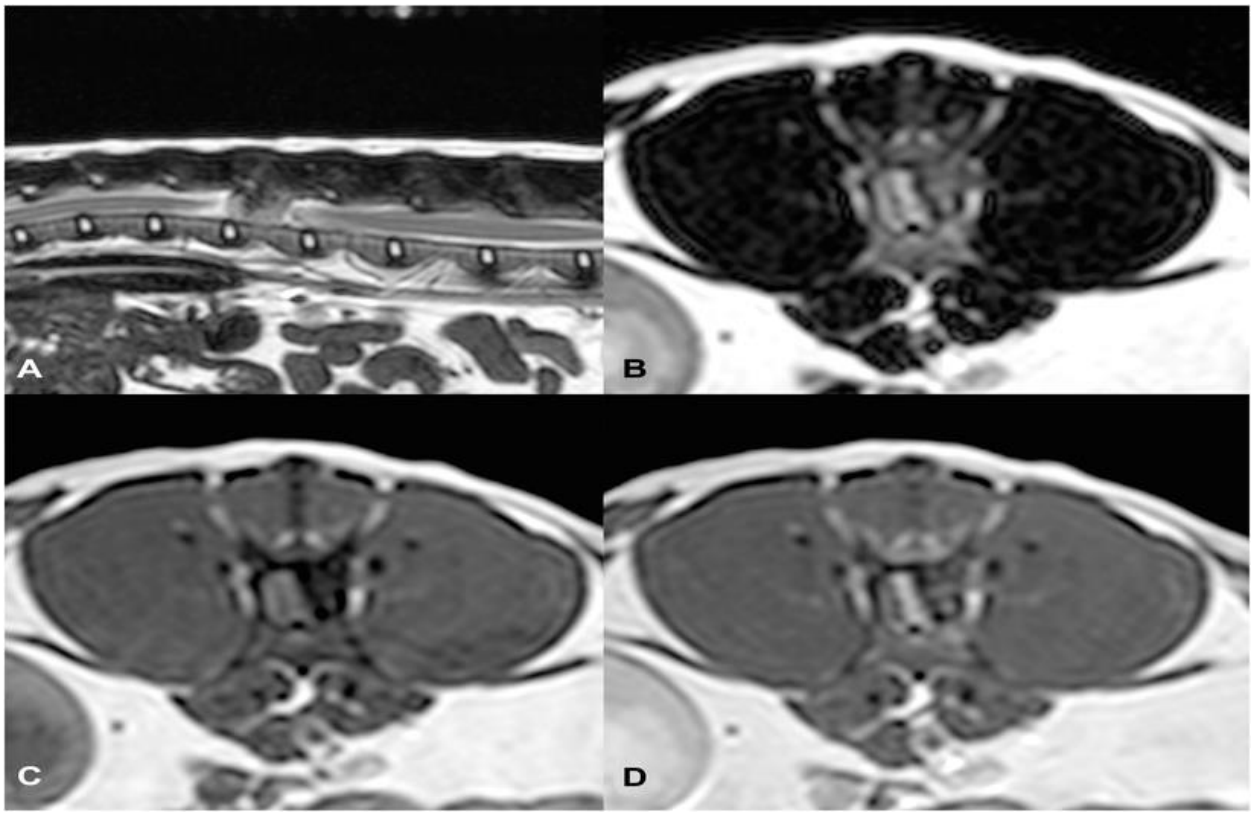

Figure 2: Transverse (A) CT image and sagittal (B) and dorsal (C) multiplanar reformatted images showing a focal, calcified extradural mass lesion associated with the left pedicle and lamina of the L2 vertebra. Adjacent vertebrae are unaffected.

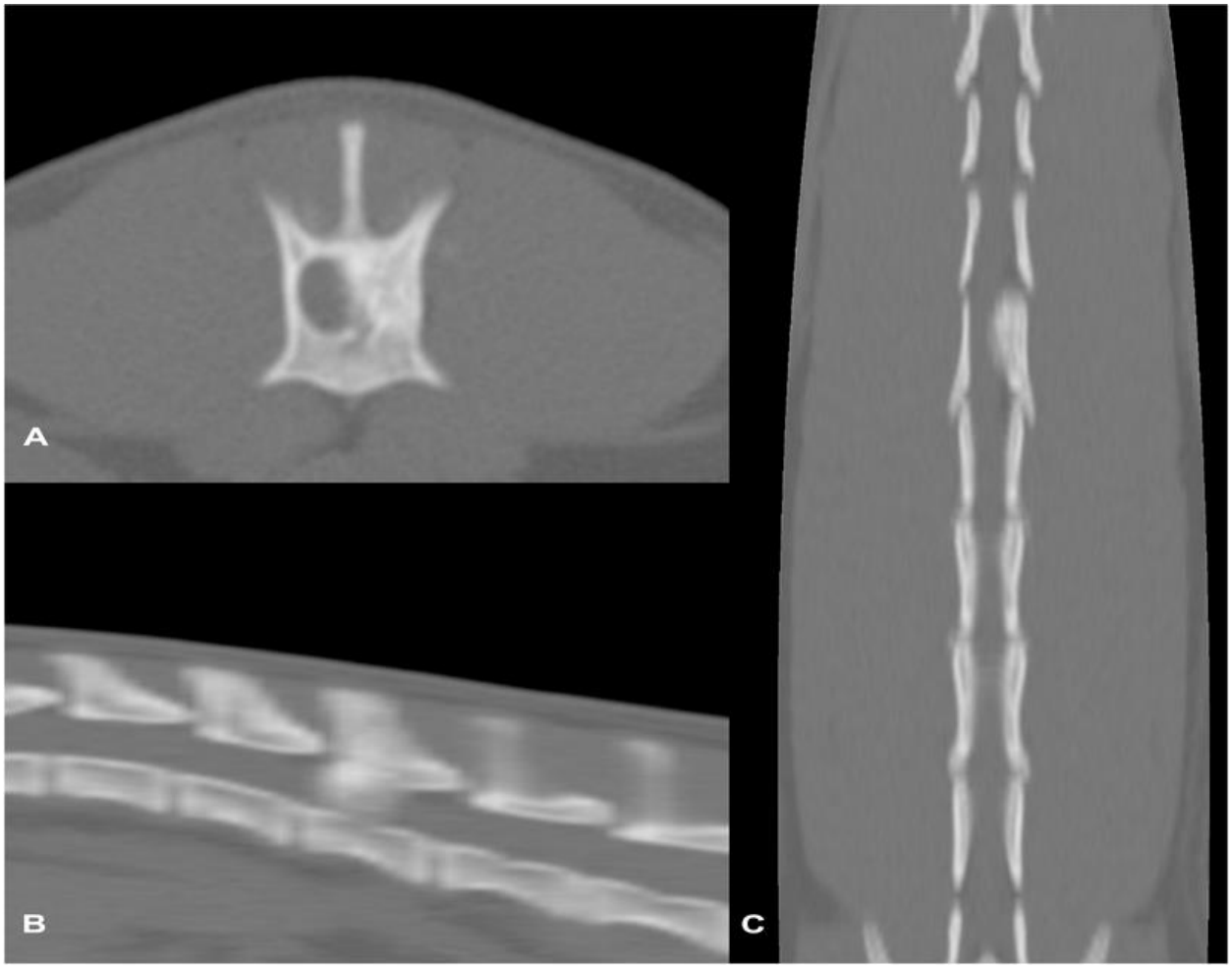

Figure 3: Intra-operative photograph of the L2 lesion at the hemilaminectomy site. (A) The appearance of normal inner cortical bone of L1 (*) contrasts with the proliferative tissue within the vertebral canal of L2 (arrow). (B) Removal of the proliferative tissue to expose the dura (arrowhead) surrounding the spinal cord.

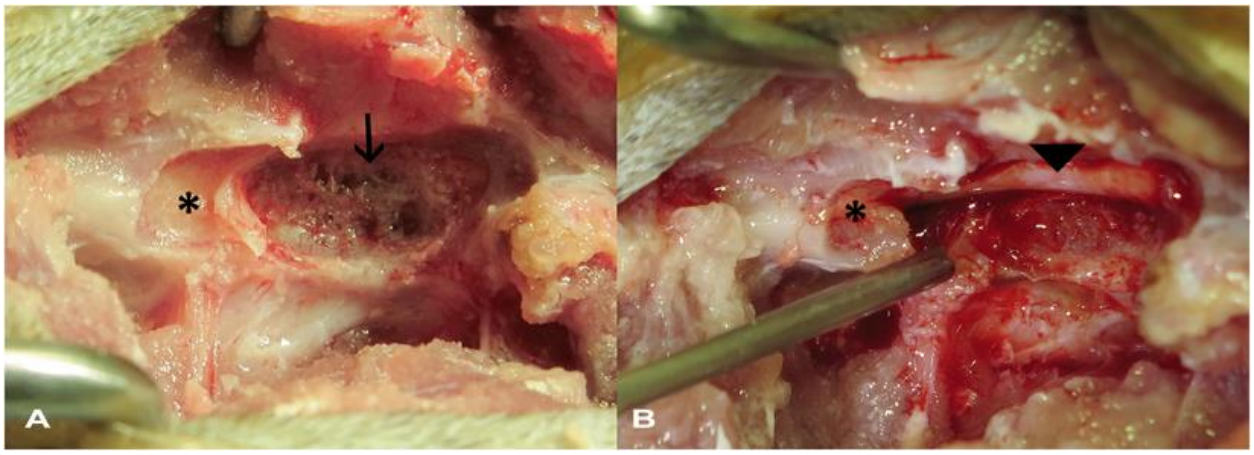

Figure 4: Hematoxylin and eosin section (at x 600 magnification) shows irregular proliferations of plump endothelial cells (arrow), which form numerous small calibre blood vessels. These vessels are surrounded by a loose myxoid stroma (*) and numerous extravasated erythrocytes (arrowhead). Scale bar = 30μm.