

# What Is Your Diagnosis?

In cooperation with



Figure 1—Lateromedial (A) and dorsopalmar (B) radiographic views of the left carpus and distal aspects of the radius and ulna of an 8-year-old spayed female German Shepherd Dog mix with a 2-month history of left carpal swelling.

## History

An 8-year-old spayed female German Shepherd Dog mix was evaluated because of a 2-month history of swelling of the left carpus without lameness. Initial physical examination revealed a nonpainful firm mass on the dorso-medial aspect of the left carpus. A CBC revealed a stress leukogram, and serum biochemical analysis revealed mild abnormalities, including hypercalcemia (11.5 mg/dL; reference range, 8.8 to 11.0 mg/dL) and hypophosphatemia (2.4 mg/dL; reference range, 3.0 to 6.0 mg/dL). Radiographs of the left carpus were obtained (Figure 1).

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

This report was submitted by Suzanne M. Sutton, DVM, and Amy F. Sato, DVM, DACVR; from the Department of Clinical Sciences, Foster Hospital for Small Animals, Cummings School of Veterinary Medicine, Tufts University, North Grafton, MA 01536. Dr. Sutton's present address is Santa Monica Pet Medical Center, 1534 14th St, Santa Monica, CA 90404. Address correspondence to Dr. Sutton (ssuttondvm@gmail.com).



Figure 2—Same radiographic images as in Figure 1. Notice the irregular periosteal new bone formation at the distal aspect of the left radius (closed arrowhead) and multifocal intramedullary mineral opacities within the bones (open arrowhead).

### Radiographic Findings and Interpretation

There are well-defined, irregular mineral opacities seen diffusely within the medullary cavities of all bones (Figure 2). Ill-defined, spiculated periosteal new bone formation is evident at the cranial and medial aspects of the distal end of the left radius. This reaction extends approximately 6 mm into the surrounding soft tissues. Minimal soft tissue swelling is noted at the distal aspects of the radius and ulna. These findings are consistent with polyostotic medullary infarcts with an aggressive lesion of the distal aspect of the left radius.

Differential diagnoses included neoplasia (infarct-associated sarcoma, primary bone tumor, lymphoma, or metastatic neoplasia) or bacterial or fungal osteomyelitis. Biopsy of the radius yielded a nondiagnostic sample of reactive new bone. No abnormalities were found on 3-view thoracic radiographs. Further diagnostic testing was not pursued.

The dog was evaluated again 9 months later because of increased swelling of the left forelimb with lameness. Recheck radiography revealed a markedly aggressive lesion in the distal aspect of the left radius compatible with a primary bone tumor (Figure 3). Polyostotic infarcts were again noted. No evidence of pulmonary metastatic disease was found on thoracic radiography at this time.

### Comments

The dog underwent limb amputation and chemotherapy. The histopathologic diagnosis was osteosar-



Figure 3—Lateromedial and dorso-palmar radiographic views of the left carpus of the same dog as in Figure 1 obtained 9 months after initial evaluation. Notice the aggressive periosteal reaction and moderate soft tissue swelling (closed arrowhead) and multifocal intramedullary mineral opacities (open arrowhead). A sandbag artifact is present (asterisk).

coma with extensive areas of hemorrhage, necrosis, and infarction. Additional infarcts were found throughout the metacarpal bones. Two months later, the dog was evaluated because of right hind limb lameness. Radiographs of the right tarsus were obtained, and multifocal infarcts of the tibia, fibula, tarsus, and metatarsal bones as well as an aggressive lesion of the distal aspect of the right tibia were present. The tibial lesion was presumed to be either a metastatic lesion or an additional primary tumor. Further treatment was declined, and the dog was euthanized at 12 months after initial evaluation. A necropsy was not performed.

Bone infarction is rare in dogs and is usually reported in association with sarcoma formation.<sup>1,2</sup> Radiographically, bone infarcts appear as multiple, discrete, irregularly demarcated areas of increased radiopacity in the medullary cavities and are due to new bone proliferation on necrotic medullary trabeculae.<sup>1-3</sup> In dogs with bone infarct-associated sarcoma, these lesions are commonly multiple and bilateral and are usually found in the distal aspects of the limbs.<sup>1,3,4</sup> The underlying cause of bone infarction is often not determined, although the cause in 1 dog with bone infarct-associated sarcoma was total hip arthroplasty.<sup>1</sup> In 2 dogs,<sup>1,2</sup> bilateral long bone infarctions were diagnosed 2 and 4 years prior to the development of osteosarcoma. On histologic and radiographic analysis, bone infarcts are noted to be intimately associated with and only partially destroyed by the sarcoma, which also suggests that infarcts may precede the sarcomas.<sup>1,2,4,5</sup> Osteosarcoma is the most commonly reported infarct-associated sarcoma in dogs.<sup>1-3</sup>

Infarct-associated osteosarcoma in dogs is similar to primary osteosarcoma in terms of radiographic appearance, characterized by poorly demarcated osteoprolif-

erative and osteolytic lesions with cortical destruction, periosteal elevation, aggressive periosteal reaction with a wide zone of transition, and adjacent soft tissue swelling.<sup>2,3</sup> Locations reported are also similar to primary osteosarcoma, with the tibia, distal aspect of the femur, and distal aspect of the radius most often involved.<sup>2,3</sup> In contrast to these similarities, 1 study<sup>3</sup> found the mean age of dogs affected with bone infarct-associated sarcoma to be 2 years older than those with primary osteosarcoma. This may be the result of the time interval required between infarction and sarcoma development.

1. Marcellin-Little DJ, DeYoung DJ, Thrall DE, et al. Osteosarcoma at the site of bone infarction associated with total hip arthroplasty in a dog. *Vet Surg* 1999;28:54–60.
2. Prior C, Watrous BJ, Penfold D. Radial diaphyseal osteosarcoma with associated bone infarction in a dog. *J Am Anim Hosp Assoc* 1986;22:43–48.
3. Dubelzig RR, Biery DN, Brodey RS. Bone sarcomas associated with multifocal medullary bone infarction in dogs. *J Am Vet Med Assoc* 1981;179:64–68.
4. Heater K, Collins PA. Osteosarcoma in association with infarction of bone. *J Bone Joint Surg Am* 1987;69:300–302.
5. Desai P, Perino G, Present D, et al. Sarcoma in association with bone infarcts. *Arch Pathol Lab Med* 1996;120:482–489.