*cula* (W. R. Davidson, personal communication), whereas the mites involved in these cases more closely resemble *Neotrombicula*. Field biologists reported that the characteristic gross lesions of trombidiosis were again present in deer taken from the same wildlife management area in January 1995. Because the previous clinical case also involved deer collected in January, there may be a winter predilection for trombidiosis due to infestation with this species of chigger in white-tailed deer. The severe infestations described here may be the result of a limited number of hosts available during the winter, or these infestations may represent a sequela of the life cycle of this mite, which might emerge in large numbers in the winter months. The distribution of mites about the eyes and mouth is not surprising as trombiculid mites prefer warm, moist areas with a thin stratum corneum through which a stylostome is easily formed. This facial distribution may also reflect the mites' initial site of contact with the host as dictated by the questing behavior of the larvae.

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# Bilateral Renal Metastases of Nasal Chondrosarcoma in a Dog

K. A. HAHN, M. D. MCGAVIN, AND W. H. ADAMS

**Abstract.** Chondrosarcoma is the most common nonepithelial sinonasal neoplasm in the dog, and metastasis is considered rare. A 7-year-old Irish Setter had bilateral renal enlargement 17 months following surgery and radiotherapy for a primary nasal chondrosarcoma. Histologic evaluation revealed chondrosarcoma metastases in both kidneys. A diagnosis of nasal chondrosarcoma with bilateral renal metastasis was made. The clinical importance of this report is that routine recommendations for the evaluation of regional and/or distant metatasis in a dog with a dignosis of nasal chondrosarcoma, namely routine whole body physical examination and thoracic radiography, failed to demonstrate the presence of abdominal metatases, which ultimately led to the demise of this dog. The biologically aggressive nature of this chondrosarcoma of the nasal cavity indicates that additional information is needed before a prognosis can be reliably established for dogs with this tumor type.

*Key words:* Chondrosarcoma; dogs; nasal metastasis; renal metastasis; radiation therapy.

A 7-year-old 30-kg neutered female Irish Setter was referred to the veterinary teaching hospital because of a 9-month history of unilateral epistaxis. The dog was negative serologically for blastomycosis and aspergillosis, and the dog's condition did not improve after treatment with cephalexin.

Radiographs of the skull showed increased soft tissue opacity with associated turbinate lysis within the right nasal
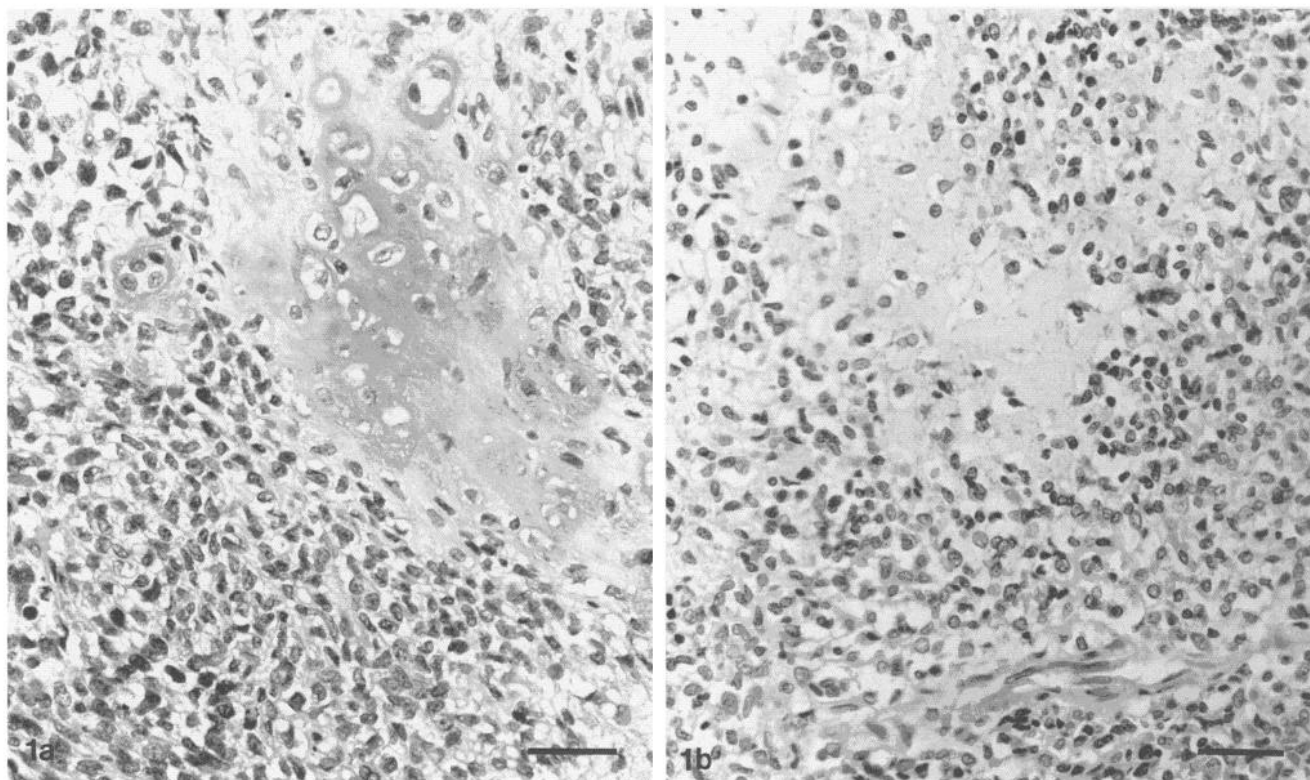
**Fig. 1.** Chondrosarcoma; dog. **Fig. 1a.** Nasal chondrosarcoma. Most of the tumor is formed by small pleomorphic cells and interspersed islands of cartilage. Mitotic figures are rare. HE. Bar = 25 μm. **Fig. 1b.** Renal metastases of nasal chondrosarcoma. Note the similarity to the primary tumor (Fig. 1a). The tumor consists of masses of small pleomorphic cells and ill defined areas of cartilage. HE. Bar = 25 μm.

passage. Fiberoptic rhinoscopy of the right nasal passage caused extensive hemorrhage. The mucosa of the left nasal passage was swollen, congested, and covered by mucus. Histologic evaluation of mucosal biopsies obtained from both nasal passages revealed that the tumor consisted of a mixture of spindle cells and cartilage (Fig. 1a). The spindle cells had oval to elongated pleomorphic nuclei, indistinct cell borders, and frequently basophilic cytoplasm. Mitotic figures were rare, usually <1/high power field (diameter = 0.5 mm). There were scattered areas of cartilage cells whose nuclei differed greatly in diameter, some cartilage cells had two nuclei. Large areas of the tumor were necrotic and other areas were hemorrhagic. Based on the presence of the poorly differentiated spindle cells, the tumor was classified as a grade 3 chondrosarcoma.

Magnetic resonance imaging of the nose and skull indicated lysis confined to the ethmoid turbinates. A dorsal rhinotomy revealed a gray, irregularly shaped spherical mass approximately 2 cm in diameter in the right nasal passage fixed to the dorsal surface of the hard palate. Radiotherapy of the right and left nasal passages was performed using temporary [192]iridium implants.[3,7] Epistaxis resolved immediately following radiotherapy, although a persistent, mild mucoid discharge was observed. Postoperative skull radiography was not performed. A complete physical examination, including the oral cavity and regional lymph nodes, was performed monthly, and a rhinoscopic examination was performed 4

and 10 months following surgery and radiotherapy. Thoracic radiography performed every 2 months following surgery and radiotherapy did not reveal evidence of pulmonary metastatic disease.

One year following nasal surgery and radiotherapy, the dog was reevaluated for lethargy and pollakiuria. On physical examination, the abdomen was visibly enlarged, and masses were palpated in the central abdomen. Abdominal radiographs demonstrated a large right cranial abdominal mas and a second smaller left caudal abdominal mass. The masses contained focal irregularly shaped areas of mineralization. Normal renal silhouettes were not identified. Ultrasonography revealed that the right cranial abdominal mass was associated with and nearly completely effaced the right kidney. The left kidney had two small hypoechoic masses within the lateral cortex and caudal pole. Magnetic resonance imaging of the abdomen revealed similar findings. Dorsal (Fig. 2) and axial (Fig. 3) plane images of the abdomen revealed that the right kidney was replaced by a large, irregularly shaped mass of mixed medium and low signal intensity. Three well-demarcated, low-signal-intensity masses were observed within the cortex of the left kidney.

A smear preparation from a fine needle aspirate obtained with ultrasound guidance showed a homogeneous population of mononuclear cells containing a large amount of eosinophilic extracellular matrix characteristic of cartilaginous or osteoid tumors. Results of a complete blood count and serum
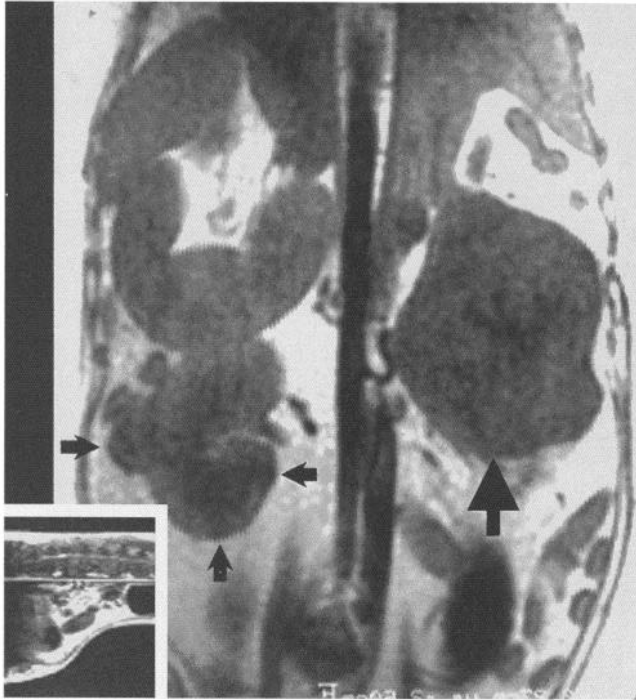
**Fig. 2.** Mid-cranial abdomen; dog. $T_1$ (TR = 500 ms, TE = 20 ms) dorsal plane image shows the right kidney to be replaced by a large irregularly shaped mixed-signal-intensity mass (large arrow). Three small low-signal-intensity masses are present in the cortex of the left kidney (small arrows).

biochemical analyses were within normal reference ranges. *Klebsiella pneumoniae* was cultured from the urine. Because of the poor prognosis based on a presumptive diagnosis of bilateral renal neoplasia, antibiotics were used to treat the urinary tract infection and aspirin was prescribed to be used as needed for analgesia.

Five months later (17 months after surgery and radiotherapy), the dog had progressive lethargy and anorexia and was euthanatized. At necropsy, no gross or histologic evidence of neoplasia was found in the nasal passages or paranasal sinuses or in the regional lymph nodes or lungs.

The right kidney was obliterated by a 21- × 22- × 12-cm mass that contained a 10- × 13-cm necrotic fluid-filled cyst. Little or no renal tissue was identifiable. The right ureter was dilated. The left kidney had three large grayish white masses (3–5 cm in diameter) attached to the surface (Fig. 4) Histologic evaluation of the renal masses revealed a poorly differentiated (grade 3) chondrosarcoma whose appearance was remarkably siimlar to that of the primary nasal chondrosarcoma (Fig. 1a). Most of the tumor consisted of cells with small pleomorphic nuclei, ill defined borders, scanty cytoplasm, and few mitotic figures (usually <1/high power field, 0.5 mm diameter). Foci of basophilic matrix in which rounded to oval nuclei, sometimes surrounded by a halo and thus resembling cartilage (Fig. 1b), were scattered throughout the spindle cell component. There were scattered necrotic areas. The diagnosis was nasal chondrosarcoma with bilateral renal metastasis.
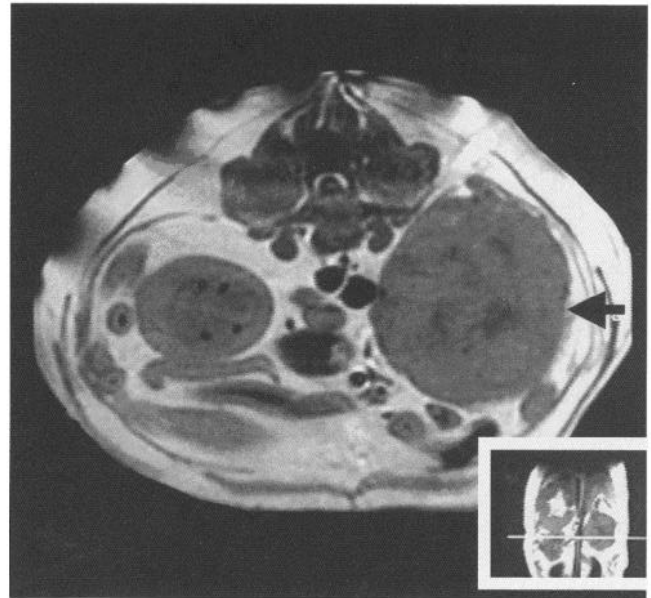


**Fig. 3.** Mid-cranial abdomen, dog. $T_1$ (TR = 700 ms, TE = 20 ms) axial plane image shows that the right kidney is enlarged, and there is distortion of renal architecture (arrow). The image of the left kidney at this level is normal.

Chondrosarcoma is a malignant tumor characterized by tumor cells that produce cartilage, not bone.[1] The most common locations of chondrosarcoma in the dog are the costochondral junction of the ribs, the nasal turbinates, and the pelvis.[1,5] Chondrosarcoma comprises approximately 10% of the primary bone tumors of dogs, and the Boxer breed is commonly predisposed.[5,6] The mean age at the onset of clinical signs is approximately 7 years.[5,6] There is no sex predilection.

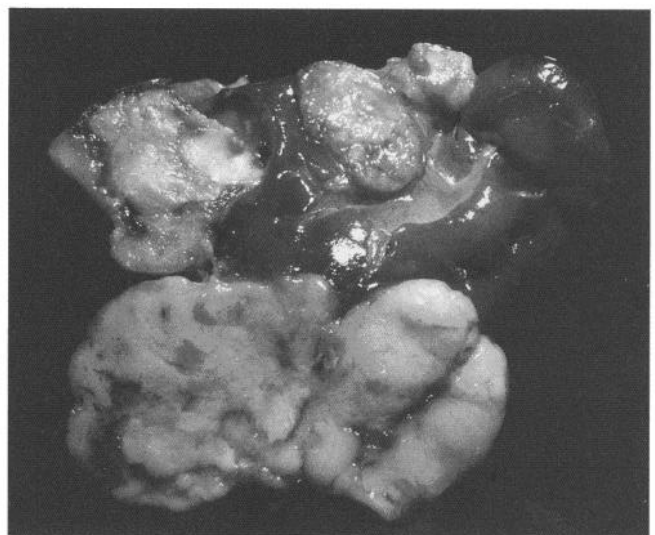Chondrosarcoma is the most common nonepithelial sino-



**Fig. 4.** Left kidney; dog. At necropsy 17 months following nasal irradiation, the left kidney, weighing 2.84 kg, had three large grayish-white masses (3–5 cm diameter) attached to the surface. Histologically, the masses were chondrosarcomas.

nasal neoplasm in the dog.[4] Chondrosarcoma is seen in equal numbers in nasal and nasofrontal areas, and tumors are commonly bilateral.[4] The metastatic rate for nasal chondrosarcoma in dogs is <15%.[1,5,6] Of the 27 necropsies reported for dogs with a diagnosis of nasal chondrosarcoma, four have had metastasis, all involving the lungs.[1,5,6] Cranial involvement and/or regional extension to lymph nodes has not been reported.

Sinonasal tumors, in particular chondrosarcoma, have not been reported to metastasize to the kidneys. Despite lack of evidence of metastasis at the time of nasal surgery and radiotherapy, the lack of evidence of neoplasia at the radiotherapy site during the necropsy 17 months after radiotherapy suggests that the neoplasm had metastasized before treatment was initiated.

Both the primary and metastatic tumors were identified as grade 3 chondrosarcomas based on the extensive areas of poorly differentiated spindle cells.[6,8] Both tumors had large areas of necrosis and relatively low mitotic indices (<1/high power field) and contained indentifiable areas of cartilage.

The clinical importance of this report is that routine recommendations for the evaluation of regional and/or distant metastasis in a dog with a diagnosis of nasal chondrosarcoma, namely routine whole body physical examination and thoracic radiography, failed to demonstrate the presence of abdominal metastases, which ultimately led to the demise of this dog. The biologically aggressive nature of this chondrosarcoma of the nasal cavity indicates that additional information is needed before a prognosis can be reliably established for dogs with this tumor type, despite the apparently longer survival observed in dogs with nasal chondrosarcoma as compared with dogs with nasal tumors of other histologic types.[2,4,5]

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Request reprints from Dr. K. A. Hahn, Department of Comparative Medicine, College of Veterinary Medicine, Knoxville, TN 37901–1071 (USA). E-mail: khahn@utk.edu.