Diagnostic Imaging in Veterinary Dental Practice

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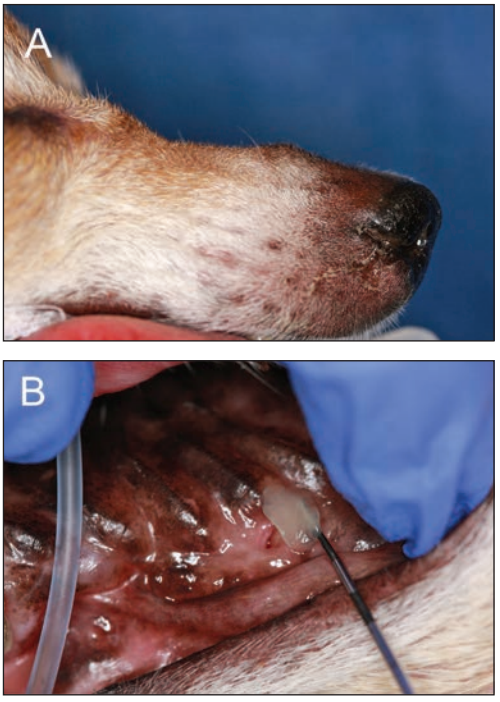

Figure 1—Photographs of the right lateral aspect of the muzzle (A) and gingiva in the region of the missing right maxillary premolar teeth (B) of a 13-year-old female Chihuahua evaluated because of acute respiratory distress, a history of poor oral health, and chronic right-sided nasal discharge. In panel A, notice swelling on the dorsolateral aspect of the muzzle and near the medial canthus of the right eye. In panel B, mucopurulent discharge from a lesion in the former area of the maxillary fourth premolar tooth can be seen.

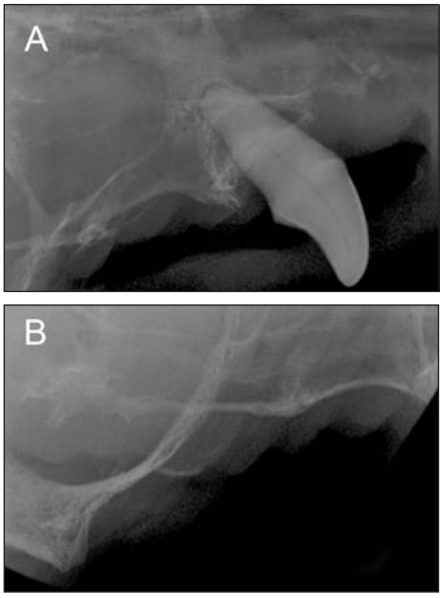

Figure 2—Right lateral intraoral radiographic views showing the right maxillary canine tooth (A) and region of the missing maxillary third and fourth premolar teeth (B) of the same dog as in Figure 1.

History and Physical Examination Findings

A 13-year-old sexually intact female Chihuahua was evaluated because of acute respiratory distress. The dog had a history of poor oral health and recurrent right-sided nasal discharge despite antimicrobial treatment with amoxicillin-clavulanic acid (14.5 mg/kg [6.6 mg/lb], PO, q 12 h) and prednisolone (1 mg/kg [0.5 mg/lb], PO, q 12 h) by the referring veterinarian. On physical examination, the dog was eupneic and had marked inspiratory difficulty. There was a soft tissue swelling (approx 5 mm in diameter) adjacent to the medial canthus of the right eye on the dorsolateral surface of the nose and a similar size swelling on the muzzle in the area over the right maxillary canine tooth root (**Figure 1**). There was a unilateral, moderate, mucopurulent nasal discharge with marked crusting around the right naris, and airflow from both nostrils was undetectable. Regional lymph nodes were palpated with findings considered unremarkable. Oral examination revealed presence of only the right maxillary canine tooth, which was covered with dental calculus and had gingival recession as well as stage 3 mobility. Oronasal fistulae were noted bilaterally at the level of the maxillary canine teeth. Purulent discharge was present at the site of the missing right maxillary fourth premolar tooth. A CBC revealed mild microcytic, hypochromic, regenerative anemia (Hct, 25.2% [reference range, 40% to 55%]; hemoglobin concentration, 8.7 mg/dL [reference range, 14 to 19 mg/dL]; mean cell volume, 62.4 fL [reference range, 65 to 75 fL]; mean cell hemoglobin, 21.5 pg [reference range, 22 to 26 pg]; and reticulocyte count, 125,000 reticulocytes/µL [reference range: 7,000 to 65,000 reticulocytes/µL]), potentially related to chronic blood loss. There was moderate leukocytosis and neutrophilia, characterized by a regenerative left shift with occasional toxic neutrophils (32,370 leukocytes/µL [reference range, 6,000 to 13,000 leukocytes/µL] and 28,809 neutrophils/µL [reference range, 3,000 to 10,500 neutrophils/µL]), and marked thrombocytosis (1,007,000 thrombocytes/µL [reference range, 150,000 to 400,000 thrombocytes/µL]); these findings were considered attributable to inflammation. Serum biochemical analysis revealed mildly high total protein concentration (7.3 g/dL [reference range, 5.4 to 6.9 g/dL]; globulin, 4.1 g/dL [reference range, 1.7 to 3.1 g/dL]) and high alkaline phosphatase activity (737 U/L [reference range, 14 to 91 U/L), which were also attributed to chronic inflammation. The dog was stabilized overnight by treatment with lactated Ringer solution (2.2 mL/kg/h [1.0 mL/lb/h], IV), an ampicillin sodium-sulbactam sodium combination (30 mg/kg [13.6 mg/lb], IV, q 8 h), and butorphanol tartrate (0.1 mg/kg [0.045 mg/lb], IV, q 6 h). The dog was anesthetized, and intraoral dental radiography, CT, and periodontal charting were performed. Selected radiographic views are provided (**Figure 2**).

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Diagnostic Imaging Findings

Full-mouth dental radiography[1] confirmed that the right maxillary canine tooth was the only tooth present; severe horizontal and vertical bone loss were evident (**Figure 3**). There were no retained roots identified on any of the dental radiographs. Radiolucencies in the rostral aspect of the maxillae at the level of the canine teeth confirmed the clinical finding of oronasal fistulae on both sides. The incisive bone was missing bilaterally, together with rostral parts of both nasal and maxillary bones. Total loss of nasal turbinate details was also noted. Geographic bone loss with poorly defined margins was noted at the caudal aspect of the right maxilla, but not on the left. Indistinct margins and poor lesion definition were considered indicative of a malignant process.[2]

Computed tomography was performed for further evaluation. Contiguous, 0.625-mm-thick, transverse images of the skull processed with a bone algorithm (120 kV; 79 to 131 mA; field of view, 157 × 157 mm in a 512 × 512-pixel matrix) were obtained before and after IV contrast medium administration. Images were viewed with a window width of 2,900 Hounsfield units and window level of 600 Hounsfield units (**Figure 4**). The CT scan revealed a large, soft tissue–attenuating mass occupying the entire right nasal cavity, with marked nasal turbinate destruction and lysis of the rostral aspect of the nasal septum; the right maxillary, frontal, nasal, and lacrimal bones; the right side of the hard palate; and the right rostral aspect of the cribriform plate. The mass was strongly, heterogeneously contrast

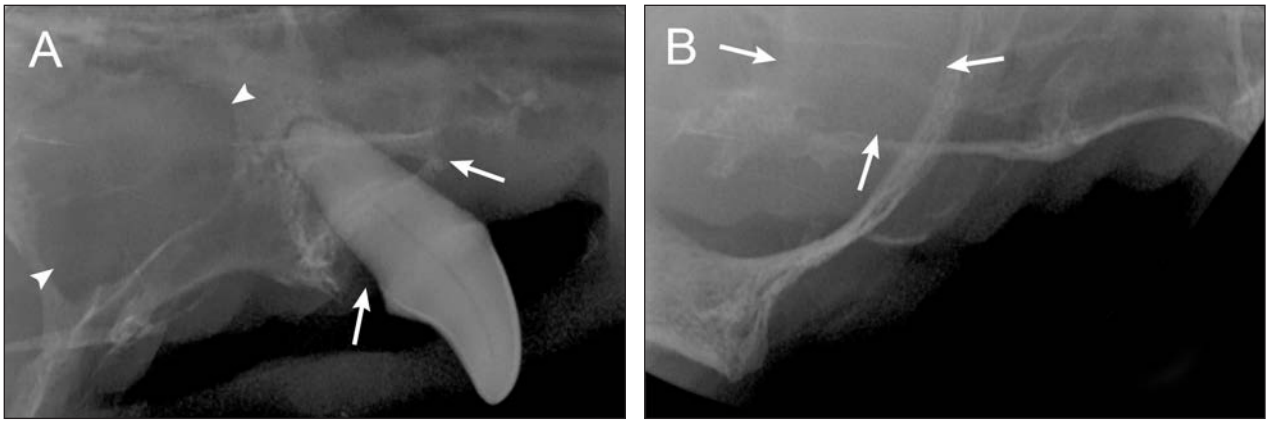

Figure 3—Same radiographic images as in Figure 2. Severe periodontitis at the right maxillary canine tooth (arrows) and an area of geographic bone loss dorsal to previous sites of the right maxillary third and fourth premolar teeth are evident (arrowheads; A). There is an additional area of geographic bone loss at the caudal aspect of the right maxilla in the absence of retained roots (arrows; B).

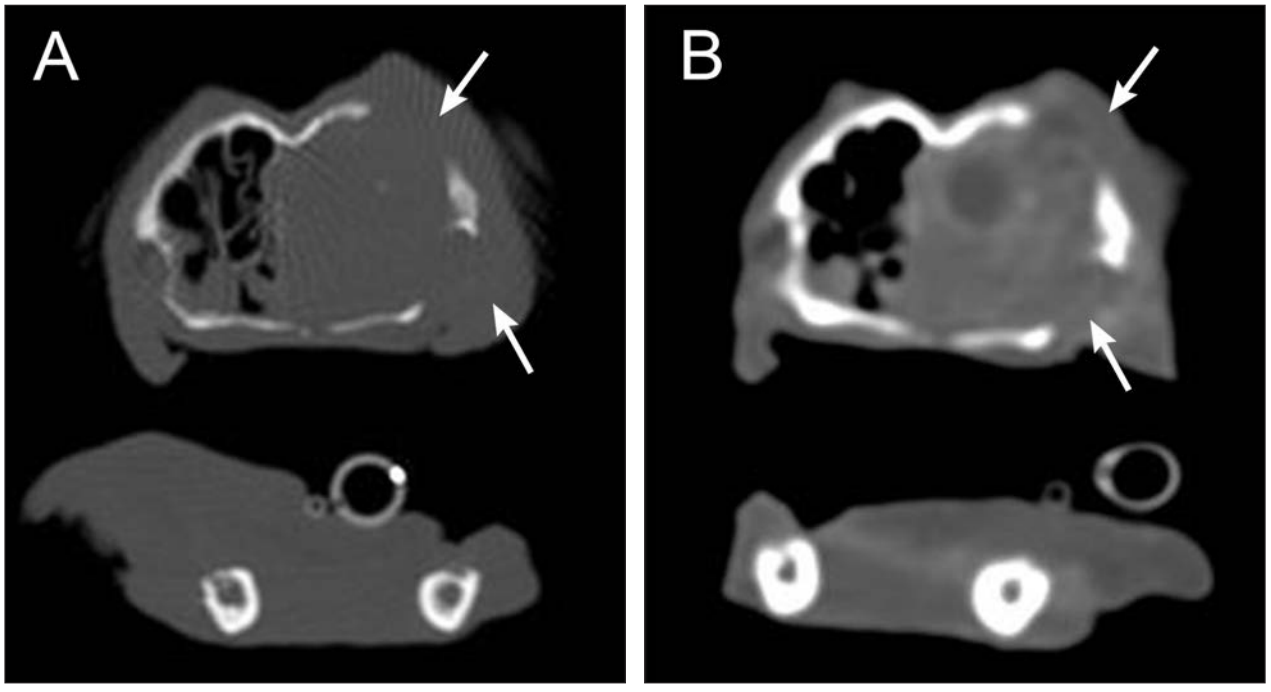

Figure 4—Representative pre- (A) and postcontrast (B) transverse CT images of the same dog as in Figure 1, taken at the level of the missing right and left maxillary fourth premolar teeth. Notice that a soft tissue–attenuating mass occupies the entire right nasal cavity with marked nasal turbinate destruction, crossing the midline and resulting in extensive lysis of the right maxillary and nasal bones with extension of the mass through large dorsal and ventral defects in the right maxilla (arrows).

enhancing. There was marked bone loss around the root of the right maxillary canine tooth and bone loss in the rostral aspect of the left maxilla at the former site of the left maxillary canine tooth.

Treatment and Outcome

An envelope flap was raised starting from the right maxillary canine tooth to the previous location of the right maxillary fourth premolar tooth. Four incisional biopsy specimens of the nasal mass were obtained, and the right maxillary canine tooth was extracted. Digital pressure with moist sterile gauze was used to control bleeding. A single-pedicle advancement flap was raised at the oronasal fistula on the left side. Both flaps were closed without tension in a simple-interrupted pattern. The obtained soft tissue samples were submitted for histologic examination.

Postoperatively, the dog was hospitalized for supportive care, which included IV fluids and administration of antimicrobials and analgesics as previously described. The following day, the dog was discharged into the owner's care, and tramadol (1.6 to 3.2 mg/kg [0.73 to 1.45 mg/lb], PO, q 8 to 12 h for 7 days), piroxicam (0.3 mg/kg [0.14 mg/lb], PO, q 24 h for 2 weeks), amoxicillin-clavulanic acid (19.5 mg/kg [8.9 mg/lb], PO, q 12 h for 2 weeks), and oral rinse (0.12% chlorhexidine gluconate solution, q 12 h for 2 weeks) were prescribed.

Histopathologic findings for biopsy samples were consistent with a malignant tumor of glandular epithelial origin. On the basis of histologic features as well as the aggressive clinical nature of the mass, it was diagnosed as adenocarcinoma.

Clinical signs improved markedly over the first week after surgery but became static afterward, with episodes of increased respiratory effort and open-mouth breathing. The surgical sites healed well over the following 2 weeks. The patient was referred for further oncological care, and chemotherapy was initiated 4 weeks after surgery.

Comments

The differential diagnoses for chronic nasal disease in dogs include inflammation (eg, lymphocytic plasmacytic rhinitis), neoplasia, foreign body, and fungal infection.[3–5] Dogs, especially toy breeds, are commonly evaluated for severe periodontitis and subsequent ascending rhinitis.[6] A detailed oral examination is essential in the diagnostic workup for all dogs with nasal disease. Dental radiographs are necessary to either characterize the extent of periodontal disease or to exclude periodontitis as a cause of nasal disease. They also allow the clinician to evaluate maxillary and nasal bone quality and integrity of the nasal turbinates. Computed tomography is a crucial diagnostic modality that provides more detailed information regarding the extent of disease and involvement of the surrounding bone, and it can be used to select sites for targeted biopsy sampling.[7,8]

The right-sided facial swelling in connection with unilateral nasal discharge, presence of severe periodontal disease, oronasal communications, and suspected draining tracts at the previous site of the right maxillary fourth premolar tooth were suggestive of a sequela of severe periodontitis and ascending infection into the nasal cavity. The full-mouth intraoral radiographs confirmed the presence of severe periodontitis but also revealed large areas of bone loss at the caudal aspect of the affected maxilla in the absence of retained tooth roots, and, therefore, further diagnostic imaging was indicated. The use of CT enabled a detailed assessment of the patient's true condition, development of an appropriate surgical plan for obtaining diagnostic biopsy specimens, and temporary improvement in the patient's quality of life.

The present case demonstrates the importance of a thorough oral examination in concert with appropriate diagnostic imaging modalities for accurate diagnosis and treatment planning in patients with nasal disease.

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