Infiltrative lipoma in a dog causing lysis and destruction of a thoracic vertebra without direct bony tumour infiltration

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CASE REPORT
An infiltrative lipoma was diagnosed and surgically treated in a female Jack Russell Terrier that had a history of progressive paraparesis and ataxia of several months’ duration. Clinical signs, diagnosis and treatment of infiltrative lipoma are described. Computed tomography performed at the level of the thoracolumbar vertebral column revealed a fat density mass within the epaxial musculature expanding towards the vertebral body of T12, associated with severe bone destruction of the spinous process and dorsal lamina and invading the vertebral canal, causing dorsal compression of the spinal cord. Histopathological analysis of biopsies indicated lipoma. Surgical excision was attempted; however, en bloc removal was not possible. Histopathological investigation confirmed the diagnosis of infiltrative lipoma and failed to reveal neoplastic infiltration of the affected bone fragments, suggesting that the osteolytic process was more likely the result of mechanical compression than the result of neoplastic infiltration. Adjunctive radiation therapy was not administered. The dog recovered uneventfully and did not show signs of recurrence over a period of 36 months.

CONCLUSION
Surgical treatment of an infiltrative lipoma causing vertebral bone lysis, clinical signs of myelopathy had a satisfactory outcome in a dog.

KEYWORDS
dogs; dorsal laminectomy; myelopathy; neoplastic disease; neurology

ABBREVIATIONS
CT, computed tomography; MRI, magnetic resonance imaging

Infiltrative lipoma refers to a group of tumours that are histologically identical to lipomas and are characterised by well-differentiated adipocytes. They do not demonstrate metastasis, but are locally aggressive with a tendency to infiltrate and invade adjacent tissues such as muscles, connective tissues, bones and, in rare cases, peripheral nerves and the spinal cord.1,2 The recurrence rate, even after aggressive surgical resection, ranges from 36% to 50%.1,3 They are reported to be uncommon in dogs and rare in cats.1

Clinical signs of infiltrative lipoma arise because of the compression or infiltration of adjacent tissues1,3 and therefore relate to the location. Typical locations of infiltrative lipomas in dogs include the ventral thoracic wall and extremities, but they may also originate in the muscles of the head and neck regions.1,3 Infiltrative lipomas extending from paraspinal musculature into the spinal extradural space and causing neurologic deficits have been sporadically reported in the veterinary literature.1,3-7

Local bone lysis associated with extension of infiltrative lipomas from adjacent tissues, particularly the muscles, has been documented.1,3,5,6 It is unclear in those cases whether bone lysis was a direct consequence of infiltration of the bone or secondary to pressure mechanisms such as compromise of the vascular supply.

In this report, we describe an infiltrative lipoma that presented with relatively limited invasion into the surrounding epaxial muscles, severe bone erosion of the dorsal aspect of the vertebral body of T12 and invasion of the vertebral canal causing secondary myelopathy. In this case, the mass did not infiltrate the vertebral bone or the spinal cord, and bone lysis was presumed to be secondary to mechanical compression. Long-term outcome following excision was favourable.

CASE REPORT
A 7-year-old 7-kg female neutered Jack Russell Terrier with a body condition score of 4/9, according to the World Small Animal Veterinary Association criteria, presented with a 2-month history of progressive paraparesis without any previous history of trauma. Management in the 2 months had been conservative, involving strict cage rest and anti-inflammatory medication (meloxicam 0.1 mg/kg PO, q24h; Metacam, Boehringer Ingelheim Ltd, UK), resulting in initial improvement in clinical signs followed by a marked deterioration consisting of ambulatory paraparesis and moderate ataxia.

On presentation the dog demonstrated moderate signs of spastic paraparesis and pelvic limb ataxia, which were more evident on the right. Hindlimb postural reactions demonstrated severe deficits. The patellar reflex was increased in both hindlimbs. Thoracic limb postural reactions, mentation and cranial nerve examination were considered within normal limits. Mild resentment was elicited to palpation of the vertebral column at the level of the thoracolumbar junction.

Based on the clinical signs, the neuroanatomical localisation was determined to be the T3–L3 spinal cord segments.

Differential diagnosis included neoplasia, intervertebral degenerative disc disease, focal meningoencephalitis (infectious or inflammatory) and discospondylitis. Degenerative myelopathy and arachnoid diverticulum were also considered because of the chronic progression of the neurological signs, although the latter conditions are usually reported to be non-painful.

Initial diagnostic investigation results of routine haematology, serum biochemistry and electrolyte analysis were unremarkable.

Computed tomography (CT) images of the thoracolumbar area were acquired with the use of a multi-detector CT scanner (HiSpeed QX/i (four-slice), GE Medical Systems, Milwaukee, WI, USA) with the dog positioned in dorsal recumbency. A non-ionic iodinated contrast medium (Iohexol 350 mg I/mL, Omnipaque™, GE Healthcare, NJ, USA) was administered intravenously at a dose of...
CASE REPORTS \ CASE SERIES

2 mL/kg. Pre- and post-contrast CT examinations were completed in transverse contiguous slices from the first thoracic vertebra to the sacrum, using the following settings: 120 kV, tube current 200 mA, 1.5 s tube rotation time, slice thickness 1.25 mm, 1-mm image reconstruction interval and collimator pitch of 1. The images were acquired using standard bone (window width, WW 1500; window level, WL 300) and soft tissue (WW 350, WL 40) algorithms. Image data were evaluated with a workstation using commercially available DICOM image viewing software (Osirix 64-bit, version 6.0.2, Pixmeo, Switzerland). Subsequent multiplanar reformatting was performed to obtain dorsal and sagittal images.

Precontrast images showed an expansive, well-defined, homogeneous mass that measured 0.6 cm in width (transverse), 3 cm in length (craniocaudal) and 2.5 cm in height (dorsoventral) within the right epaxial muscles at the level of the T11–T13 vertebral bodies. The mass infiltrated the longissimus lumborum, multifidus lumborum and iliocostalis muscles. The lesion appeared as a homogeneous, hypoattenuating mass with a CT density of −80 Hounsfield units, similar to that of adipose tissue (Figure 1). The mass had caused marked lysis of the spinous process and of the lamina of the vertebral arch of T12 on the right side (Figure 2). The spinal process of T12 showed marked cortical thinning with a lack of a periosteal reaction, whereas the dorsal lamina of T12 showed bone destruction and no periosteal reaction. The mass protruded into the right dorsal aspect of the vertebral canal and caused marked deviation and compression of the spinal cord. Based on the CT images, it was not considered possible to exclude spinal cord infiltration.

CT-guided fine needle aspirates and Tru-cut biopsy were obtained to further characterise the mass. Cytology revealed blood and adipocytes, which suggested a lipoma as the most likely diagnosis. Histopathological sections of the Tru-cut biopsy specimens were composed of sheets of well-differentiated adipocytes between which some striated muscle fibres were noted.

Based on the diagnostic findings, the dog underwent spinal surgery for a suspected infiltrative lipoma. The goal of the surgery was to decompress the spinal cord and improve the dog’s clinical status. A modified right-sided dorsolateral hemilaminectomy was performed to better visualise the mass and surrounding tissues. Skin and superficial tissues were incised on the midline from the spinous process of T8 to the spinous process of L3. Subcutaneous fat was reflected on either side of the midline to expose the lumbodorsal fascia, which was incised on either side of each spinous process. Muscles were levered away from the spinous process and articular facets on each side and the muscular insertions were transected.

On the right side, at the level of the T11, T12 and T13, a multilobular, soft, off-white, poorly demarcated, unencapsulated and locally infiltrative mass was present immediately beneath the fascia. It appeared to extend between the paravertebral muscles and was firmly attached to the dura mater. Because of its location and friable nature, it was impossible to excise wide margins or to remove the mass en bloc and thus it was removed piecemeal, together with the abnormal right vertebral arch and spinous process of T12.

Histopathology of the excised tissue confirmed the suspected diagnosis of infiltrative lipoma. Well-differentiated neoplastic adipocytes that were arranged in sheets and separated into lobules by discontinuous bands of fibrovascular tissue had replaced the bone structure and invaded the vertebral canal. The remaining myofibres demonstrated a range of degenerative changes, including

**FIGURE 1.** Computed tomography scans of the thoracolumbar region of a Jack Russell Terrier with a history of progressive paraparesis and ataxia, immediately after contrast administration (WW 1147, WL 339): (A) sagittal, (B) transverse, (C) dorsal. Note the well-defined, homogeneous, hypoattenuating, non-enhancing mass in the right epaxial muscles (arrows). The mass has caused lysis of the dorsal aspect of T1, entered the vertebral canal and compressed the spinal cord (*).
No neurological abnormalities 3 years following surgery. Examination performed by the primary practitioner revealed no neurological abnormalities 3 years following surgery.

FIGURE 2. 3D multiplanar reconstruction of the thoracolumbar vertebral column of a Jack Russell Terrier with a history of progressive paraparesis and ataxia. Note the lysis of the dorsal aspect of T12 at the level of the right dorsal lamina (arrow).

FIGURE 3. Intraoperative image of the vertebral column of a Jack Russell Terrier after complete muscle retraction. The black arrow indicates the infiltrative lipoma at the level of T12 vertebral body. SP, spinous process; AF, articular facets. L1 and L2, 1st and 2nd lumbar vertebral bodies. The white R and L indicate the right and left side of the vertebral column. The infiltrative lipoma can be seen immediately beneath the fascia (arrow) and appears like a multilobular, soft, off-white, poorly demarcated, unencapsulated and locally infiltrative mass.

DISCUSSION

Lipomas are benign neoplasms that consist of localised nodules of fat and originate from the adipocytes of subcutaneous tissue. Infiltrative lipomas are locally aggressive and can cause pain upon palpation because of the compression of neighbouring tissues. Infiltrative lipomas that invade and compress the spinal cord have been sporadically described in the veterinary literature. Labrador Retrievers, Doberman Pinschers and large mixed-breed dogs appear to have a higher prevalence of infiltrative lipomas, although they can occur in any breed and in any location along the vertebral column. This case report describes an infiltrative lipoma in an adult (7 years old) small-breed dog (Jack Russell Terrier) at the level of T12.

In the veterinary literature, we found six previous cases of infiltrative lipoma extending and compressing the spinal cord in dogs. All the previous cases describe adult dogs (age range between 4 and 12 years): four were large-breed dogs (2 mixed-breed, 1 Labrador Retriever, 1 Bernese Mountain Dog) and two were small-breed dogs (1 Maltese Terrier, 1 Fox terrier).

Four cases involved the thoracic vertebral column (two at the level of T5, one at the level of T9 and one at the level of T10–11). One case involved the cervical vertebral column (C5–6) and one case involved the lumbar vertebral column (L5–6).

In common with these previous reports, the case presented in this report demonstrated neurological deficits attributed to mechanical compression of the spinal cord. In the majority of previously reported cases the masses appeared to extend into the vertebral canal through a preexisting aperture, such as an intervertebral foramen. In only two cases had the authors reported that the mass was suspected to have reached the vertebral canal because of bone destruction. In one case, the dog had a history of trauma, presented with vertebral fracture and was subsequently euthanased based on a poor prognosis. In the second case of vertebral bone lysis secondary to infiltrative lipoma, signs of mass recurrence (soft tissue masses at the level of the surgical site) were noted 5 months following surgical excision. In the current case the mass entered the vertebral canal following destruction of the vertebral arch of T12, similar to the second previously reported case; however, there was no recurrence. Therefore, given the better outcome associated with surgical treatment in the current case, a prognosis regarding the potential for recurrence cannot be made based on the imaging appearance of vertebral arch (or other bone) lysis alone.

Imaging of cases with thoracolumbar myelopathy may involve plain or contrast-enhanced radiography, CT or magnetic resonance imaging (MRI). Although MRI is reported to be the gold standard for diagnosis and characterisation of thoracolumbar myelopathy, CT was performed in this case because of financial considerations. Helical CT is accurate for evaluation of thoracolumbar disc extrusion in chondrodystrophic dogs, which was a leading differential in this case.

In this case the diagnostic imaging findings obtained through CT were most consistent with lipoma, although alternative, more aggressive neoplastic lesions, such as infiltrative angiolipoma and liposarcoma, were also considered based on the severity and extent of the bone lysis and relatively limited extension in the paraxial muscles compared with previously reported cases. Based on the CT images, it was not possible to exclude the possibility of spinal cord infiltration prior to surgery. MRI would have allowed for more precise evaluation of the extent of infiltration of the mass because this technique gives better delineation of fat, fluid and tissue because of the different signal characteristics and is more sensitive to detecting spinal cord infiltration.

The dog recovered uneventfully from surgery. Adjunctive treatment, such as chemotherapy or radiation therapy, was not performed. Clinical signs of ataxia and paraparesis resolved over approximately 2 weeks following surgery, at which stage a neurological examination revealed no significant abnormalities.

Examination performed by the primary practitioner revealed no neurological abnormalities 3 years following surgery.
CT myelography may have permitted superior delineation of the margins of the mass, but this was not performed because of concerns regarding the potential for associated complications, including neurological deterioration and the possibility of obtaining no further diagnostic information.

Differentiation of lipoma from liposarcoma is of importance in terms of prognosis, with survival times for the latter being significantly poorer and strictly correlated to the tumour grade.12–15 This differentiation is typically possible with cytology alone. However, although the cytological features have been reported,2 differentiation of lipoma from infiltrative lipoma requires histological evaluation to confirm infiltrative behaviour.1,2 Therefore, the authors recommend fine needle aspirates to permit sampling from multiple sites and Tru-cut biopsy as performed in this case.

Differential diagnosis should also include infiltrating angiolipomas. These are rare, benign tumours characterised by well-differentiated adipocytes interspersed with small- to medium-calibre vessels. They are located in the epidural space and are reported to infiltrate and invade the bony structure of the vertebra.11 Although histologically similar to infiltrating lipomas, they are usually confined to the ventral aspect of vertebral body and may result in pathological fracture.11

Treatment of infiltrative lipomas causing spinal cord compression involves decompression by surgical excision of the lesion.3–7 The reported recurrence rate for infiltrative lipoma at all sites, even with aggressive surgical resection, ranges from 36% to 50%. In contrast, the recurrence rate for non-infiltrative lipomas is less than 2%.8 The higher recurrence rate of infiltrative lipoma appears to be linked to the difficulties in macroscopic distinction of pathological fat from physiological fat and therefore incomplete excision.9 For this reason, adjuvant therapy such as radiotherapy and chemotherapy is suggested in combination with surgery to reduce the risk of recurrence.3–7

In all of the previously reported cases of infiltrative lipoma causing spinal cord compression, treatment involved surgical excision without adjuvant treatment. Three of the four cases had a good postoperative outcome and long-term prognosis with absence of recurrence at 6–24 months post surgery. Tumour recurrence at 5 months after surgery was reported in a single case.9 In the case presented in this report clinical signs of myelopathy had not returned 3 years following decompression without any adjuvant therapy. Survival time without clinical signs suggests complete surgical excision may have been achieved in this case.

CONCLUSION

Infiltrative lipoma that extends from the epaxial musculature to the spinal extradural space, while uncommon, should be considered in the differential diagnosis in dogs that present with progressive paresis and focal spinal pain. The more commonly reported presentation involves extension of the mass into the spinal extradural space through a preexisting opening, such as a spinal foramen. However, the infiltrative lipoma in this case report entered the vertebral canal following severe bony destruction of the vertebral arch. The CT imaging finding of severe lysis should not necessarily be misinterpreted as a sign of a more malignant neoplasm and infiltrative lipoma should remain a consideration. Extensive bone destruction does not necessarily suggest a worse prognosis because of presumed neoplastic bone infiltration and may occur secondary to mechanical compression only. Surgical treatment may be curative, particularly if the mass can be entirely removed.

REFERENCES