



What Is Your Diagnosis?

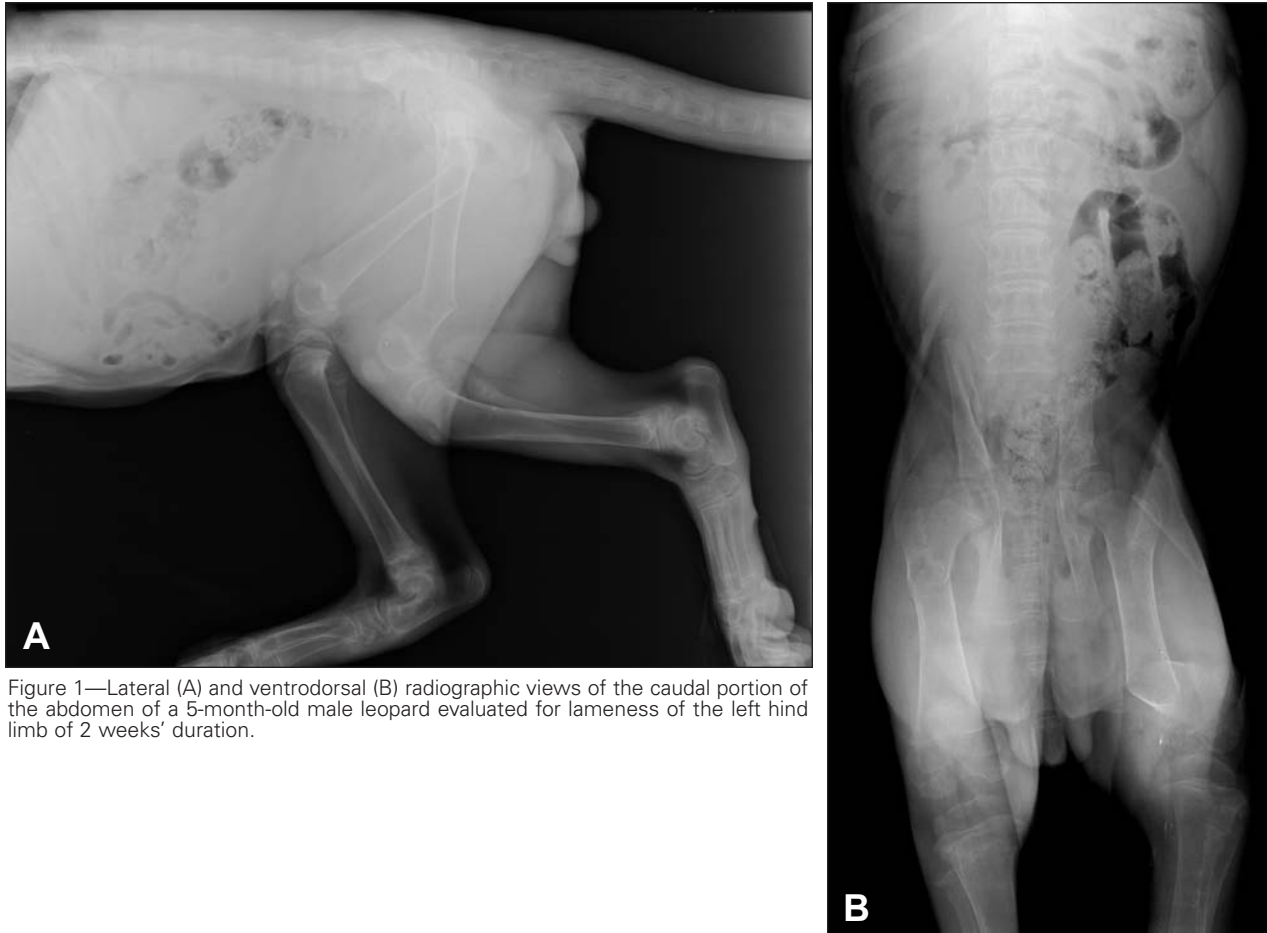


Figure 1—Lateral (A) and ventrodorsal (B) radiographic views of the caudal portion of the abdomen of a 5-month-old male leopard evaluated for lameness of the left hind limb of 2 weeks' duration.

History

A 5-month-old male leopard (*Panthera pardus*) was evaluated for lameness of the left hind limb of 2 weeks' duration. A hairline fracture of the left radius was diagnosed by the referring veterinarian. The leopard had been treated with aspirin and cage rest; however, the lameness had not improved. The leopard was being fed an all-meat diet.

On physical examination, the leopard was unable to stand and palpation of the left hind limb elicited signs of pain. A high phosphorus concentration (9.4 mg/dL; reference range, 5.1 to 8.3 mg/dL) was the only abnormality detected on serum biochemical analyses; concentrations of BUN (23 mg/dL; reference range, 20 to 49 mg/dL), creatinine (0.5 mg/dL; reference range, 0.5 to 3.3 mg/dL), and calcium (10.8 mg/dL; reference range, 8.5 to 12.3 mg/dL) were within reference ranges.¹ The parathyroid hormone concentration was also high (9.4 pmol/L; reference range, 0.1 to 6.4 pmol/L).¹ Radiographs of the caudal portion of the abdomen were obtained during general anesthesia (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 Kristina Feigin, DVM; Joerg Mayer, DVM; and Mauricio Solano, DVM, DACVR; from the Department of Clinical Sciences, Cummings School of Veterinary Medicine, Tufts University, North Grafton, MA 01536. Dr. Feigin's present address is Winchester Veterinary Group, 95 Cross St, Winchester, MA 01890. Address correspondence to Dr. Feigin.

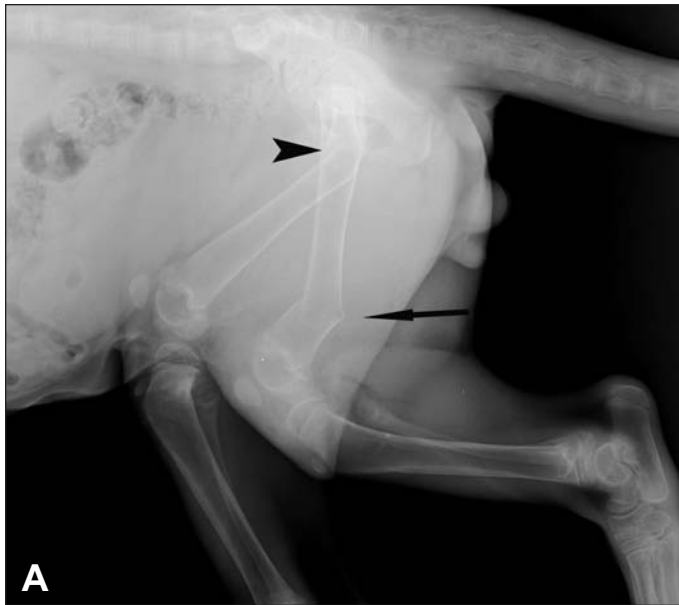


Figure 2—Same radiographic views as in Figure 1 (enlarged). Notice a diffuse decrease in bone opacity throughout the skeleton and generalized thinning of the cortices of most of the long bones. On the lateral radiographic view, notice pathologic fractures of the distal end of the left femur (arrow) and proximal portion of the right femur (arrowhead). On the ventrodorsal radiographic view, a nondisplaced fracture of the body of the left ileum (black arrowhead) is also evident.

Radiographic Findings and Interpretation

A pathologic fracture of the left ileum and pathologic folding fractures of both femurs secondary to severe, generalized osteopenia can be seen (Figure 2). Differential diagnoses included nutritional or renal secondary hyperparathyroidism and osteogenesis imperfecta.

Comments

Disorders commonly associated with diffuse osteopenia include secondary hyperparathyroidism (nutritional imbalance and renal failure), glucocorticoid excess, vitamin D deficiency, osteogenesis imperfecta, and feline mucopolysaccharidosis.² In the leopard of this report, nutritional secondary hyperparathyroidism (NSHP) was diagnosed on the basis of signalment, history, physical examination, and radiographic findings. Renal secondary hyperparathyroidism was excluded because concentrations of serum creatinine and BUN were within reference ranges.

Before the general availability of balanced commercial pet foods, NSHP was commonly encountered.^{2,3} Although diseases caused by dietary deficiencies have become rare, NSHP should be considered in growing animals with spontaneous fractures.^{4,5} Nutritional hyperparathyroidism is caused by a dietary imbalance of calcium and phosphorus. The erroneous belief that carnivorous exotic animals require all-meat diets makes NSHP a common disease in exotic animals kept as pets.^{4,5} Reptiles, birds, and humans and other mammals are also affected by NSHP.^{3,6}

A 2:1 calcium-to-phosphorus ratio is required for normal skeletal development. Typical all-meat diets contain calcium-to-phosphorus ratios between 1:10 and 1:50.^{4,5} Calcium deficiency causes hypocalcemia and triggers an increase in the concentration of parathyroid hormone. Serum calcium is then maintained at the expense of bone demineralization, resulting in increased fragility and pathologic fractures.

A 30% to 50% loss in bone mass is required before osteopenia is radiographically evident. Radiographic findings of osteopenia include decreased bone opacity, thin cortices, and coarse pathologic fractures. Osseous lesions in animals with NSHP are often reversible by correction of dietary calcium and phosphorus concentrations. Feeding a balanced diet with supplemental minerals and multivitamins, phosphorus binding drugs, UVB light exposure, and cage confinement are recommended. Treatment with calcitonin, which inhibits bone resorption and aids calcium deposition, may be beneficial. Prior to treatment with calcitonin, the dietary calcium-phosphorus imbalance must be corrected.

The leopard of this report improved considerably after dietary correction. Three months after the initial evaluation, the leopard was able to walk and jump normally. Radiography revealed substantially increased bone opacity and strong callus formation at prior fracture sites.

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3. Miller RM. Nutritional secondary hyperparathyroidism. *Vet Med Small Anim Clin* 1969;64:400–408.

4. Won DS, Park C, In YJ, et al. A case of nutritional secondary hyperparathyroidism in a Siberian tiger cub. *J Vet Med Sci* 2004;66:551–553.

5. Herz V, Kirberger RM. Nutritional secondary hyperparathyroidism in a white lion cub (*Panthera leo*), with concomitant radiographic double cortical line. *J S Afr Vet Assoc* 2004;75:49–53.

6. Deplas A, Debais F, Alcalay M, et al. Bone density, parathyroid hormone, calcium and vitamin D nutritional status of institutionalized elderly subjects. *J Nutr Health Aging* 2004;8:400–404.