What Is Your Diagnosis?

Figure 1—Lateral (A) and dorsopalmar (B) radiographic views of the left forelimb of a 3.5-year-old castrated male Bernese Mountain Dog that was referred because of inappetence, weight loss, and periodic shifting forelimb lameness of 1 to 2 months’ duration.

History

A 3.5-year-old castrated male Bernese Mountain Dog was referred to the Colorado State University Veterinary Teaching Hospital for evaluation of inappetence, weight loss, and periodic shifting forelimb lameness of 1 to 2 months’ duration. The dog had a history of 2 occurrences of hematuria, which resolved with empirical antimicrobial treatment. The owner reported weight loss of 9.1 kg (20 lb) in the 2 months prior to evaluation.

Physical examination revealed mild bilateral forelimb lameness (grade 1/5), bilateral soft tissue swelling that was firm on palpation of the distal aspect of the forelimbs, and a body condition score of 4 on a scale from 1 to 9. The remainder of the physical examination findings were unremarkable.

Serum biochemical abnormalities included a high serum cholesterol concentration (398 mg/dL; reference range, 130 to 300 mg/dL). Urine specific gravity was 1.015. Urinalysis revealed a high WBC count (20 to 50 WBCs/hpf; reference value, 0 WBCs/hpf) and RBC count (200 to 500 RBCs/hpf; reference value, 0 RBCs/hpf); the urine sample was obtained by cystocentesis. Radiographs of the distal aspect of the left forelimb had been obtained by the referring veterinarian (Figure 1).

Determine whether additional imaging studies are required, or make your diagnosis from Figure 1—then turn the page →

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Diagnostic Imaging Findings and Interpretation

In the left forelimb, a mild, generalized proliferative periosteal reaction can be seen along the cranial surface of the radius and the cranial and caudal surfaces of the ulna, centered in the mid and distal diaphyseal regions of these bones, and along the medial surface of the first and second digits and the lateral surface of the fifth digit (Figure 2). There is smooth periosteal proliferation along the diaphysis of only the long bones, particularly affecting the second and fifth metacarpal bones. The articular surfaces are smooth with no evidence of bony proliferation. This is consistent with a diagnosis of hypertrophic osteopathy; however, hepatozoonosis and remodeling caused by fungal osteomyelitis should be considered, dependent on geographic location. The soft tissue structures surrounding the carpus are mildly swollen. The remaining osseous and soft tissue structures are normal.

Thoracic radiography revealed that the cardiovascular structures, pulmonary parenchyma, mediastinal structures, pleural space, and all organs within the cranial aspect of the abdomen appeared normal. Smooth periosteal reaction of the caudal aspect of the humerus could be appreciated on the lateral thoracic radiograph.

Abdominal ultrasonography was performed with the dog positioned in dorsal recumbency. A 5.0 X 3.7 X 4.7-cm mass of mixed echogenicity with areas of internal hypoechogenicity was found arising from the ventrocranial surface of the right kidney (Figure 3) just caudal to the caudate lobe of the liver. On the basis of color Doppler ultrasonography, the mass was determined to be mildly vascularized. The right adrenal gland was well defined and was not involved in the disease process. Differential diagnoses for the mass included a primary renal adenocarcinoma, transitional cell carcinoma, hemangiosarcoma, granuloma, or metastasis from a primary neoplastic lesion elsewhere.

Treatment and Outcome

The day following imaging, the dog was anesthetized and placed in dorsal recumbency; a right nephrectomy was performed through a ventral midline
incision, along with concurrent biopsy of the adjacent mesenteric lymph node. Histologic evaluation of the mass did not reveal extension of the tumor beyond the confines of the renal capsule. Histologic evaluation of the mesenteric lymph node revealed marked sinus histocytosis but no evidence of metastatic spread. The dog received a patch for transdermal administration of fentanyl and was discharged from the hospital the afternoon following nephrectomy. Two weeks after surgery, at a follow-up consultation for suture removal, general physical examination findings were unremarkable and the owner reported the dog had been doing well.

**Comments**

Hypertrophic osteopathy is a secondary pathological process, or paraneoplastic syndrome, characterized by periosteal proliferation along the diaphysis of the long bones in response to neoplastic and nonneoplastic lesions. It is generally associated with an intrathoracic disease process or primary pulmonary disease. It has also been associated with diseases affecting intra-abdominal organs such as the urinary bladder, liver, kidney, ovarian tissue, and pancreas and with cardiac disease without thoracic metastasis.

Primary renal tumors are rare in dogs, accounting for only 0.6% to 1.7% of all reported neoplasms. Clinical signs in dogs with renal tumors are often nonspecific and may include anorexia, lethargy, and weight loss. Signs of pain as a result of skeletal metastasis or hypertrophic osteopathy are uncommonly observed. Hematuria may also be a nonspecific finding associated with renal tumors, as was observed in the case described in the present report.

The etiology of hypertrophic osteopathy is currently unknown and is believed to be multifactorial. The most widely accepted theory is that the periosteal reaction is due in part to increased blood flow to the distal part of the limbs because of a neural reflex and also to peripheral appendicular vasodilation caused by the primary disease process. However, other proposed theories include abnormal shunting of blood, overproduction of humoral factors such as estrogen and parathyroid hormone, and growth-promoting factors such as vascular endothelial growth factor.

Primary treatment for hypertrophic osteopathy involves removal of the inciting tumor or cause where possible. Reports document resolution of hypertrophic osteopathy in most dogs following primary tumor removal. In dogs with renal adenocarcinoma, the prognosis is poor when the tumor is metastatic, bilateral, or locally invasive, thus affecting other intra-abdominal structures at the time of diagnosis. In the dog of the present report, the carcinoma was unilateral and solitary, and no evidence of metastatic spread was evident on histologic evaluation of local lymph nodes, abdominal ultrasonography, and thoracic radiography. Imaging modalities used in this case allowed accurate staging and detection of possible metastasis. Abdominal imaging assisted greatly in surgical planning and assessment of tumor invasiveness prior to abdominal exploration. Following complete right nephrectomy, this dog was clinically normal with improved quality of life at the time of recheck examination 2 weeks after surgery. The resultant hypertrophic osteopathy affecting the distal aspects of the limbs was expected to resolve with time, as has been previously demonstrated.