

# Case Report

## Mandibular ameloblastoma in a mare

M. A. KUTZLER\*, J. FELECIANO<sup>†</sup> AND B. A. VALENTINE

*Departments of Clinical Sciences and Biomedical Sciences, Oregon State University, Corvallis, Oregon 97331; and*  
*<sup>†</sup>Veterinary Diagnostic Imaging and Cytopathology, Clackamas, Oregon 97015, USA.*

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### Introduction

Mandibular swellings are routinely encountered in equine practice. Most swellings involving the mandible result from underlying dental disease or trauma, however a small percentage are due to neoplasia. In a 27 year study of 102 horses with mandibular swelling, Pirie and Dixon (1993) found 7 tumours, including 4 ameloblastomas, 2 bony hamartomas and one fibroma. Accurate diagnosis of the tumour type is necessary for treatment recommendations and to allow prognosis of mandibular neoplasia; however, clinical, radiographic and histological diagnosis of these tumours can be difficult.

**The following case report describes the difficulties that can arise in making an accurate *ante mortem* diagnosis of a mandibular ameloblastoma in a horse. The literature on previously reported mandibular ameloblastomas in the horse is also reviewed.**

### Case history

A 17-year-old Quarter Horse mare was presented to the Oregon State University Veterinary Teaching Hospital with a 12 month history of a slowly progressive, nonpainful enlarging right mandibular mass (**Fig 1**). The mare had developed some difficulty chewing but had not lost weight, despite recently weaning a 6-month-old foal. Other symptoms included dropping feed, halitosis and right ventral buccal ulcerations. The referring veterinarian had performed radiography 7 months prior to presentation and had suspected osteosarcoma based on the radiographic appearance.

### Clinical findings

#### *Ante mortem diagnosis*

On presentation to Oregon State University, a complete blood count and chemistry panel were found to be within normal

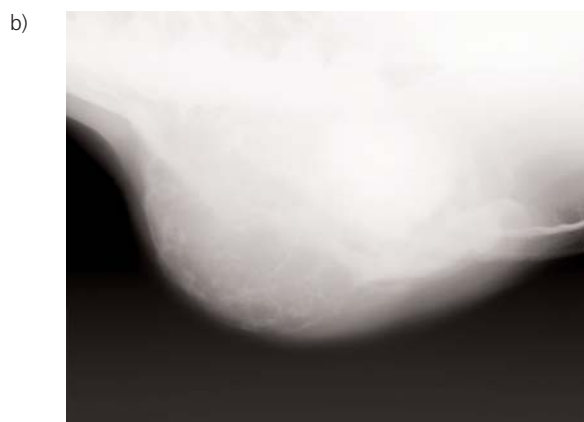


**Fig 1:** Dorsoventral (a), right caudal oblique (b) and right dorsal oblique (c) views of a 17-year-old mare with a slowly enlarging right mandibular mass.

\*Author to whom correspondence should be addressed. Present address: 105 Magruder Hall, College of Veterinary Medicine, Oregon State University, Corvallis, Oregon 97331, USA.

limits. Radiographic studies demonstrated a multi-cavitary, expansile mass involving the majority of the right hemimandible (**Fig 2**). Within the medial aspect of the mass was a large, rounded, irregularly marginated, mineralised opacity. The mass extended laterally to the premolars and molars without significantly displacing the teeth. The radiographic findings were suggestive of an odontogenic neoplasia, possibly odontoma (Dubielzig *et al.* 1986).

Five biopsies of the mass within the horizontal ramus were made using a Michelle trephine as described by Schooley and Hendrickson (1998). Samples were fixed in 10% neutral buffered formalin and decalcified in citrate buffered formic acid prior to processing. Samples were embedded in paraffin, sectioned at 6  $\mu$ m, and stained with haematoxylin and eosin. Sections obtained consisted primarily of reactive bone, with only a small fragment of a tumour composed of closely packed elongate cells with scattered islands of associated eosinophilic matrix. The findings were suggestive of sarcoma, but a definitive diagnosis was not made. Because of the size of the tumour and the poor prognosis, euthanasia was elected.



**Fig 2: Dorsoventral (a) and right lateral oblique (b) radiographs taken at the time of presentation. There is a multi-cavitary, expansile mass involving the majority of the right hemimandible and a large, rounded, irregularly marginated, mineral opacity on the medial side.**



**Fig 3: Gross examination of the dorsal (a) and medial (b) aspects of a mass on the right hemimandible, measuring 57 cm in diameter.**

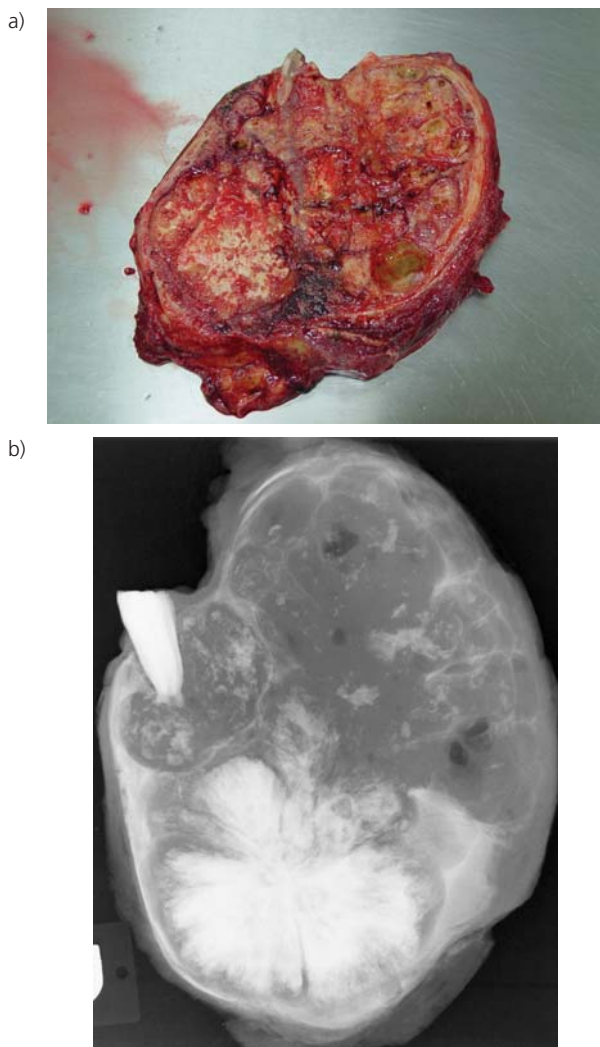
**TABLE 1: Summary of 13 cases of equine mandibular ameloblastoma**

Reference	Age, gender and breed	Side affected	Mandible location
Dixon <i>et al.</i>	6-year-old female pony	Left	Posterior
French <i>et al.</i>	11-year-old male*	Right	Posterior
Gardner	12-year-old male Quarter Horse	Right	Posterior
Gorlin <i>et al.</i>	4-year-old male*	Not identified	Anterior
Hanselka <i>et al.</i>	11-year-old male Paint	Right	Posterior
Jones and Brumbaugh	14-year-old gelding Thoroughbred	Right	Anterior
Pirie and Dixon	4-year-old gelding pony	Right	Posterior
Pirie and Dixon	14-year-old gelding pony	Bilateral	Anterior
Pirie and Dixon	19-year-old gelding pony	Not identified	Posterior
Rosol <i>et al.</i>	16-year-old gelding Saddlebred	Left	Posterior
Summers <i>et al.</i>	5-year-old gelding Standardbred	Right	Posterior
Vaughan and Bartels	14-year-old male Tennessee Walker	Bilateral	Anterior
Current report	17-year-old female Quarter Horse	Right	Posterior

\*Breed not identified in case report.

### Post mortem *diagnosis*

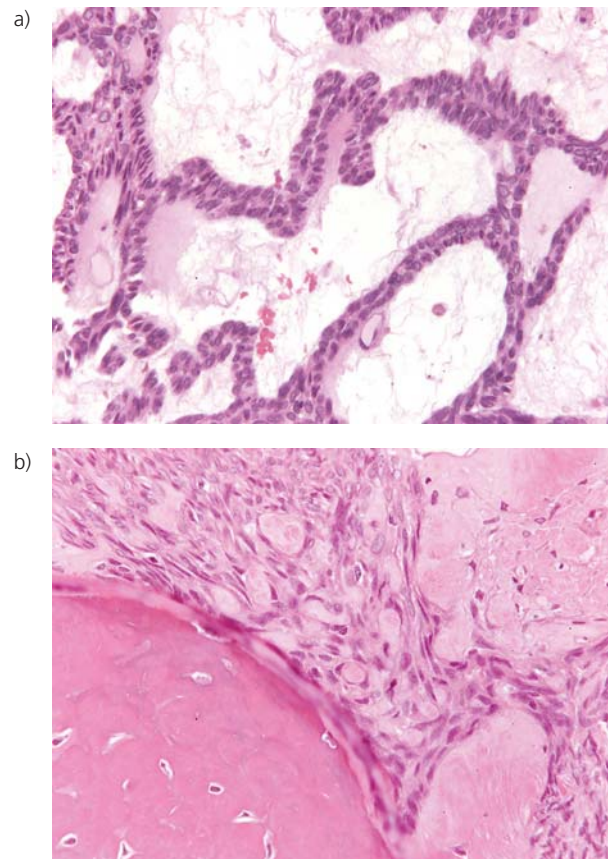
The mandibular mass originated at the base of the first molar tooth (Triadan 409) and measured 57 cm in diameter (**Fig 3**). A transverse section of the right hemimandible (approximately 2 cm thick; **Fig 4a**) was made on a low speed saw using a diamond coated circular blade. The roots of the tooth were not seen. Approximately 50% of the tumour tissue was at least partially mineralised. A large zone of remarkably dense mineralised tissue formed by radiating seams of mineral (measuring 8 x 10 x 10 cm) was present within the medial portion of the tumour. The remainder of the tumour was composed of alternating soft fleshy tissue, sometimes forming cyst-like areas and irregular seams of mineralised tissue. No evidence of tumour metastasis to lymph nodes, lung or other organs was found.



**Fig 4:** Gross (a) and high-resolution radiographic (b) examination of a transverse section made from the right hemimandible. Note the cross-section of a first molar tooth. The mass is multi-cavitary and expansile, involving the alveolar bone of the first molar, with a large, rounded, irregularly marginated, mineral opacity.

High resolution evaluation of the frontal section was performed using high-contrast radiographic film and revealed a multi-cavitary, expansile mass involving the entire diameter of the right hemimandible and the alveolar bone of the first molar tooth (**Fig 4b**). There were amorphous, irregularly marginated mineral opacities scattered throughout the mass. A large, rounded irregularly marginated, mineral opacity containing multiple radiating linear subdivisions was present medially.

Tumour samples for histopathology were obtained from multiple sites of the frontal section of the right hemimandible and were fixed, decalcified and processed as previously described. In addition, serial sections of selected areas were immunostained for cytokeratins. Sections of soft tissue areas contained large sheets, nests and dissecting thin cords of relatively homogenous small basophilic cells varying in shape from stellate or slightly elongate to cuboidal or short columnar. Palisading along the basement membrane and apical polarisation of nuclei was most apparent within thin dissecting cords of tumour (**Fig 5a**). Intact cells in the centre of thick cords and nests were most often closely packed polygonal to slightly elongate cells, with only rare areas of



**Fig 5:** Histopathological examination of the mandibular mass. Dissecting cords of tumour cells with apical polarisation of nuclei palisade along the basement membrane (a; stained with haematoxylin and eosin, x 200). Irregularly arranged stellate to elongate tumour cells dissect amongst islands of cementum and collagen (b; decalcified section stained with haematoxylin and eosin, x 200).

loosening with visible intercellular bridges, typical of stellate reticulum. Only occasional mitoses (<1 per high power field) were seen. Tumour cells expressed cytoplasmic cytokeratin. No associated odontoblasts were found. Histopathological features of the mineralised material were consistent with cementum. Cords and nests of epithelial tumour cells dissected amongst this matrix, even in the most densely mineralised zones (**Fig 5b**). A diagnosis of ameloblastoma with cemental proliferation was made.

## Discussion

A review of the literature found 12 cases of mandibular ameloblastoma (summarised in **Table 1**). Analysis of the data from this case and the 12 previously reported cases indicates that equine mandibular ameloblastoma occurs in a wide range of ages, from 4–19 years, with a mean of 11 years of age. Tumours most often involve the cheek teeth in the caudal aspect of the mandible. Involvement of the symphysis and anterior mandible is less common. Ameloblastoma has been reported more commonly in males (11 cases) than females (2 cases), and more often involves the right mandible (7 cases) than the left (2 cases). No breed predisposition is apparent, and ameloblastomas have occurred in multiple horse and pony breeds.

Odontogenic tumours are uncommon in domestic animals. Classification of odontogenic tumours can be confusing and reviews of the veterinary literature have often resulted in reclassification of previously published cases (Gardner 1992). The complex relationships that exist between odontogenic epithelium and associated mesenchymal tissue that can be induced to form dental tissues result in a wide array of possible patterns of odontogenic neoplasia. Simply stated, neoplastic odontogenic epithelium that does not induce mesenchyme to form dental tissues (e.g. dentin, enamel) gives rise to ameloblastoma. That which induces dental differentiation gives rise to odontoma. Various subclassifications of ameloblastoma and odontoma are often made, further complicating the picture (Dubielzig 2002).

Ameloblastomas arise from epithelial remnants of the developing root sheath and dental lamina (Gorlin *et al.* 1963; Dubielzig 2002) and appear to be the most common odontogenic tumour occurring in the jaw of horses (Pirie and Dixon 1993; Dixon *et al.* 2000). Adamantinoma is a term used in much of the original veterinary literature and is considered to be synonymous with ameloblastoma; however, enamel is not produced as the name adamantinoma implies (Dubielzig 2002). In man, ameloblastomas most commonly occur in the 20–49 age group, with >80% of cases arising from the mandible and of those, 70% within the molar-ramus area (Gorlin *et al.* 1963). The mandible is also the most common site of ameloblastoma in horses (Gardner 1994). One previously reported case (Summers *et al.* 1979) of an ossifying ameloblastoma appears to have been similar to the case described here, although Gardner (1994) reviewed this case and determined that the mineralised material was dentin rather than cementum.

The radiographic appearance of odontogenic tumours of the equine jaws is variable. Radiographically, equine ameloblastomas have been described as polycystic with concentric and eccentric areas of radiolucency with calcium-density borders (Hanselka *et al.* 1974) or to have limited lineo-reticular mineralisation, granular calcification and bone lysis (Pirie and Dixon 1993). Vaughan and Bartels (1968) describe an adamantinoma (ameloblastoma) as a cortical expansion caused by well-defined radiolucent areas around the periphery of a bony-appearing mass, with the general radiographic density of the expansile cystic portions not suggestive of osseous tissue. The radiographic appearance of ameloblastoma is not pathognomonic, though it is suggestive. The presence of an expansile mass within the bone associated with one or more teeth, with variable mineralisation within an intact mandibular cortex, is highly suggestive of odontogenic neoplasia. Histopathological evaluation of tissue sections is necessary for diagnosis of tumour type, and in many cases an accurate diagnosis necessitates examination of multiple sections from different areas within the tumour.

This case emphasises the diagnostic challenge in *ante mortem* tumour diagnosis. An accurate diagnosis is essential for appropriate treatment, especially given the report by French *et al.* (1984) in which radical *en bloc* resection of the mandible in a horse with ameloblastoma was apparently curative. The radiographic appearance of osteosarcoma in horses has a characteristic 'starburst' appearance with thinning or destruction of the cortical wall (Schooley and Hendrickson 1998). Based on initial radiographs, the referring veterinarian suspected this diagnosis. Osteosarcomas are found predominantly on the equine head, and occasionally involve the limb or ribcage (Schooley and Hendrickson 1998). However, osteosarcoma of the equine jaw appears to be quite rare, occurring far less commonly than ameloblastoma (Pirie and Dixon 1993). The follow-up radiographs obtained 7 months later were more characteristic of odontogenic neoplasia than of osteosarcoma.

Although multiple sites were biopsied, in an attempt to sample as deeply as possible, the amount of tumour tissue present on biopsy samples was small, and the nature of the cells was not clearly epithelial, leading to an erroneous suspicion of sarcoma. The histological appearance of tumour cells in many areas of the samples obtained at *post mortem* were also not clearly epithelial, and could also represent poorly differentiated sarcoma. The areas in which tumour cells formed thin dissecting cords with polarisation to the basement membrane, and the cytokeratin expression in all tumour cells, confirmed the epithelial origin of this neoplasm. The prominent zones of dense mineralisation, determined histologically to be cementum, are not typical of ameloblastoma in most other species (R. R. Dubielzig, personal communication). The presence of prominent cementum in association with odontogenic epithelium made classification of this tumour problematic. If cementum production is considered to be an inductive effect, then this tumour would be more appropriately classified as an odontoma. But given that no evidence of odontoblastic, dentin or enamel

differentiation was found, and that cemental proliferation can be seen in domestic herbivores associated with both neoplastic and non-neoplastic conditions of the jaw (Dubielzig 2002), this tumour was classified as ameloblastoma.

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