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## A case of a dog with mandibular extraskelatal osteosarcoma after long-term puncture extirpation of the salivary gland cyst in the mandible

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### Abstract

**Background:** Extraskelatal osteosarcoma, unlike skeletal osteosarcoma, is a rare malignant mesenchymal tumor with a soft tissue primary that has been reported to occur in a variety of soft tissues.

**Case Description:** The case is a 14-year-old, unneutered male Miniature Pinscher, weighing 6.7 kg, who had been treated medically for more than 5 years with a management strategy of puncture extirpation of a salivary gland cyst in the mandible; 1 month earlier, the fluid retention could not be removed, and after a computerized tomography scan showed no lesion in the mandible adjacent to the mass lesion, surgical resection was performed.

**Conclusion:** Previous reports of extraskelatal osteosarcoma from the salivary glands in dogs have been rare. However, treatment of a salivary gland cyst in the mandible by long-term puncture extirpation may be a potential predisposing factor for the development of extraskelatal osteosarcoma around the mandible.

**Keywords:** Dogs, Extrasosseous osteosarcoma, Mandible, Salivary gland.

### Introduction

Extraskelatal osteosarcoma is a highly malignant mesenchymal neoplasm that arises from internal organs and soft tissues and is characterized by the formation of bone without invasion into bone or periosteal tissue (Duffy *et al.*, 2017). Its occurrence is rare, although it has been reported in dogs and humans (Makielski *et al.*, 2019). This case report describes a dog that developed extraskelatal osteosarcoma at the same site after long-term puncture extirpation of a salivary gland cyst in the mandible.

### Case Details

Case 1 is a 14-year-old, unneutered male miniature pinscher weighing 6.7 kg. For over 5 years, the patient had repeatedly been diagnosed with salivary gland cysts at several hospitals due to the presence of mucus accumulation in the mandible. He had been routinely treated medically by aspirate removal. Three months before first visiting the university, mucus viscosity decreased and became partially indurated, leading to an increase in the frequency of puncture removal. One month earlier, the mucus in the reservoir had solidified, making it impossible to aspirate. As such, the patient was referred to our hospital for further examination and

treatment. The size of the mandibular mass lesion at the time of the first visit (day 1) was 130 \* 98 \* 75 mm (Figs. 1 and 2). Blood tests showed hypoalbuminemia (Table 1).

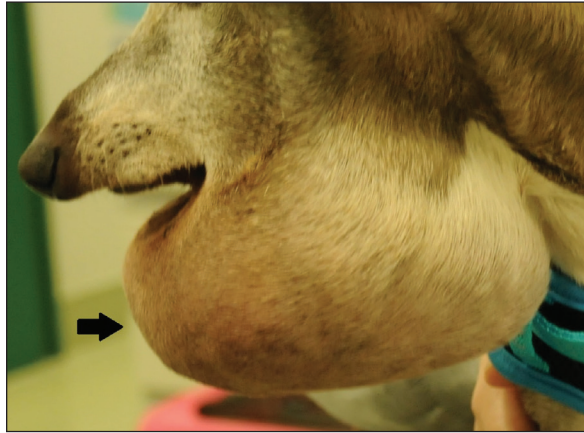
Fine needle aspiration of the mass lesion showed no significant cellular component. Chest and abdominal radiographs and chest ultrasound showed no specific findings, including metastatic lesions. Abdominal ultrasonography showed no noteworthy findings except a mild enlargement of the left adrenal gland (9 mm in short diameter).

A computerized tomography (CT) performed on day 8 showed a hyper-absorbable area comparable to cortical bone lining the entire mass wall. In the arterial phase, the interior of the hyper-absorbable area was occupied by a slightly hypo-absorbable area compared to the margins of the mass lesion (Fig. 3). There was no vascular run inside the mass, and the mandibular glands, sublingual glands, and mandibular lymph nodes were enlarged bilaterally. There were no significant findings in the mandible.

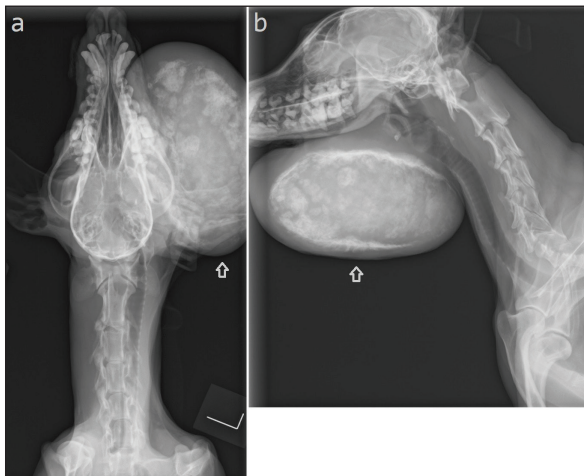
On day 14, the patient underwent surgery to resect the mass lesion. After inducing general anesthesia, the mandibular mass lesion was excised. The resected mass was a large neoplastic lesion in the subcutaneous

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**Fig. 1.** External appearance of case 1 at the initial examination. A large mass (130 × 98 × 75 mm; arrow) was found in the mandible.



**Fig. 2.** X-ray examination of the skull. Calcification was seen inside the mass lesion that increased from the mandible to the neck (arrow). (a) AP, anterior-posterior view and (b) LR, right lateral view.

tissue with extensive necrosis in the center. In the tumor tissue corresponding to the mass wall, bundles, sheets, and wreaths of osteoblast-like tumor cells with bone formation were observed (Fig. 4). These tumor cells were moderately atypical, and numerous mitotic figures were observed. No vascular invasion was observed, and the resection margin was good. Together with the CT scan results, the diagnosis of extraskelatal osteosarcoma was made.

Postoperatively, the patient was in good general condition, including appetite and activity, and was treated with antibiotics until day 25. Since the owner did not wish to receive concurrent chemotherapy, patient follow-ups were carried out by her family doctor from day 29 onward.

## Discussion

The exact incidence of extraskelatal osteosarcoma in dogs is not known (Makielski *et al.*, 2019), but it has been reported that there were 11 cases of extraskelatal osteosarcoma out of approximately 1,000 cases of skeletal osteosarcoma (Patnaik, 1990). The spleen (Kuntz *et al.*, 1998; Duffy *et al.*, 2017), gastrointestinal tract, and mammary gland (Langenbach *et al.*, 1998) have also been reported as the common sites of extraskelatal osteosarcoma in dogs. Although four cases of extraskelatal osteosarcoma in the cervical salivary glands of dogs have been reported in the past (Langenbach *et al.*, 1998; Thomsen and Myers, 1999; Umeda *et al.*, 2023), with no report of a common site of occurrence.

In addition to the reported hereditary occurrence of osteosarcoma in dogs (Phillips *et al.*, 2007), physical irritation at the site of bone plate insertion has been reported as a suspected predisposing factor for tumor development (Boudrieau *et al.*, 2005).

The factors leading to extraskelatal osteosarcoma development are still largely unknown. However, since there have been reports of dogs with extraskelatal osteosarcoma caused by residual surgical sponges (Miller *et al.*, 2006; Slovak *et al.*, 2015) and cotton swabs (Goto *et al.*, 2022), long-term physical irritation by foreign objects may be associated with the development of the disease. The occurrence of fibrosarcoma due to trauma or microchip insertion sites is well-known in cats (Daly *et al.*, 2008). In dogs also, there is a risk of postinjection sarcoma, and the known occurrence of extraskelatal osteosarcoma at injection sites is suggested to result from severe local inflammation caused by the adjuvant contained in the vaccine (Selmic *et al.*, 2016).

In this case, the accumulation of mucus was treated internally as a salivary gland cyst by long-term puncture extirpation. Drainage of salivary gland cysts by puncture extirpation is sometimes performed as an emergency evacuation. However, healing salivary gland cysts without surgery is rare, and long-term continuous use of internal puncture extractions is not recommended as a treatment (Peeters, 1991; Waldron and Smith, 1991).

On imaging examination, the typical case of extraskelatal osteosarcoma is a soft-tissue mass with localized sclerosis and no lesion in the adjacent bone (Schena *et al.*, 1989). In the present report, the mass lesion and the adjacent mandible in this case were consistent with this finding on both X-ray and CT. Together with the histopathological examination, these were some of the determining factors in diagnosing extraskelatal osteosarcoma in this case. Extraskelatal osteosarcoma may be considered a differential diagnosis in soft tissue mass lesions with sclerosis in the submandibular region in the absence of an adjacent mandible or other bone

**Table 1.** Blood test results, day 1.

| Test | Value | Range     | Unit                 | Test | Value | Range      | Unit   |
|------|-------|-----------|----------------------|------|-------|------------|--------|
| WBC  | 169   | 60–170    | *10 <sup>2</sup> /ul | CK   | 108   | 0–405      | U/l    |
| RBC  | 597   | 550–850   | *10 <sup>4</sup> /ul | TCho | 237   | 61–259     | mg/dl  |
| HGB  | 13.8  | 12.0–18.0 | g/dl                 | Glu  | 109   | 75.5–128.7 | mg/dl  |
| HCT  | 39.7  | 37–55     | %                    | BUN  | 16.9  | 9.8–21.3   | mg/dl  |
| PLT  | 58.4  | 20.0–50.0 | *10 <sup>4</sup> /ul | Cre  | 0.50  | 0.26–1.15  | mg/dl  |
| ALB  | 1.7   | 2.9–3.8   | g/dl                 | Na   | 148.4 | 144–152    | mmol/l |
| ALT  | 38    | 14–76     | U/l                  | K    | 5.29  | 3.5–4.5    | mmol/l |
| AST  | 31    | 10–70     | U/l                  | Cl   | 116.8 | 105–119    | mmol/l |
| ALP  | 437   | 12–93     | U/l                  | Ca   | 8.6   | 9.4–11.2   | mg/dl  |
| GGT  | 6     | 0–7       | U/l                  | P    | 3.6   | 2.0–4.6    | mg/dl  |
| Tbil | 0.03  | 0–0.09    | mg/dl                | CRP  | 20 <  | 0.00–0.09  | mg/dl  |
| LDH  | 151   | 11–190    | mg/dl                |      |       |            |        |

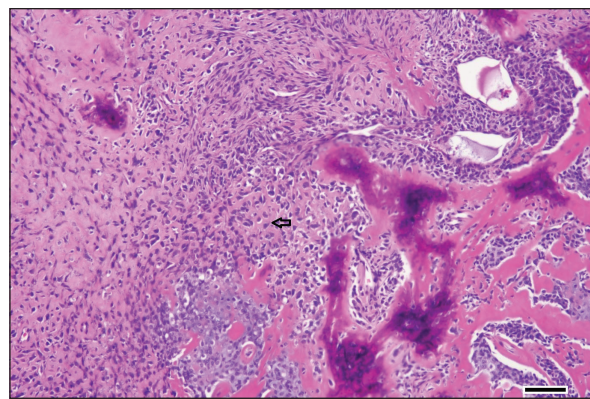
WBC: white blood cell count; RBC: red blood cell count; HGB: hemoglobin; HCT: hematocrit; PLT: platelet; ALB: albumin; ALT: alanine aminotransferase; AST: aspartate aminotransferase; ALP: alkaline phosphatase; GGT:  $\gamma$ -glutamyl transpeptidase; Tbil: total bile acids; LDH: lactate dehydrogenase; CK: creatine kinase; TCho: total cholesterol; Glu: glucose; BUN: blood urea nitrogen; Cre: creatinine; Na: natrium; K: Kalium; Cl: chlorine; Ca: calcium; P: phosphorum; CRP: C-reactive protein.



**Fig. 3.** CT scan on day 8. A hyper-absorptive area as large as the cortical bone was observed lining the entire mass wall (arrow). In the arterial phase, the interior of the highly absorbable area was occupied by a slightly less absorbable area compared to the margins of the mass lesion.

lesions. Unfortunately, there were no clear histologic findings that the extra salivary osteosarcoma in this case is of salivary gland origin.

In this case, the physical irritation from the puncture needle and the iodine injected by the primary veterinarian caused regression of the salivary gland cyst. The long-term presence of chronic inflammation due to prolonged saliva accumulation in the soft tissue may have predisposed the patient to develop extraskeletal osteosarcoma. Salivary gland cysts in the submandibular region are commonly encountered



**Fig. 4.** Histopathological examination results of the resected mass lesion. In the tumor tissue corresponding to the mass wall, bundles, sheets, and wreaths of osteoblast-like tumor cells (arrow) with bone formation were observed. The tumor cells were moderately atypical, and numerous mitotic figures were observed; bar, 100  $\mu$ m.

clinically and often heal without major complications with appropriate surgical procedures. On the other hand, extraskeletal osteosarcoma has a poor prognosis, with a reported median survival time of 26 days (Langenbach *et al.*, 1998), and a high rate of metastases (Kuntz *et al.*, 1998; Duffy *et al.*, 2017). Given the history of this case, surgical treatment should be promptly considered for salivary gland cysts around the mandible rather than continuing uncontrolled medical treatment.

This report provides an overview of a dog with a salivary gland cyst in the mandible that had been under medical management for over 5 years that developed extraskeletal osteosarcoma in the same region. This

case also suggests that surgical resection of salivary gland cysts should be performed at the appropriate time.

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#### Conflict of interest

The authors declare that there is no conflict of interest.

#### Author contributions

AU: conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing original draft, and writing review and editing; IM: writing original draft; TY: methodology; and data curation, formal analysis, investigation, methodology, software, and writing review and editing.

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#### Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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