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What Is Your Diagnosis?

In collaboration with the American College of Veterinary Radiology

History

An 11-year-old 27-kg castrated male Bull Terrier was evaluated because of left thoracic limb lameness of a few weeks' duration. The dog was resident in the UK with no history of trauma or foreign travel. The dog had previously been diagnosed with allergic skin disease but was not receiving any treatment for this at the time of examination.

On physical examination, the dog had vital signs within reference limits. On gait examination, a moderate left thoracic limb lameness was observed. Signs of pain were elicited on palpation of the left humerus. No abnormalities were detected on routine hematologic and serum biochemical analysis. The dog was sedated, and radiographic images of the thoracic limbs were obtained **(Figure 1)**.

Formulate differential diagnoses, then continue reading.

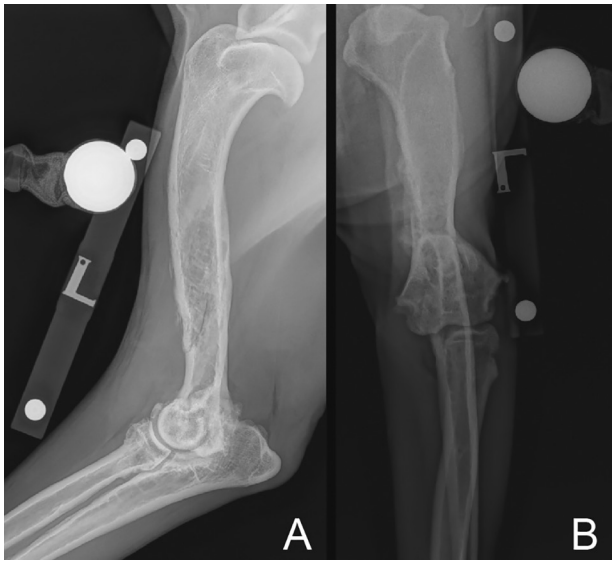

Figure 1—Lateral (A) and craniocaudal (B) radiographic images of the left forelimb of an 11-year-old castrated male Bull Terrier evaluated because of left thoracic limb lameness of a few weeks' duration.

Diagnostic Imaging Findings and Interpretation

A focal area of bone lysis with cortical thinning was identified at the level of the mid-diaphyseal region of the left humerus **(Figure 2)**. The lytic region of bone was bordered by a lamellated to active-appearing periosteal reaction. An incomplete, nondisplaced, oblique fissure of the cranial cortex of the distal humeral diaphysis was also noted. The dog also had subtrochlear sclerosis with osteophytes evident at the level of the left radial head and ulnar anconeal process. The changes were indicative of degenerative joint disease of the left elbow joint. New bone formation was also present on the medial and lateral humeral epicondyles, suggestive of chronic enthesopathies. The radiographic changes in the region of the mid-diaphysis of the left humerus were suggestive of a destructive, mildly proliferative monostotic process, with the fissure fracture likely pathological in etiology. Based on radiographic findings, diagnosis of a neoplastic process was prioritized, with a septic process less likely. Tumor type included both primary and metastatic bone tumors. Given that the lesion location was atypical for osteosarcoma, carcinoma metastasis or hemolymphatic origin neoplasia was considered more likely.

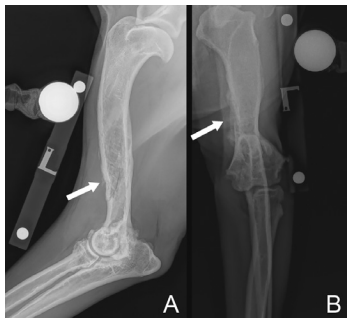

Figure 2—Same images as in Figure 1. There is mild to moderate periosteal proliferation circumferentially on the mid-diaphysis region of the left humerus, the most active portion medially, with local cortical destruction (arrow; B). An incomplete, nondisplaced curvilinear fissure fracture of the distal aspect of the humeral diaphysis is evident extending proximally into a localized region of permeative osteolysis.

The dog underwent CT of the left thoracic limb, thorax, and abdomen. Findings on CT for the affected limb **(Figure 3)** confirmed the focal region of medullary permeative osteolysis with nondisplaced fracture, the medial cortical lysis, and the variable

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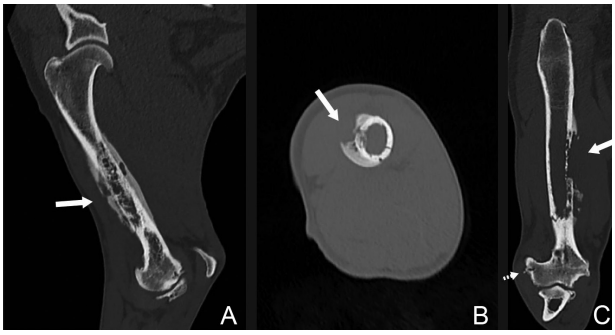

Figure 3—Sagittal (A), transverse (B), and craniocaudal (C) CT images obtained at the level of the mid-diaphyseal region of the left humerus of the dog described in Figure 1. Osteoproliferative and lytic changes with cortical destruction (solid arrows) are evident. The incomplete pathological fracture is not well profiled on these selected CT slices. Humeral epicondyle enthesophytes (dotted arrow) are partially evident.

periosteal proliferation of the humeral diaphysis seen radiographically. There was mild soft tissue swelling at the level of the lesion.

Thoracic CT revealed a cranioventral mediastinal mass (not shown). The lesion was in the anatomic location of the thymus and sternal lymph nodes. Differential diagnoses included thymoma, lymphoma, and thymic lymphoma. Spondylosis of the thoracolumbar vertebrae was noted as an incidental finding. No clinically important abnormalities were detected on abdominal imaging.

Treatment and Outcome

Fine-needle aspiration of the distomedial diaphyseal region of the left humerus was performed, and cytologic smears were prepared and submitted to an external laboratory for cytologic analysis. Moderate numbers of well-differentiated plasmacytoid osteoblasts and large multinucleate osteoclasts with occasional clumps of eosinophilic extracellular matrix were identified. The findings were suggestive of a remodeling process; however, a small population of round cells 1.5 to 2 erythrocytes in diameter was also noted, prompting further investigation. A PCR assay for antigen receptor rearrangement performed on the smear samples revealed a T-cell clonal population. On the basis of cytologic findings and PCR assay, a diagnosis of osseous lymphoma was made.

Surgical stabilization of the fracture was performed with a 3.5-mm contoured, locking compression plate applied to the craniolateral aspect of the humerus. L-asparaginase (400 IU/kg, IM) was administered once the dog recovered from anesthesia, and zoledronic acid (0.25 mg/kg, IV) was administered the following day. The dog was further treated with prednisolone (2 mg/kg, PO, q 24 h for 2 weeks and then 1 mg/kg, PO, q 24 h for 2 weeks), omeprazole (1 mg/kg, PO, q 24 h), and amoxicillin–clavulanic acid (22 mg/kg, PO, q 12 h). Three weeks after surgery, systemic chemotherapy with a standard protocol[1] including cyclophosphamide, doxorubicin hydrochloride, vincristine sulfate, and prednisone was initiated for treatment of lymphoma.

Radiography repeated 6 weeks after surgery revealed a moderate increase in the periosteal proliferation surrounding the humeral lesion (not shown). At that time, the dog showed no signs of discomfort on palpation of the left humerus and surgical site. The dog remained ambulatory on the limb with no substantial lameness. Chemotherapy was administered for 10 months, and the dog survived 1 year after diagnosis. The final cause of death was unknown because necropsy was declined.

Comments

Lymphoma primarily affecting bone is an uncommon diagnosis in dogs.[2] Primary bone neoplasms in dogs are typically osteosarcomas, chondrosarcomas, fibrosarcomas, or hemangiosarcomas. A radiographic pattern of osteolytic and osteoproliferative change may be associated with a neoplastic or infectious bone lesion.[2,3] Both primary bone tumors and osteomyelitis have a predilection for the metaphyseal region of long bones.[2] The lesion location for the dog of the present report was atypical for either of the aforementioned conditions, prompting the need for advanced imaging of the thorax and abdomen.

Osseous involvement of lymphoma, whereby neoplastic cells infiltrate and replace bone marrow, is typically associated with the multicentric form of the disease.[2] Destruction of cortical bone or clinical signs related to osseous pathology is rarely reported. In the absence of a cytologic evaluation of the mediastinal mass, we could not confirm whether this was truly a lymphoma primarily affecting bone or the multicentric presentation. Metastasis from an intrathoracic carcinoma was less likely. On review of the literature, we found few descriptions of lymphoma primarily affecting bone.[2,4,5] Sites affected included long bones, vertebrae, and ribs with mono- and polyostotic lesions confirmed.[2,5] Pathological fractures were confirmed in at least 5 of the affected animal.[2]

Histologic interpretation of bone biopsy samples obtained from suspected bone tumors has typically been advised prior to surgical intervention.[3] Obtaining a preoperative diagnosis provides, in most instances, both the owner and veterinarian with vital information pertaining to therapeutic options and prognosis. Surgical biopsies, however, are not free from complication. Pathological fracture and local seeding of tumor cells are important complications associated with this technique and are a serious concern should a limb-sparing surgery be requested.[3] When cytologic examination of fine-needle aspirate samples of bone was compared with histologic examination of bone biopsy samples, it was found that both techniques were equally diagnostic.[3] Sampling technique, the number of samples submitted, and the choice of sampling sites are important factors in achieving a correct diagnosis. Fine needle aspiration was chosen in this instance over biopsy because the osseous lesion was predominantly lytic and hence the chances of obtaining a representative sample

of the lesion site, especially if approached medially, were considered high.

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