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TITLE: Imaging Diagnosis – The Computed Tomographic Appearance of a Giant Cell Tumor affecting the mandible in a pygmy goat

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1 **THE COMPUTED TOMOGRAPHIC APPEARANCE OF A GIANT CELL TUMOR**
2 **AFFECTING THE MANDIBLE IN A PYGMY GOAT**

3

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12 Keywords: CT, pygmy goat, giant cell tumour

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26 **Abstract**

27 A 3-year old male neutered pygmy goat presented for evaluation of a progressive
28 mandibular swelling and inappetence. A computed tomographic (CT) scan of the
29 head and thorax was performed under general anaesthesia. CT revealed an
30 extensive multiloculated, markedly expansile lesion within the right
31 hemimandible, which involved the articular surface of the temporomandibular
32 joint. The goat was euthanased due to a poor prognosis and postmortem
33 examination confirmed the diagnostic imaging findings. Histopathology was
34 strongly suggestive of a multinucleated giant cell tumor, therefore this condition
35 should be considered in goats presenting with expansile mandibular mass
36 lesions.

37

38

39 **Signalment, history and clinical findings**

40 A 19.7 kg, three year old, male neutered pygmy goat presented to the Farm
41 Animal Clinical Centre at the Royal Veterinary College (UK) for evaluation of a
42 bilateral mandibular swelling which had been present since the owner
43 purchased the animal 7 months prior to presentation. At the time of purchase the
44 goat was seen to have a mild visible swelling to the rostral aspect of the right
45 mandible. This swelling progressively enlarged, this being most evident in the 4
46 weeks prior to presentation. Episodes of oral haemorrhage were reported in
47 addition to a malodorous smell and superficial skin sores, and the animal became
48 progressively inappetent with slight weight loss (body condition score 4/9),
49 Antimicrobial therapy (Ceftiofur sodium, 2.2 mg/kg bwt i.m. BID, Excenel, Zoetis
50 UK Limited, London, UK), resulted in no change in the rate of mass enlargement
51 or improvement in appetite.

52

53 On oral examination a malodorous and well defined soft tissue mass,
54 approximately 3cm x 4cm was present at the right rostral aspect of the mandible,
55 and showed cutaneous erythema and crusting. Palpation of the vertical and
56 horizontal rami of the mandibles revealed enlargement, and the goat resented
57 palpation. There was slight right mandibular and retropharyngeal
58 lymphadenomegaly.

59

60 **Imaging, diagnosis and outcome**

61 The patient was anaesthetised and placed in sternal recumbency on the patient
62 table of a 16 slice multidetector CT scanner (GE Healthcare, Lightspeed Pro 16,
63 GE Medical Systems, Berkshire, UK) using the following technical parameters; 80

64 kV, 160 mAs, 1.25 mm slices with an interslice gap of 1.25 mm, tube rotation of
65 0.8 seconds, pitch of 0.56 and a helical acquisition. The field of view was set using
66 a scout scan at 25 cm. Images were obtained and reconstructed using a bone and
67 soft tissue algorithm and a matrix size of 512 x 512. Intravenous contrast media
68 was not administered in this case.

69

70 CT images identified an extensive, multiloculated and multifocal expansile soft
71 tissue mass lesion located within the right hemimandible mandible both rostral
72 and caudal to the cheek teeth. The right first incisor was absent and the
73 remaining incisors were misaligned, with the mass causing destruction of the
74 alveolus and periapical bone surrounding the right incisor teeth, though
75 remaining teeth retained normal internal structure. The right mandible was
76 grossly misshapen rostrally with irregular margins, and the rostral right
77 premolar teeth were slightly displaced. The soft tissue filled cavities located
78 predominantly rostral and caudal to the cheek teeth were homogeneously
79 attenuating (average 50HU). Caudal to the mandibular cheek teeth the medullary
80 cavity of the right mandible was widened, with marked expansion, cortical
81 thinning, and irregular outlines to the mandibular condyle. The lateral cortical
82 bone of the right hemimandible was markedly thin caudal to the cheek teeth and
83 there was a focal region of absent bone plate ventral to the right
84 temporomandibular joint. The articular surface and subchondral bone of the
85 right mandibular condyle was poorly defined and irregular in contour, in places
86 appearing incomplete (Fig 1-3). There were ill-defined heterogeneous regions of
87 bone and soft tissue attenuation within the caudal aspect of the left
88 hemimandible, and multiple gas bubbles within this, consistent with impacted

89 feed material. There was a cortical bone defect along the lateral aspect of the left
90 hemimandible, caudal to the molar teeth.

91

92 In addition there was a small volume of soft tissue attenuating material in the left
93 tympanic cavity. There was slight symmetric enlargement of the mandibular
94 lymph nodes and retropharyngeal nodes, measuring approximately 10 mm in
95 maximal diameter. The thorax was considered normal.

96

97 The lesions identified fit the criteria to be categorized as an aggressive bone
98 lesion, therefore due to the extensive and progressive nature of the lesions, the
99 most likely differential diagnoses were considered to be neoplastic, with an
100 infectious aetiology less likely. Additionally, due to the extensive nature of the
101 lesions identified, and the involvement of the right temporomandibular
102 articulation, appropriate surgical resection was not considered possible. A
103 wedge biopsy of the lesion in the rostral mandible was obtained under sedation,
104 which was suggestive of a multinucleated giant cell neoplasm. A poor prognosis
105 was conferred and therefore the owners elected that the goat be humanely
106 euthanased.

107

108 At necropsy there was an approximately 3cm x 4cm soft tissue mass located to
109 the right of midline on the rostral aspect of the mandible with haemorrhagic
110 surface ulcerations. On sectioning, the right rostral mandibular bone was
111 disintegrated and replaced by soft cavitative brown tissue. A further
112 approximately 5cm mass was confirmed within the right mandible extending
113 dorsally into the temporomandibular joint. The mid left mandible was thickened,

114 firm and had green roughage impacted in a pocket caudal to the last left molar
115 tooth. The right sub-mandibular lymph node was slightly enlarged. Necropsy
116 findings correlated well with CT findings.

117

118 Histopathological examination of samples obtained from the right mandible
119 revealed two predominate populations of cells; dense spindle shaped cells in a
120 streaming pattern and numerous and bizarre multinucleated giant cells (Fig 4).
121 The multinucleated giant cells, contained between 2 and 20 nuclei with varying
122 numbers of nucleoli. There were very few mitoses present. Histological diagnosis
123 was consistent with a giant cell tumour of the mandible. There was no indication
124 of neoplastic spread to lymph node or lungs. Sections obtained from the caudal
125 aspect of the left mandible were interestingly not suggestive of neoplastic
126 aetiology, instead suggestive of inflammatory changes, most likely secondary to
127 an abscess.

128

129 **Discussion**

130 Multinucleated giant cell tumors affecting the mandible are rare in all domestic
131 species and humans¹, and to the authors' knowledge this is the first reported
132 case of this type of lesion in the goat. The use of CT in this case enabled an
133 accurate depiction of lesion characteristics and lesion extent, this allowing the
134 lesions to be categorized as expansile and aggressive. The ability of CT to rule out
135 more benign conditions for example periapical infection was critical for patient
136 management and establishing decision criteria for euthanasia. In the goat,
137 previously reported mandibular and maxillary neoplasia include
138 adenocarcinoma,² ossifying fibroma,³ lymphosarcoma,⁴ osteoma,⁵ nasal papillary

139 adenoma,⁶ and non-ossifying fibroma,⁷ conditions which must also be considered
140 as differential diagnoses for potentially neoplastic masses in this location.

141

142 Previous reports in the human literature include the case of a giant cell lesion of
143 the jaw in a child.¹ It is possible from the histopathological descriptions that the
144 terms “giant cell granuloma” and “giant cell lesion” are synonymous with that
145 described here, and may reflect a similar, if not the same pathological process. It
146 should be noted that in the human field the aetiopathogenesis remains unclear,
147 however it has been established that epithelioid macrophages that define a
148 granuloma are not present in giant cell tumors. This differentiation aided in the
149 classification of the lesion as a giant cell tumor. In people, giant cell granuloma
150 lesions often present as unilocular lesions which subsequently develop into a
151 multilocular structure which thus may appear similar to that described in this
152 goat.⁸ Conservative and radical surgical techniques have been applied to types of
153 human giant cell granuloma lesions but nonetheless have been associated with
154 recurrence, and serious facial mutilation and loss of dentition.¹

155

156 Other conditions that have been documented to manifest within the caprine
157 mandible include primary dental disease, actinomycosis (lumpy jaw) and fibrous
158 osteodystrophy secondary to hyperparathyroidism.⁹ In our institution, pygmy
159 goats most frequently presenting for conditions of the head are as a result of
160 dental disease with additional secondary pathology. This case report suggests
161 that alternative pathological processes can occur in these species and that an
162 additional differential diagnosis for an expansile lesion such as that depicted
163 here should include a giant cell tumor. Advanced tomographic imaging e.g. CT,

164 was found to be an excellent diagnostic tool to evaluate the extent of the lesion
165 depicted here and the authors advocate its use in such cases. The use of
166 intravenous iodinated contrast media may have facilitated lesion
167 characterization and could be considered in future patients.

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173 **Acknowledgments**

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175 their assistance.

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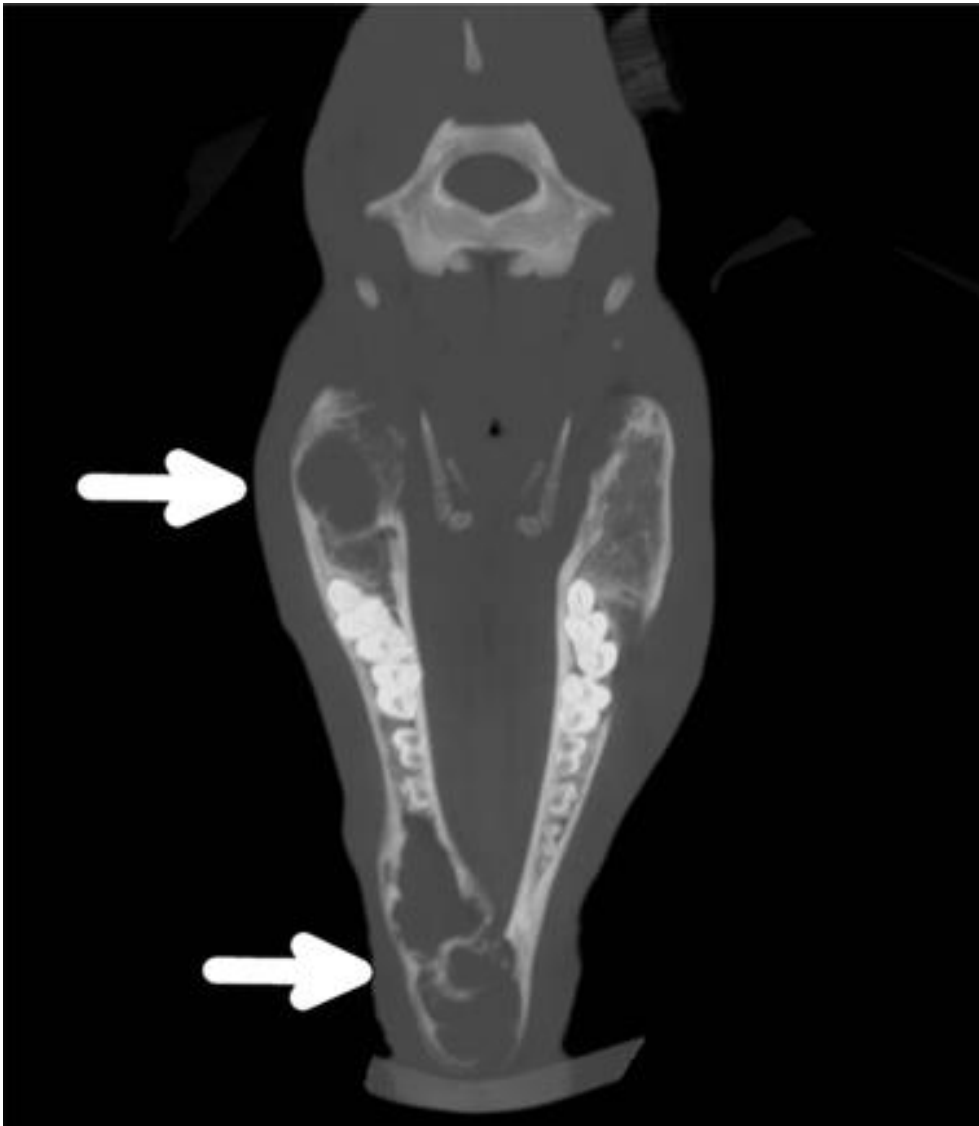
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204 **Figure Legends**

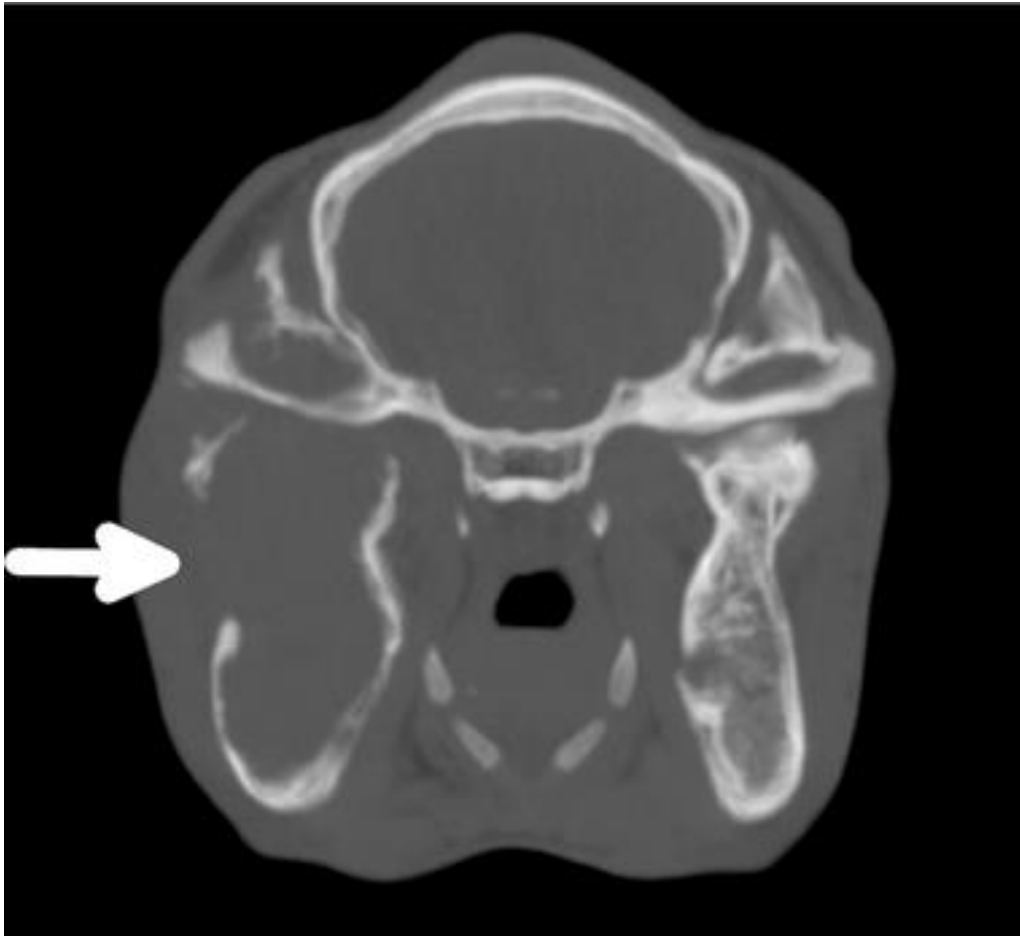
205 Figure 1: Dorsal plane maximum intensity projection (MIP) computed
206 tomographic image depicting the multiloculated, markedly expansile lesion
207 within the right mandible (white arrows).



208

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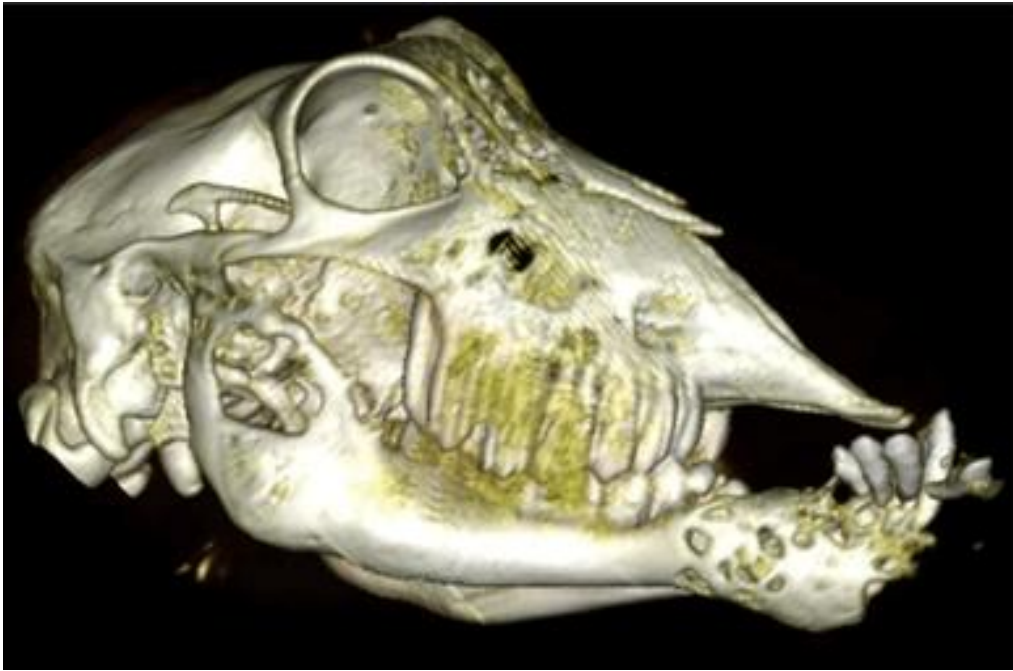
210 Figure 2: Transverse MIP computed tomographic image at the level of the
211 temporomandibular joints depicting the markedly expansile lesion causing
212 enlargement of the right mandibular ramus and lack of normal contour to the
213 right mandibular condyle at the level of the temporomandibular joint. There is a
214 cortical bone defect located laterally in the vertical ramus.



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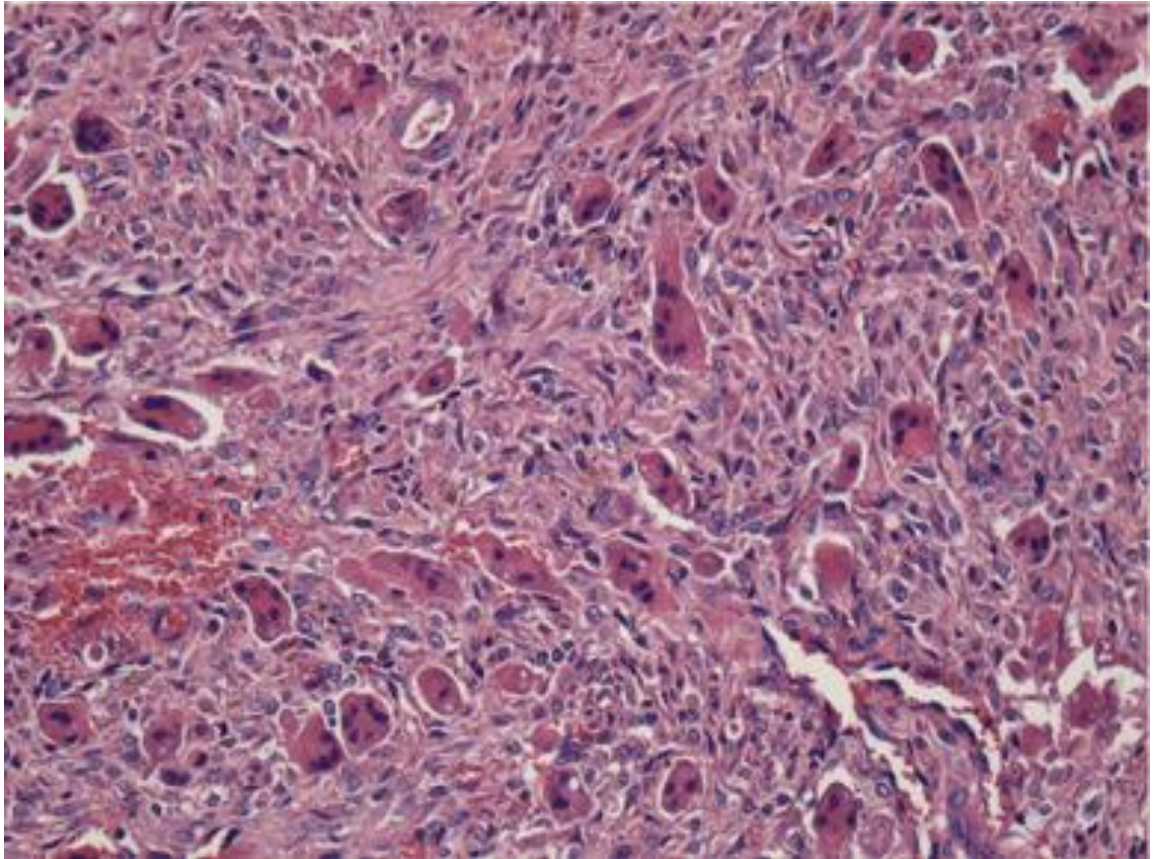
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217 Figure 3: 3D volume rendered computed tomographic image viewed from the
218 right depicting the skull lesions present within the rostral and caudal mandible.



219
220

221 Figure 4: Histopathological section of the mandibular mass (H& E stained; x 400
222 magnification): moderately cellular neoplasm consisting of dense spindle shaped
223 cells and numerous and bizarre multinucleated giant cells that are diffusely
224 distributed throughout the mass.



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