Title: Mandibular chondroblastic osteosarcoma in a dog

Contributors: Tamires Goneli Wichert Teodoro,1,2 DVM; Tatiane Terumi Negrão Watanabe,2 DVM, MS, PhD; Katherine Barnes,3 BA, DVM, MS; David Cradic,3 DMV; Fabio Del Piero,2 DVM, PhD, DACVP. 1Universidade Federal de Lavras (UFLA), Lavras, MG, Brazil; 2 Louisiana State University School of Veterinary Medicine, Department of Pathobiological Sciences and Louisiana Animal Disease Diagnostic Laboratory, Baton Rouge, LA 70803; 3 Louisiana State University School of Veterinary Medicine, Department of Veterinary Clinical Sciences, Baton Rouge, LA 70803.

Morphologic diagnosis: Mandible, left: Chondroblastic Osteosarcoma

Typical gross findings: The gross appearance of osteosarcomas varies depending on the behavior of the tumor cells.2 Tumors are characterized by variable degrees of bone lysis, bone formation, and production of neoplastic bone.6 Pathological fractures accompany erosion of the cortical bone, and osteolytic tumors may invade the adjacent tissue.2 Chondroblastic osteosarcomas usually produce enough pale white, glistening chondroid matrix to be grossly recognized.6

Typical microscopic findings: The oral submucosa is expanded by a non-encapsulated, densely cellular, multilobulated neoplasm of bundles of spindle cells with interspersed osteochondrous cores supported by scant fibrovascular stroma (Fig. 1). The fusiform neoplastic cells have indistinct cell borders, scant to moderate homogenous to vacuolated eosinophilic cytoplasm, and oval to elongated nuclei with coarsely stippled to vesicular chromatin often containing multiple nucleoli. Anisokaryosis and anisocytosis are marked; mitotic figures are frequent (32/10 hpf). In some areas, neoplastic cells are surrounded by eosinophilic homogenous material (osteoid) with occasional mineralization. Islands of cartilage with variably sized chondrocytes are often present (Fig. 2+3). There are also multifocal to coalescing extensive areas of necrosis and hemorrhage with scattered hemosiderin-laden macrophages. The overlying mucosa has multifocal superficial intracytoplasmic vacuolization/edema with rare apoptosis. No vascular invasion is observed.
Figure 1. Subgross micrograph, H&E.

Figure 2. 5x, H&E.
**Discussion:** Osteosarcoma is a malignant proliferation of osteoblasts producing osteoid or immature bone.²,⁶ It is considered the most common primary bone neoplasm in dogs (85%)⁶,⁷ and cats (70%).⁷ This tumor is prone to form metastases, in particular in the lungs, which often develop already during the first few months after the diagnosis of the neoplasm.¹ Large and giant canine breeds are predisposed, including Saint Bernard, Irish Wolfhound, Great Dane, Irish Setter, Rottweiler, German Shepherd, Doberman Pinscher, Boxer, and Golden Retriever.⁶,⁸ Middle-aged to older dogs (around 7 years of age) are most commonly affected.⁶ The appendicular skeleton is more likely to be affected than the axial skeleton.²,⁶ Most osteosarcomas involve the distal radius, proximal humerus, and distal tibia and femur, followed closely by the proximal femur and tibia, leading to the rule of thumb that these tumors tend to occur away from the elbow and towards the knee. Osteosarcomas of the appendicular skeleton tend to occur more often in male dogs⁶ while females have a higher incidence of axial osteosarcoma.¹,⁴

The macroscopic findings of osteosarcomas vary.² Some forms are predominantly lytic, some are productive, and others are comprised of both destructive and proliferative elements.²,⁶ The histopathological features of osteosarcomas also vary, with the production of osteoid or bone by malignant osteoblasts representing the main feature of this malignant tumor.²,⁶ Malignant osteoblasts can be spindloid or plump, oval or round, with abundant basophilic cytoplasm and eccentric hyperchromatic nuclei. Mitotic figures are frequently atypical.²,⁶ In addition, there are often areas of hemorrhage and necrosis.⁶
Osteosarcomas are classified into subtypes depending on the quality and quantity of the produced extracellular matrix. The three most common histological types are the osteoblastic, chondroblastic, and fibroblastic variants. The chondroblastic osteosarcoma, diagnosed in this case, is characterized by osteoid deposits intermixed with areas of chondroid matrix. Small neoplastic biopsy samples of this osteosarcoma variant can lead to an incorrect diagnosis of chondrosarcoma.

The prognosis for osteosarcomas is somewhat variable and depends on multiple factors (age, breed, tumor localization, existence of metastases, and tumor subtype). Animals that are treated with surgery and chemotherapy have a lifespan of approximately one additional year. Patients that are less than 7 years of age and have a large tumor at the proximal humerus have a poorer prognosis. Dogs between 7 and 10 years of age have a longer survival rate than younger or older dogs. The median survival time for dogs with appendicular skeletal osteosarcomas is between 14 to 19 weeks while for dogs with osteosarcomas in the mandible and maxilla it is 22 weeks. Thus, in general, prognosis for osteosarcomas is poor. Attempts to follow up for this case were unsuccessful.

References:

*The Diagnostic Exercises are an initiative of the Latin Comparative Pathology Group (LCPG), the Latin American subdivision of The Davis-Thompson Foundation. These exercises are contributed by members and non-members from any country of residence. Consider submitting an exercise! A final document containing this material with answers and a brief discussion will be posted on the CL Davis website (http://www.cldavis.org/diagnostic_exercises.html).

**Associate Editor for this Diagnostic Exercise:** Ingeborg Langohr  
**Editor-in-chief:** Vinicius Carreira