Canine Extraskeletal Osteosarcoma and Chondrosarcoma: a Clinicopathologic Study of 14 Cases

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Abstract. Canine extraskeletal osteosarcomas are extremely rare tumors. Over a period of 25 years at the Animal Medical Center, approximately 1,000 cases of skeletal osteosarcomas have been diagnosed. During the same period 11 cases of extraskeletal osteosarcomas and three extraskeletal chondrosarcomas were diagnosed. Tumors of the mammary gland were excluded. Extraskeletal osteosarcomas were found in the adrenal gland, eye, gastric ligament, ileum, kidney, liver, spleen, testicle, and vagina. The chondrosarcomas were found in the mitral valves, lungs, and omentum. The mean age of the dogs with extraskeletal osteosarcoma was 11 years, and the mean age of the dogs with extraskeletal chondrosarcoma was 14 years. The sizes of the tumors ranged from 3 cubic centimeters to 8,315 cubic centimeters. Osteoblastic osteosarcomas were the most common histologic type (7/11, 63.6%); there was a single case of each of the following: fibroblastic, fibrous histiocytic, chondroblastic, and mixed osteo-chondroblastic osteosarcoma. Two of the dogs with chondrosarcomas had mesenchymal chondrosarcomas involving the lungs and omentum. The remaining dog had a regular chondrosarcoma involving the mitral valve. Distant metastases were present in seven of 11 dogs with extraskeletal osteosarcoma and in none of the dogs with chondrosarcoma. In contrast to human beings, in which most extraskeletal osteosarcomas occur in the soft tissues and the extremities, most canine extraskeletal osteosarcomas develop in the visceral organs.

Key words: Chondrosarcoma; dog; osteosarcoma extraskeletal.

Extraskeletal osteosarcomas are mesenchymal neoplasms of soft tissues and visceral organs that produce osteoid and have no involvement of bone or periosteal tissue. They are rare in the dog (Table 1).1,2,3,4,6,7,13,15,17,25,27,29,30 Fifteen cases mentioned by Jacobson15 were eliminated from this review because of inadequate clinical and histopathologic information. The remaining reports are of single cases, with two exceptions: one describes two tumors of the upper respiratory tract and the other six tumors of the lower respiratory tract.6 Extraskeletal chondrosarcomas are extremely rare; only one case in a dog was found in the literature.14

In dogs, mixed malignant neoplasms (carcinosarcomas) that produce osteoid and chondroid are fairly common among mammary gland tumors and rare among thyroid neoplasms, but most arise in conjunction with adenocarcinomas. These tumors were not included in this study because of their bimodal histologic content and their assumed origin from the stromal metaplasia of the associated adenocarcinomas. Extraskeletal osteosarcomas of the esophagus in association with parasite infection with Spirocerca lupi have been reported in dogs, and these also were excluded from this study.2,36

In animals other than dogs, extraskeletal osteosarcomas and chondrosarcomas are extremely rare. An osteosarcoma of the eye and extraskeletal chondrosarcoma of the extremities have been reported in cats.9,39 An extraskeletal osteosarcoma has been described in a guinea pig.11 Experimentally produced extraskeletal osteosarcomas have been reported in nonhuman primates.31

Extraskeletal osteosarcomas are also extremely rare in human beings.5,9,10,14,36 They compose approximately 1.2% of all soft tissue sarcomas and 3.7% to 4.6% of osteosarcomas.10,15,32 The extremities are the most common site (77% to 85%) for these neoplasms in human beings, but they have been reported in other tissues including the urinary bladder, intestines, liver, thymus, major blood vessels, testis, and retroperitoneum.10,15,20,22,24,32,33,37,40 These tumors are very malignant in human beings; 69% recur locally and 80% metastasize.10,15,32 A five-year survival rate is reported in 20% to 25% of patients.10,15,32 Extraskeletal osteosarcomas, also rare in human beings, have been described at various sites.15,33

It is now established in human beings that radiation therapy can cause osteosarcoma.10,32,38 Since the introduction of radiotherapy for the treatment of cancer in small animals, post-radiation osteosarcoma has also been reported in dogs.34,35

In this report we describe the clinicopathologic findings in 11 dogs with spontaneous extraskeletal osteo-
Canine Extraskeletal Osteosarcoma

Table 1. Summary of extraskeletal osteosarcoma reported in the dog.

<table>
<thead>
<tr>
<th>Site</th>
<th>Number of Cases</th>
<th>Sex</th>
<th>Age (year)</th>
<th>Number with Metastasis Detected</th>
<th>Mean Survival (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>7</td>
<td>M</td>
<td>8</td>
<td>3</td>
<td>117</td>
</tr>
<tr>
<td>Liver</td>
<td>3</td>
<td>F</td>
<td>11</td>
<td>3</td>
<td>35</td>
</tr>
<tr>
<td>Larynx</td>
<td>1</td>
<td>M</td>
<td>12</td>
<td>NA*</td>
<td>2</td>
</tr>
<tr>
<td>Trachea</td>
<td>1</td>
<td>F</td>
<td>7</td>
<td>NA*</td>
<td>14</td>
</tr>
<tr>
<td>Retroperitoneum</td>
<td>1</td>
<td>M</td>
<td>9</td>
<td>NA*</td>
<td>1</td>
</tr>
<tr>
<td>Muscle</td>
<td>3</td>
<td>F</td>
<td>8</td>
<td>1</td>
<td>55</td>
</tr>
<tr>
<td>Intestines</td>
<td>1</td>
<td>M</td>
<td>10</td>
<td>1</td>
<td>150</td>
</tr>
<tr>
<td>Soft tissue (subcutaneous, perianal)</td>
<td>2</td>
<td>M</td>
<td>13</td>
<td>2</td>
<td>176</td>
</tr>
<tr>
<td>Total number of tumors</td>
<td>19</td>
<td></td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Mean days of survival</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>82</td>
</tr>
</tbody>
</table>

* NA = not available.

Sarcoma and three dogs with extraskeletal chondrosarcoma. A discussion of the comparative aspects of extraskeletal osteosarcoma in human patients and domestic animals is included.

Materials and Methods

In the last 25 years, 11 cases of canine extraskeletal osteosarcoma and three cases of canine extraskeletal chondrosarcoma have been diagnosed at The Animal Medical Center. The diagnoses of these tumors were established by two criteria: 1) no clinical, radiologic, or pathologic evidence of bone involvement, and 2) histologic evidence of the production of osteoid or chondroid by the neoplastic cells.

Complete physical and radiologic examinations were done in all dogs to eliminate involvement of the skeletal system and metastasis of skeletal sarcomas to visceral organs. Complete necropsies were done in nine dogs (seven by the author). Tissue specimens from the tumor and all major organs including lungs and lymph nodes were submitted for histologic examination. In the remaining five dogs, necropsy was not done, but tissue specimens taken at surgery of the tumor and visceral organs including lymph nodes were examined by the author. All tissues for histologic examination were fixed in 10% neutral buffered formalin, embedded in paraffin, sectioned at 6 μm, and stained with hematoxylin and eosin, Masson’s trichrome, and von Gieson’s stains. Ten to 40 slides of each case were examined. For all dogs, survival times were calculated from the date of diagnosis to the date of death. Two cases had been reported previously.14,27

Neoplasms were classified and their malignancy determined according to the current classification system for skeletal and extraskeletal osteosarcomas and chondrosarcomas in human beings and dogs.12,15,23,26,32,32

Results

In dogs with primary extraskeletal osteosarcoma, the primary sites of involvement were the adrenal gland (one), eye (one), gastric ligament (one), ileum (one), kidney (one), liver (one), spleen (two), testicle (one) and vagina (two); in dogs with primary extraskeletal chondrosarcoma, the sites were the heart (one), lungs (one), and omentum (one).

The mean age of dogs with extraskeletal osteosarcoma was 11 years (range, 9 to 15 years), and dogs with extraskeletal chondrosarcoma were 11, 14, and 17 years old. The male to female ratio in dogs with osteosarcoma was 1:2.7 (three/eight); all dogs with chondrosarcoma were male. There was no breed prevalence in dogs with osteosarcomas, and two of the three dogs with chondrosarcomas were German Shepherd Dogs.

Clinical signs varied depending on the site of involvement (Table 2). The tumor was palpated on physical examination or seen on radiographs in all but one dog (No. 14). In dogs with tumors of the liver, spleen, omentum, and adrenal gland, opacity was obvious on radiographs, because of ossification and mineralization of the neoplasm. No other clinical signs were specific or diagnostic.

Grossly, both osteosarcomas and chondrosarcomas varied widely in size, ranging from 3 cubic centimeters to 8,315 cubic centimeters (27 cm × 22 cm × 14 cm). Tumors of the eye and testis completely replaced these organs. Neoplasms were generally gray-white and lobular with ossified and mineralized areas. The large tumors were characterized by areas of necrosis and cyst-like structures. Areas of severe edema and extensive hemorrhage also were also seen. Infiltration to surrounding tissue was common and extensive in all dogs except those with osteosarcoma of the kidney, one dog with osteosarcoma of the spleen, and the two dogs with chondrosarcoma of the lungs and heart. In the dog with osteosarcoma of the gastric ligament, the neoplasm extended to the gastric wall that resulted in a large ulcer.

Histopathologic findings

Osteosarcoma. Osteoblastic osteosarcoma was the most common histologic type (7/11, 63.6%). The sites
Table 2. Clinical and pathologic findings in 11 dogs with extraskeletal osteosarcomas and three dogs with extraskeletal chondrosarcoma.

<table>
<thead>
<tr>
<th>Dog Number</th>
<th>Site of Tumor</th>
<th>Clinical Findings</th>
<th>Gross Pathology</th>
<th>Histologic Classification</th>
<th>Site of Metastasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adrenal gland</td>
<td>Polydipsia/polyuria, panting, anxiety, calcified mass in renal area</td>
<td>16 × 15 × 11-cm firm cystic mass with areas of ossification</td>
<td>Fibroblastic</td>
<td>Diffuse local infiltration</td>
</tr>
<tr>
<td>2</td>
<td>Spleen</td>
<td>Acute onset of lethargy, diarrhea, large abdominal mass disclosed by palpation</td>
<td>Large mass at one end of spleen, nodules in omentum</td>
<td>Osteoblastic</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Eye</td>
<td>Chronic glaucoma, panophthalmitis, corneal opacity</td>
<td>Right eye replaced by firm, necrotic tissue</td>
<td>Osteoblastic</td>
<td>Recurrence, lymph nodes</td>
</tr>
<tr>
<td>4</td>
<td>Testicle</td>
<td>Massively large right testis, tumor extending to inguinal canal and skin</td>
<td>Ossified mass replacing testis, extending to cord and skin</td>
<td>Osteoblastic</td>
<td>Diffuse local infiltration, lymph nodes</td>
</tr>
<tr>
<td>5</td>
<td>Vagina</td>
<td>Mass in retrovaginal area, previous ovariohysterectomy for leiomyosarcoma of cervix</td>
<td>3-cm firm nodular mass</td>
<td>Osteoblastic</td>
<td>Local infiltration</td>
</tr>
<tr>
<td>6</td>
<td>Kidney</td>
<td>4-month history of large right kidney, dilated pelvis</td>
<td>5-cm spongy mass in renal pelvis extending to parenchyma</td>
<td>Osteoblastic</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>Intestine</td>
<td>3-week history of anorexia, anemia, leukocytosis, abdominal pain</td>
<td>4-cm ulcerated mass, 10 cm from ileocecal junction</td>
<td>Chondroblastic</td>
<td>Lymph nodes</td>
</tr>
<tr>
<td>8</td>
<td>Vagina</td>
<td>Vaginal discharge, multiple pulmonary nodules seen on radiographs</td>
<td>6 × 4.5 × 2-cm firm gray mass in posterior vagina invading vaginal wall</td>
<td>Osteoblastic</td>
<td>Lungs, lymph nodes, local infiltration</td>
</tr>
<tr>
<td>9</td>
<td>Spleen</td>
<td>Pain in abdomen, large spleen with homogenous abdominal opacity</td>
<td>14 × 10 × 10-cm firm white mass with central necrosis in spleen; recurrent 12 × 8 × 8-cm mass in omentum at 65 days</td>
<td>Fibrous histiocytic osteosarcoma</td>
<td>Liver, omentum</td>
</tr>
<tr>
<td>10</td>
<td>Gastric ligament (mesentery)</td>
<td>Anorexia, listlessness, anterior abdominal mass</td>
<td>23 × 22 × 12-cm firm cartilaginous, lobulated mass in greater curvature of the stomach extending to gastric wall with ulcer</td>
<td>Mixed osteoblastic and chondroblastic</td>
<td>Extension to stomach, mesentery, and liver</td>
</tr>
<tr>
<td>11</td>
<td>Liver</td>
<td>Swollen abdomen, anorexia, ascites, extensive mineralization of abdominal viscera</td>
<td>Firm, diffuse, nodular lesions in liver</td>
<td>Osteoblastic</td>
<td>Diffuse to mesentery, omentum, and lymph nodes</td>
</tr>
<tr>
<td></td>
<td>Omentum</td>
<td>Distended abdomen with large mass</td>
<td>27 × 22 × 14-cm firm gray-white, lobulated mass in omentum</td>
<td>Mesenchymal</td>
<td>Diffuse to omentum</td>
</tr>
</tbody>
</table>
involved were the spleen, eye, testis, vagina (2), kidney, and liver. There were single cases of fibroblastic (adrenal gland), fibrous histiocytic (spleen), chondroblastic (ileum), and mixed (gastric ligament) osteosarcoma; in the latter tumor, the osteoblastic and chondroblastic components were present in almost equal volumes.

**Osteoblastic osteosarcoma.** Various organs were the primary sites of osteoblastic osteosarcomas, but the morphologic features were similar in all seven neoplasms. These neoplasms were characterized by small- to medium-sized, oval, spindle- to polygonal-shaped cells with large vesiculated nuclei, one or more large nucleoli, and eosinophilic or clear cytoplasm. These cells formed osteoid, which constituted the major component of the tumor (60% to 80%), both at the primary and metastatic sites (Fig. 1). Minor components of the tumors included chondroblastic and fibroblastic areas. Giant and multinucleated cells were seen occasionally, most commonly in the renal tumor. Mitotic figures were 0 to 2 per high power field (0.25 μm in diameter). There were large areas of hemorrhage and necrosis forming pseudocysts. Mineralization and mature bone formation were seen in the large tumors involving the visceral organs. Four of the seven neoplasms (57%) had distant metastasis. In both dogs with vaginal tumors, intravascular invasion was common.

**Fibroblastic osteosarcoma.** The one fibroblastic osteosarcoma involved an adrenal gland. The major component of the tumor consisted of large, anaplastic spindle cells forming interlacing bundles, but there were areas in which these cells had formed osteoid and chondroid. The neoplastic cells had large, vesiculated nuclei, one or more large nucleoli, and eosinophilic cytoplasm (Fig. 2). Mitotic figures were 3 to 4 per high power field (0.25 μm in diameter). There were areas of mature bone with mineralization. Extensive areas of hemorrhage with thrombosis, necrosis, and sclerosis were seen in the remaining adrenal tissue and in the neoplasm. There was scant, cortical adrenal tissue, which was closely associated with the pathologic and neoplastic changes. Even though no distinct metastasis was seen, there was extensive invasion beyond the adrenal capsule and into the surrounding tissue. Intravascular invasion was also seen.

**Fibrous histiocytic osteosarcoma.** There was one fibrous histiocytic osteosarcoma that involved the spleen. Histologically, the neoplasm had features typical of the malignant fibrous histiocytoma with areas of malignant osteoid formation (Fig. 3). The tumor was composed of a large- to medium-sized spindle and polygonal cells forming a storiform or pinwheel pattern. The cells had vesiculated nuclei and prominent nucleoli, with a moderate amount of eosinophilic cytoplasm. There were 2 to 4 mitotic cells per high power field (0.25 μm in diameter). The tumor had metastasis to the omentum consisting mostly of osteoid tissue.

**Chondroblastic osteosarcoma.** The one chondroblastic osteosarcoma involved the ileum. The tumor was composed of multilobed chondroid tissue with focal areas of osteoid and fibroblastic components. The chondroblastic cells consisted of moderately pleomorphic, irregularly arranged polygonal cells with vacuolated cytoplasm, vesiculated nuclei, and large nucleoli. The neoplastic cells formed eosinophilic osteoid stroma (Fig. 4). There were 0 to 1 mitotic figures per high power field (0.25 μm in diameter). The tumor extended to the serosa and had metastasis to the regional lymph nodes.

**Mixed osteo-chondroblastic osteosarcoma.** The tumor classified as mixed osteosarcoma involved the gastric ligament; this neoplasm had chondroblastic and osteoblastic elements in nearly equal volumes. The histologic features were similar to what has been described for the osteoblastic as well as the chondroblastic osteosarcomas. There were 3 to 4 mitotic figures per high power field (0.25 μm in diameter). The tumor had invaded the gastric wall, extending to the mucosa with ulceration, and was also seen in the blood vessels. There was metastasis to the liver.

**Chondrosarcoma.** The chondrosarcomas of the omentum and lungs were considered mesenchymal chondrosarcomas, and the third, which was located in the heart, was a regular chondrosarcoma. The mesenchymal chondrosarcomas were characterized by irregularly arranged, small- to medium-sized, oval and spindle cells associated with areas composed of pleomorphic, cartilaginous cells producing chondroid tissue (Fig. 5). There were 0 to 1 mitotic figures per high

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### Table 2. Continued.

<table>
<thead>
<tr>
<th>Dog Number</th>
<th>Site of Tumor</th>
<th>Clinical Findings</th>
<th>Gross Pathology</th>
<th>Histologic Classification</th>
<th>Site of Metastasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Lungs</td>
<td>Listlessness, diarrhea, vomiting, solitary large mass</td>
<td>3 × 2 × 2-cm pale white mass in left cranial lung lobe</td>
<td>Mesenchymal</td>
<td>None</td>
</tr>
<tr>
<td>14</td>
<td>Heart</td>
<td>Lethargy, listlessness, coughing, &quot;pounding heart,&quot; no murmur</td>
<td>5-cm smooth multilobular mass in mitral valve</td>
<td>Regular</td>
<td>None</td>
</tr>
</tbody>
</table>

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*Canine Extraskeletal Osteosarcoma*
power field (0.25 μm in diameter). Neither tumor had distant metastasis, but in one there was diffuse infiltration of the omentum.

The regular chondrosarcoma involved the mitral leaflet of the heart and had features similar to those of chondrosarcomas of the bone, which have been described. This tumor did not have metastasis.

Extension of the tumor and metastasis

Extension of the tumor was seen as local infiltration into adjoining tissues and tissues in contact with the tumor or as a distant metastasis (metastases) to an organ (organs) other than the primary site (Table 2). Distant metastasis was found in seven of 11 dogs (64%) with osteosarcoma and in none of the dogs with chondrosarcoma. Five of nine dogs in which necropsies were done had distant metastasis, and two of four dogs in which necropsies were not done had distant metastasis. Metastasis was to the lymph nodes in five dogs (45%), to the liver in two dogs (18%), and to the lungs and stomach in one dog each (9%). Four of the seven dogs with osteoblastic osteosarcoma had distant metastasis.

**Fig. 1.** Testis, osteoblastic osteosarcoma with a few seminiferous tubules (Fig. 1a—arrows.) Testis is replaced by neoplastic spindle to ovoid cells forming extensive osteoid tissue (Fig. 1b) with areas of mineralization (Fig. 1a). Note the single or small groups of well-differentiated cells associated with osteoid at higher magnification in Fig. 1c. HE.
(eye, testis, vagina, and liver). Three of the four dogs with other histologic types of osteosarcoma also had distant metastasis. The exception was the dog with fibroblastic osteosarcoma of the adrenal gland. Local infiltration and contact extension to the omentum and mesentery from the tumors involving the visceral organs were seen in eight of 11 dogs with osteosarcoma (72%) and in one dog with chondrosarcoma (33%).

Survival time

Follow-up information in two dogs with osteosarcoma (spleen and testis) was not available. Six of the nine dogs (67%) were killed immediately after diagnosis. The other three lived for 15, 65, and 124 days. All three dogs with extraskeletal chondrosarcoma were killed immediately, one after surgery and histologic diagnosis and the other two after clinical diagnosis of the tumor.

Discussion

Extraskeletal osteosarcomas and chondrosarcomas are extremely rare in human beings and domestic animals. In a 25-year span at The Animal Medical Center, there were only 11 cases of canine extraskeletal osteosarcoma and three cases of canine chondrosarcoma out of several thousand cases of neoplasms in dogs and approximately one thousand cases of skeletal osteosarcoma in dogs. Up to 1988, there were approximately 19 case reports of extraskeletal osteosarcoma in dogs and approximately 300 documented cases in human patients. There are even fewer numbers of extraskeletal chondrosarcoma in human beings. To establish a diagnosis of extraskeletal osteosarcoma or chondrosarcoma, it is essential to rule out primary skeletal tumors with metastases, carcinosarcomas, mesenchymomas, unilaterally differentiating teratomas, and metaplastic changes in tumors and tumorous lesions. It is also essential that an adequate number of slides is examined to demonstrate the presence of osteoid, because, except in cases of osteoblastic osteosarcoma in which there is abundant osteoid, other histologic types of tumor may be misdiagnosed on the basis of predominant morphologic findings.

In contrast to human beings, in which most extraskeletal osteosarcomas develop in the superficial tissue, most canine extraskeletal osteosarcomas develop in the visceral organs. In 86% of the cases in dogs (24/28, 17 cases in the literature and our 11 cases), the tumors developed in the visceral organs, and only 14% developed in the soft tissues of the extremities (Tables 1, 2). In human beings, it is the reverse; up to 85% of extraskeletal osteosarcomas develop in the extremities, with the retroperitoneum the next most common site (up to 17%). Comparison of these percentages may be invalid, however, because even though extraskeletal osteosarcomas have been described in visceral organs in human beings, they are usually excluded...
from large survey studies of extraskeletal osteosarcoma.\textsuperscript{10,15,32} Similarly, extraskeletal chondrosarcomas in human beings are more common in the extremities than in the visceral organs.\textsuperscript{15}

The mean age of the dogs with extraskeletal osteosarcoma reported here was 11 years, while the mean age of those previously described is 9 years.\textsuperscript{9-13} In contrast, the mean age of dogs with skeletal osteosarcoma is 7.7 years.\textsuperscript{18,19,28} In human patients, extraskeletal osteosarcomas develop almost exclusively in patients older than 50 years. In contrast, skeletal osteosarcomas develop most frequently in the first two decades of life.\textsuperscript{10,32,33} Both types of chondrosarcoma develop in adult humans.\textsuperscript{15,33}

No breed was commonly represented among the cases of our series, nor has one been reported, but there is a significant breed predisposition in cases of skeletal osteosarcoma, which affects mostly large breeds of dog.\textsuperscript{18,19,28} Our findings contrast with those seen in the 15 dogs described by Jacobson,\textsuperscript{16} most of which were said to be large-breed dogs.

A history of trauma is documented in up to 13\% of extraskeletal osteosarcomas in human beings.\textsuperscript{10,15} None of our dogs, including the dog with primary osteosar-

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Fig_3.png}
\caption{Spleen, fibrous histiocytic osteosarcoma with the storiform pattern formed by spindle cells (Fig. 3a, b) and areas of osteoid tissue formation by these cells. Higher magnification shows osteoid tissue in association with the neoplastic cells (Fig. 3c—arrow). HE.}
\end{figure}
Fig. 4. Intestines, chondroblastic osteosarcoma with predominantly chondroid tissue formed by abnormal chondroblasts (Fig. 4a, b) and areas of oval- to spindle-shaped neoplastic cells forming osteoid (Fig. 4b—arrow). HE.

coma of the eye, had a reported history of trauma; however, cases of post-traumatic osteosarcoma arising from the eye have been reported in cats.39 Similarly, 10% of extraskeletal osteosarcomas in human beings develop at a site that has been irradiated.10,32 None of our dogs had a history of irradiation, but post-radiation sarcomas have been reported in dogs.34,35

Extraskeletal osteosarcomas in dogs are highly malignant tumors. Distant metastasis was seen in 64% of the dogs in this study. In contrast, none of the three chondrosarcomas had distant metastasis, and only one had diffuse local infiltration. In human beings, extraskeletal osteosarcomas are considered highly malignant; up to 80% have pulmonary metastasis. Extraskeletal osteosarcomas are considered less malignant.10,15,32 The rate of metastasis in dogs with skeletal osteosarcoma is lower (20% to 50%)6,19 than that seen in dogs of this study with extraskeletal osteosarcoma. It is higher in dogs with skeletal osteosarcoma whose lives have been prolonged by treatment.21

The mean survival time of our dogs with extraskeletal osteosarcoma (23 days) is shorter than that reported for dogs with skeletal osteosarcoma.18,19,28 All three dogs with chondrosarcoma were killed immediately. In human patients with extraskeletal osteosarcoma, the median survival time is 60 months.10,15,32

As in human beings, various morphologic types of osteosarcoma and chondrosarcoma were diagnosed among the canine extraskeletal neoplasms of this study, and the morphologic features were closely aligned to what has been described for similar tumors in human patients.10,32,33 The osteoblastic variant was the most common histologic type of tumor in this study (64%). This contrasts to what was seen in a study of canine...
osteoarthritis of the nasal region, in which the fibroblastic (44%) and the angioblastic (25%) types were more common than the osteoblastic (19%).26 but the number of extraskeletal osteosarcomas in our study is too small for a definitive pattern to be established. Osteoblastic osteosarcomas were the most common (47%) in another study of 144 cases of skeletal osteosarcoma in dogs.23 Site preference for different histologic types of osteosarcoma may be identified in dogs as more cases are studied.1 Two of the three extraskeletal chondrosarcomas had features of mesenchymal chondrosarcoma. Mesenchymal chondrosarcoma is one of the most common types of sinonasal skeletal tumors in dogs, and it has not been described in the long bones.18,26,28

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