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Infiltrative Intramuscular Lipoma in the Antebrachium of a Dog

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Abstract

This case report describes a dog with an infiltrative intramuscular lipoma in the antebrachium, presenting with chronic left forelimb lameness and altered posture of the digits. Computed tomography showed a fat-attenuating mass displacing the flexor tendons. The mass was surgically excised along with the affected muscle belly and tendon; histopathological examination revealed infiltration of adipose tissue cells within the muscle belly and tendon sheath of the deep digital flexor muscle. After removal of the lipoma, lameness resolved, full ambulatory function returned, without recurrence at 1 year follow-up.

Keywords
- infiltrative lipomas
- intramuscular lipomas
- dogs
- lameness

Introduction

Lipomas are common benign neoplasms originating from subcutaneous tissue adipocytes, with no tendency to metastasize.[1,2] They can arise from anywhere in the body, including deeper structures and within body cavities.[3,4] The malignant counterpart, liposarcoma, is rare and is characterized by infiltrative growth, low metastatic rate and high recurrence rate.[5] In some cases, benign lipomas can become locally aggressive, infiltrating adjacent tissues, including muscle, fascia, nerve and bone.[2,6–17] In these cases, they are referred to as infiltrative lipomas. Large breed, older, female dogs are considered predisposed, with Labrador Retrievers, Doberman Pinscher and mixed breed dogs being most commonly represented.[3,12] Infiltrative lipomas can cause pressure atrophy of muscles, pain and may interfere mechanically with normal movement and locomotion.[4,18] Infiltrative lipomas have been reported to recur in 36 to 50% of cases after surgical resection; this is a much higher rate when compared with lipomas (2%).[19,20] In one study investigating 16 cases of infiltrative lipomas, the median time to recurrence was 239 days, with 67% of dogs being disease-free at 1-year post-surgical resection.[20] A further categorization of benign lipomas can be found in human and veterinary literature. This differentiates between intermuscular and intramuscular lipomas, describing not only their anatomical location but also their biological behaviour: that is, expansive, benign growth between muscle bellies for the intermuscular type and with tissue infiltration within the muscle compartment for the intramuscular type.[18,21,22] The distinction of these two forms may generate some confusion in terminology and in diagnostics.[23] Benign intermuscular lipomas are most frequently found in the pelvic limb, particularly between the semitendinosus, semimembranosus and bicep femoris muscles and less frequently in the thoracic limbs.[15,18,19,21] Intramuscular lipomas are distinctly infiltrative and thus, form a separate group of lipomas, based on growth characteristics.[21]

This report describes an infiltrative intramuscular lipoma almost completely replacing the deep digital flexor muscle by adipose tissue and with invasion of the fascial planes; consequently, gait abnormalities were present due to displacement of and increased tension within the digital flexor tendons. Although infiltrative lipomas are not uncommon, the clinical and surgical challenges they often present due to local functional damage and recurrence are infrequently described.[2,5,19,20]

Case Report

A 8-year-old neutered female Alaskan Malamute was presented with a 12 months history of progressive left thoracic limb lameness of variable degree. Lameness was reported to

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be worse on harder, uneven surfaces and only partially responded to non-steroidal anti-inflammatory drug therapy and activity restriction. A small, soft, sessile, non-painful mass on the caudo-medial aspect of the distal left antebrachium was initially noted approximately 1 year before. At that time, a biopsy result was consistent with lipoma. Initial management of metacarpophalangeal joint (MCPJ) of digit V osteoarthritis, with methylprednisolone acetate (Zoetis, New Jersey, United States) injected intra-articularly and peri-articularly, coupled with activity restriction had been unsuccessful.

On presentation, due to continued lameness, there was mild atrophy of the left thoracic limb musculature and an abnormal posture of the left weight-bearing digits with hyper-flexion of all inter-phalangeal joints and increased wear to the nails and digital pads. Manipulating the digits elicited discomfort. The MPCJ of digit V was markedly thickened and had a reduced range of motion but was not painful. A small, soft elastic, sessile, non-painful mass on the caudomedial aspect of the distal left antebrachium was present. Carpal manipulation elicited no pain and the range of motion was not restricted. Neurological examination revealed no abnormality.

A 64-slice computed tomography (CT) study (Somatom Go All, Siemens Healthcare, Frimley, United Kingdom) of the left forelimb was performed under sedation. The CT revealed moderate degenerative arthritis of MCPJ of digit V, including new bone formation on the distal metacarpus, proximal phalanx and sesamoid bones with the abaxial sesamoid being most notably affected. The joint space was considered normal and there was no evidence of aggressive lesions. The CT also showed a well-defined, space-occupying lesion, in the caudal soft tissues of the distal radius, measuring 4.9 cm L × 3.4 cm W × 2.4 cm H. The mass was fat attenuating (Hounsfield Unit approximately -100). It was noted that the fat attenuating mass replaced the muscular tissue of the deep digital flexor, particularly the humeral head and moderately displaced the muscle's tendon laterally (►**Fig. 1A–C**). In addition, the lipoma had almost completely replaced the flexor carpi ulnaris and the deep digital flexor muscles from the middle third to the carpus. No bone invasion was present and regional lymph nodes were considered normal (►**Fig. 1**). Considering the clinical examination and the CT images, it was suspected that the lipoma was acting as a space occupying lesion, displacing the digital flexor tendons in the distal antebrachium. This in turn would have increased the tension on the tendons, causing hyper-flexion of the digits and an abnormal paw posture, which has resulted in increased nail wear.

Surgical excision of the infiltrating lipoma was planned. The patient was anaesthetized with medetomidine 0.005 mg/kg (Sedator, Dechra, Shrewsbury, United Kingdom) and methadone 0.3 mg/kg (Comfortan, Dechra, Shrewsbury, United Kingdom) intramuscularly for premedication and propofol 4 mg/kg (PropoFlo, Abbott, Maidenhead, United Kingdom) intravenously for induction. Anaesthesia was maintained with isoflurane (IsoFlo, Zoetis, Leatherhead, United Kingdom) in oxygen. Preoperative clavulanate-potentiated amoxicillin (Augmentin, GlaxoSmithKline, Ulverston, United Kingdom) was given intravenously and repeated every 90 minutes during surgery.

Fig. 1 Sagittal plane (**A**), dorsal plane (**B**), and axial plane (**C**) computed tomography images (slice thickness 0.8 mm, window level 40, window width 350) of the left forelimb showing a well-defined fat attenuating mass (Hounsfield unit -100) located within the deep digital flexor muscle (*white star*) and displacing the muscle's tendon and the surrounding structures. Note the presence of soft tissue strands within the mass in all planes.

An incision was made on the medial aspect of the distal antebrachium over the mass and the previous biopsy site. The lipoma was protruding through the antebrachial fascia at the biopsy site. A linear incision was made through the antebrachial fascia to expose the lipoma (►**Fig. 2**). This was attached to the palmar aspect of the tendons of the palmaromedial muscles as showed by the CT study. The lipoma almost completely replaced the affected muscle, with only a few muscle fibres attaching the muscle belly proximally and a single tendon protruded from the distal pole of the tumour. The mass was removed via a combination of blunt and sharp dissection, with monopolar diathermy for haemostasis, with excision of part of the antebrachial fascia. The proximal attachment of the muscle belly was divided as proximally as possible and the tendon was transected distal to the lipoma. No attempt was made to reconstruct the function of the excised muscle.

The mass measured 55 × 37 × 30 mm and was sent for histological examination.

The remaining fascia was sutured with PDS 3–0 (Polydioxanone, Ethicon, Bridgewater, Massachusetts, United States) in a simple continuous pattern. The subcutis was closed with Monocryl 3–0 (Poliglecaprone, Ethicon, Bridgewater, Massachusetts, United States) in a simple continuous pattern, and the skin was stapled. A light bandage was placed after surgery and removed the following day.

The dog was discharged the next day with firocoxib (Previcox, Boehringer Ingelheim Animal Health UK Ltd, Bracknell, United Kingdom) for 5 days and tramadol (Tralieve, Dechra, Shrewsbury, United Kingdom) for 2 days. The owner was instructed to keep confined the dog to a small area in the house and to restrict exercise for 2 to 3 weeks.

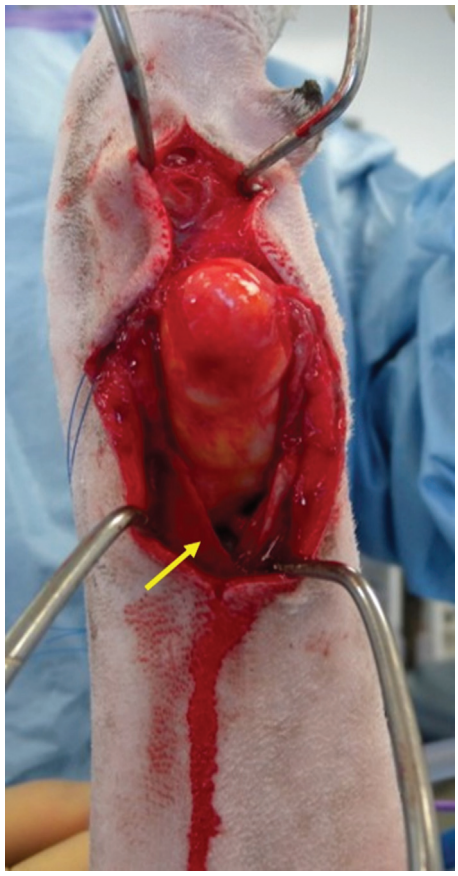

Fig. 2 Intraoperative picture showing the intramuscular lipoma partially dissected. Note the antebrachial fascia (*yellow arrow*).

Histological examination of the excised tissue confirmed the diagnosis of infiltrative intramuscular lipoma. The mass was poorly circumscribed and there was evidence of invasive growth, particularly involving the fascial tissue, and a small amount of skeletal muscle, with mild myofiber degeneration (►**Fig. 3**). The mass was considered completely removed aside from the distal segment where the deep digital flexor tendon was infiltrated.

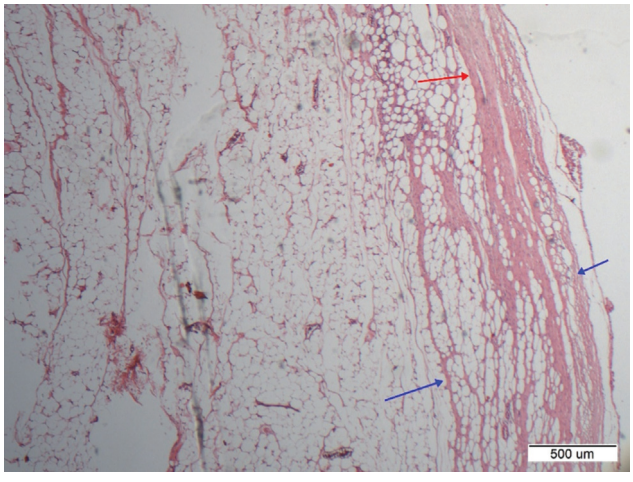

Fig. 3 Histological picture of a section of the mass. Mature adipocytes are present throughout. Note the infiltration of the fascial plane by well-differentiated adipocytes. The blue arrows indicate infiltrating fat, and the red arrow shows more intact adjacent fascia (haematoxylin and eosin stain ×40; Scale bar = 500 µm).

At re-examination 5 weeks after surgery lameness was absent and activity was being normalized with no adverse effect reported.

The owner was contacted via phone and email 1 year after surgery: no lameness was reported, and no recurrence of the mass was evident on visual inspection and on palpation by the owner. The posture of the left manus was reported as being normal.

Discussion

In people, benign lipomas are classified in subtypes according to location, clinical features and microscopic characteristics.[22] The classification includes deep-located lipomas, which are divided in intermuscular (or simple lipomas) and intramuscular (or infiltrative lipomas).[22] These two subcategories need to be differentiated between each other and between the lipoma-like well-differentiated liposarcoma, as they exhibit different biological behaviour and recurrence rate with intramuscular lipomas displaying infiltrative growth and a recurrence rate up to 62.5%.[22] A classification of lipomas has not been clearly defined in veterinary literature. Intermuscular lipomas are thought to originate from the intermuscular septum, with subsequent development of the adipose tissue between adjacent muscle bundles.[21] They are preferentially located in the caudal thigh, with 75 to 80% of cases reported between the semitendinosus and the semimembranosus muscles.[3,18,21,24] Other displaced muscles include the bicep femoris, adductor and gracilis muscle.[24] Cases are also reported between the thoracic limb muscles, with equal distribution between the shoulder muscles and the pectoral muscles.[18,21] More rarely, they can localize between the abdominal wall muscles.[9,10] One report describes three dogs with an intermuscular lipoma compressing the sciatic nerve.[7] Other cases with spinal cord compression are reported, but the mass is described as an infiltrative lipoma instead.[2,11–14] Infiltrative lipomas represent a separate entity from benign lipomas: although they preserve the normal morphology of adipocytes and very rarely metastasize, their behaviour is more locally aggressive, showing a higher recurrence rate (36–50%) compared with benign lipomas (2%).[19] In one study, recurrence after surgical resection was approximately 6 months.[3] Infiltrative lipomas are more common in older female dogs, although one study reported a 1:1 ratio between males and females.[19] Despite they can develop in any breed, a higher incidence has been reported in Labrador Retrievers, Doberman Pinschers and cross-breed dogs.[6] These tumours can invade adjacent tissues including muscles, connective tissue, bones, peripheral nerve and spinal cord.[8] Reports of infiltrative lipomas within the muscles of the thoracic limb are sparse in the literature.[19,23] Among all cases reported in the literature, only four described the presence of an infiltrative intramuscular lipoma in the antebrachium.[19,23] Fascial infiltration of the deep digital flexor tendon sheath has never been reported.

Differentiation between benign lipomas (including intermuscular lipomas) and infiltrative lipomas is usually made at the of surgery.[3,21]

Accurate diagnosis of infiltrative lipoma cannot be reached by cytology because cellular features are equivalent to a benign lipoma.[20] Moreover, even with a biopsy, it is not possible to distinguish an infiltrative lipoma if infiltration of adjacent tissues is not included in the sample.[19] Various imaging modalities have been used to describe and diagnose infiltrative lipomas including radiography, ultrasonography, CT and magnetic resonance imaging.[24,25] Radiography is not considered very useful for the diagnosis, as it does not allow to determine the full extent of local invasion.[19] Ultrasonography is very accessible, and it can be used as an adjunctive modality to look for visceral metastasis, but it does not provide a definitive diagnosis.[4,21] Advanced imaging is currently considered the best diagnostic tool to accurately assess the nature of the tumour, although inspection of the mass at surgery may also yield this information.[5,19,21] According to a human study, magnetic resonance imaging is considered superior to CT for delineating the tumour extension, whereas CT allows better differentiation.[22] A more recent study also reports that CT allowed differentiation between intermuscular lipoma and diffuse infiltrative lipoma.[24] Despite the use of advanced diagnostic imaging, it was very challenging to plan the surgery and to give a prognosis to the owner regarding long term use of the limb in this case. Although considered 'benign' neoplasms, the high recurrence rate of infiltrative lipomas (36–50%) and the difficulty in removing all the infiltrated tissue can lead to limb amputation and even euthanasia in some cases.[2,19,20,23,26]

Surgical excision is the therapy of choice for infiltrative lipomas, although other treatments have been reported, including intra-lesional 10% calcium chloride injection, minimally invasive liposuction, irradiation and intra-lesional steroid injection.[4]

Intra-lesional 10% calcium chloride injection is not recommended anymore as it can cause skin irritation and necrosis.[4] Liposuction represents an effective way to remove small, well-defined lipomas but the absence of discrete lobules and the tendency to interdigitate muscle fibres makes it not suitable to treat infiltrative lipomas.[27] Furthermore, lipomas bigger than 15 cm have a higher risk of developing seroma and the reported recurrence is high (28%).[27] In one study, radiation therapy alone or in combination with surgery was beneficial for 12 out of 13 dogs, but numbers were too small in this report.[26] Single studies reported the use of subcutaneous deoxycholate injections and the use of a subdermal 1064-nm Nd: YAG laser, but large-based studies are needed to validate these techniques.[4] Intra-lesional steroids injection has been reported to be effective against small lipomas, but only one infiltrative lipoma was treated in this study; following an initial reduction in size of 70%, the mass recurred and it was definitely treated only with surgical excision.[4]

In this case report, the muscular tissue on the palmaromedial aspect of the antebrachium had almost completely been replaced by adipose tissue. Furthermore, the mass was displacing the tendons of the deep and superficial digital flexor muscles, but it was also infiltrating the terminating deep digital flexor tendon sheath. Displacement of the tendons resulted in hyper-flexion of the digits. During weight bearing, and when attempting to manipulate the digits attempt to elongate the muscle tendon unit increased tension, which resulted in discomfort.

Local excision of the mass was the treatment of choice and allowed limb salvage in this case. Restoration of normal digit posture was achieved following mass removal.

The median nerve was not identified in close proximity to the mass during surgery. Despite the possibility of compression of this nerve due to the location of the mass, as previously reported,[18] our dog did not show pain on direct palpation of the mass or on carpal manipulation, and the range of motion was not restricted. It is not entirely clear to what extent the degenerative changes of MCPJ of digit V were related to the infiltrative lipoma and why this was the only joint affected. It might be speculated that the degenerative changes were related to the abnormal position of the phalanges; however, it is more likely they were an unrelated but concomitant problem.

Conclusion

This report describes the case of an infiltrative intramuscular lipoma located in the antebrachium and locally invading muscle fibres and fascia. The mass generates a 'tension-effect' on the deep and superficial digital flexor muscles resulting in hyper-flexion of the digits and discomfort. The mass was surgically resected, and restoration of normal digit posture allowed resolution of clinical signs. No recurrence was clinically evident at 1 year follow-up.

Authors' Contribution

All authors contributed to the conception of study, study design and data collection. A.F., S.C., and S.J.B. reviewed and interpret the images. All authors drafted, revised and approved the submitted manuscript.

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Conflict of Interest

None declared.

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