History

A 9-year-old spayed female Golden Retriever developed a mass on the right mandible. At the time that the owner noticed the mass, it was not associated with signs of pain, and the dog was eating and drinking without difficulty. Although the mass did not change considerably over the next 4 months, the dog was examined by a veterinarian and 2 needle biopsy specimens were obtained for histologic evaluation. The histopathologic diagnosis was inconclusive. The dog was then referred to the University of Minnesota Veterinary Medical Center to undergo computed tomography of the head and for possible excision of the mass.

Clinical and Gross Findings

The referring veterinarian detected a firm mass (approx 2.5 cm in diameter) near the angle of the right mandible. Radiography (performed by the referring veterinarian) revealed an expansive mass in the right mandible with a large soft tissue component; cortical osteolysis extended from near the beginning of the body of the mandible to just caudal to the mandibular symphysis. The radiographic findings were confirmed via computed tomography. Results of a CBC and serum biochemical analyses were within reference limits. A right mandibulectomy was performed to remove the entire mass; the resected tissues were submitted for histologic examination. The dog’s condition was considered good on the night after surgery, although it was reluctant to eat. The following day, the dog was discharged from the hospital.

On gross examination of the excised tissues, the mass was hard and poorly demarcated (7.0 X 3.0 X 2.5 cm); it extended from the caudal aspect of the body of the right mandible rostrally toward the mandibular symphysis. On cut section, the mass was solid and white and it had infiltrated and replaced the mandibular alveolar and cortical bone (Figure 1).

Formulate differential diagnoses from the history, clinical findings, and Figure 1—then turn the page —
**Histopathologic Findings**

Histologic examination of sections of the excised tissues revealed a partially encapsulated, moderately cellular, well-demarcated, infiltrative mass of neoplastic cells that effaced much of the cortical and alveolar bone of the body of the right mandible (Figure 2). Tumor cells were arranged in irregular, interwoven fascicles and bundles with fine fibrovascular stroma and areas of abundant dense collagen. Typically, tumor cells were spindloid and had indistinct cell borders, scant amounts of eosinophilic, finely fibrillar cytoplasm, and ovoid nuclei with finely stippled chromatin and no to 3 basophilic nucleoli (Figure 3). There was minimal anisocytosis and anisokaryosis with occasional karyomegaly. The mitotic rate was < 1 mitotic figure/10 fields (400× magnification). Scattered throughout the mass, mainly along the margins, were numerous, small spicules of woven bone lined by angulated cells that resembled primitive osteoblasts. There were also spicules of woven bone lined by osteoblasts with osteocytes in the lacunae. Numerous small to large osteoclasts were along the margins of the bone spicules and within the surrounding tumor stroma. The neoplastic spindle cells appeared to be contiguous with the portions of the periodontal ligament remaining around the tooth. Segmentally, the periodontal ligament of the tooth was absent and the cementum layer was irregular (likely the result of multiple episodes of resorption). Small numbers of lymphocytes and plasma cells infiltrated the lamina propria of the gingiva around the tooth. At the level of the mandibular symphysis, neoplastic cells infiltrated the medullary cavity but did not extend into the cortical bone. The neoplastic cells also extended from the caudal end of the visible portion of the primary mandibular mass dorsally for a distance of 2 cm within the medullary cavity of the ramus. Because a mandibulectomy was performed, the neoplastic cells were completely within the excised bone and did not extend to the surgical margins.

**Morphologic Diagnosis**

Ossifying fibroma of the right mandible.

**Comments**

Ossifying fibromas of bones of the jaw appear to most commonly affect young horses, but there are some reports of affected dogs, cats, a greater kudu, an Anglo-Nubian goat, a sheep, a llama, and a miniature Rex rabbit. Ossifying fibromas in young horses typically develop at 2 months to 1 year of age.
age, leading to their classification as juvenile ossifying fibromas. In humans, juvenile ossifying fibromas are usually associated with individuals < 13 years old and have a more aggressive nature than similar tumors in adults. Reports of ossifying fibromas in dogs are limited; although most tumors develop in mandibles and maxillae, an ossifying fibroma of the os penis (which resulted in obstruction of the urethra and dysuria) in a dog has been described. One interesting feature of ossifying fibromas of the face and jaw bones is the reported lack of pain associated with these tumors; likewise, the tumor in the dog of this report was not associated with signs of pain.

Treatment for ossifying fibromas in humans and domestic animals typically involves surgical removal of the mass. When surgical debulking is performed, there is a high likelihood of local recurrence of the tumor, whereas wide surgical excision, such as partial or complete mandibulectomy, is generally curative. In the dog of this report, there was no radiographic evidence that the lesion extended to the mandibular symphysis or into the ramus of the right mandible, but on histologic examination of the excised tissues, neoplastic cells were present within the narrow spaces at those sites. This finding highlights both the highly locally invasive nature of this benign tumor and the need for excision with wide margins during removal of ossifying fibromas. If a complete mandibulectomy had not been performed in the dog of this report, neoplastic cells would have remained in situ, and subsequent local tumor recurrence would have been highly probable. Two years after the removal of the mandible, the referring veterinarian reported that dog was well and that the tumor had not recurred.

Gross and histologic differential diagnoses for ossifying fibromas in animals include fibrous dysplasia, osteomas, fibrous osteodystrophy, osteosarcomas, and multilobular tumor of bone. Ossifying fibromas and fibrous dysplasia are almost identical histologically except that the bony spicules in ossifying fibromas are lined with osteoblasts, a characteristic that is not associated with fibrous dysplasia. However, the radiographic appearance of these diseases differs considerably; an ossifying fibroma typically appears as a distinct mass, whereas fibrous dysplasia is poorly defined. Osteomas are also highly similar to ossifying fibromas histologically, although osteomas have more dense cancellous or compact bone, a smaller fibrous component, and possibly narrow spaces. Grossly, osteomas generally are distinct masses that extend from the surface of the bone without deep involvement of the underlying bone. Ossifying fibromas typically replace and expand the bone with a much more invasive nature. In animals with fibrous osteodystrophy, radiography generally reveals a widespread, bilaterally symmetric pattern of bone loss with poorly defined areas of rarefaction and infrequent cystic lesions that are not features of the solitary ossifying fibromas. Animals with fibrous osteodystrophy have a calcium-phosphorus imbalance that results in bony changes. In the dog of this report, no serum biochemical abnormalities were detected; on the basis of this finding, in combination with the localized nature of the mass, fibrous osteodystrophy was ruled out. Where- as ossifying fibromas almost always develop in bones of the face and jaw, osteosarcomas rarely do. Osteosarcomas also typically have more malignant histologic cellular features, including anisocytosis, anisokaryosis, and a high mitotic rate, as well as osteoid. Multilobular tumor of bone can develop in the mandibles of dogs but has a characteristic histologic appearance of numerous lobules containing various amounts of cartilage and osteoid and was ruled out by histopathologic findings for the dog of this report.

Although ossifying fibromas are rare in dogs, these tumors need to be considered when a dog develops an apparently nonpainful, infiltrative, destructive, radiographically well-demarcated mass in a bone of the jaw. Recognition of this disease by clinicians and pathologists is needed to ensure that proper treatment—wide excision with a curative intent—can be instituted.

References