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# Spindle cell sarcomas, suggestive of peripheral nerve sheath tumours, arising in the tongues of two cats

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## Abstract

**Case summary** Two domestic shorthair cats, one an 11-year-old female neutered cat and the other a 13-year-old male neutered cat, presented with partly raised, well-demarcated masses at the rostral tip of the tongue. Histological examination and immunohistochemical staining were consistent with sarcomas, and were most suggestive of peripheral nerve sheath tumours. One tumour had histological features consistent with a malignant peripheral nerve sheath tumour (PNST).

**Relevance and novel information** Feline PNSTs arising on the tongue are rarely described in the published literature, and, to our knowledge, a case of malignant PNST originating at this site has not been described to date. Therefore, this represents a new differential diagnosis for cats presenting with a lingual mass. Regardless of histological malignancy, in cats these tumours have the potential for local recurrence but appear very unlikely to metastasise.

**Keywords:** Tongue; tumour; sarcoma; neoplasia; lingual

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## Introduction

Mass lesions arising either on the tongue or sublingually are not an uncommon clinical presentation in cats. Of these, the most commonly occurring neoplasm is squamous cell carcinoma (SCC), which often originates on the ventral aspect of the tongue, but other frequently diagnosed tumours affecting the feline tongue include melanoma, granular cell tumour (GCT), haemangioma, fibrosarcoma and haemangiosarcoma.<sup>1</sup> Non-neoplastic masses are an important differential diagnosis, in particular those falling within the eosinophilic granuloma complex (EGC);<sup>2</sup> these lesions can also arise on the ventral aspect of the tongue meaning they are a key differential for SCC. On rare occasions, both SCC and EGC can arise at the same site (author's own experience, MJD). Other rarer lesions arising on the feline tongue include viral-induced oral papillomas,<sup>3</sup> and also feline 'sarcomas' or fibropapillomas (author's own experience, MJD).

In dogs, lingual neoplasms include melanoma, SCC, plasmacytoma, lymphoma, GCT, haemangiosarcoma

and fibrosarcoma.<sup>1,4</sup> Individual case reports of sarcomas of neural origin include one lingual ganglioneuroma<sup>5</sup> and one neurofibroma on the ventral aspect of the tongue.<sup>6</sup> The most common tumours arising in the tongue of horses also include SCC, together with several forms of sarcoma, including rhabdomyosarcoma and one reported chondrosarcoma.<sup>1,7</sup> Lingual sarcomas of neural tissue origin have also been reported,<sup>8,9</sup> while another study described multiple perineural proliferations 'not unequivocally diagnosed as neoplasia' in the tongue of a horse.<sup>1,10</sup>

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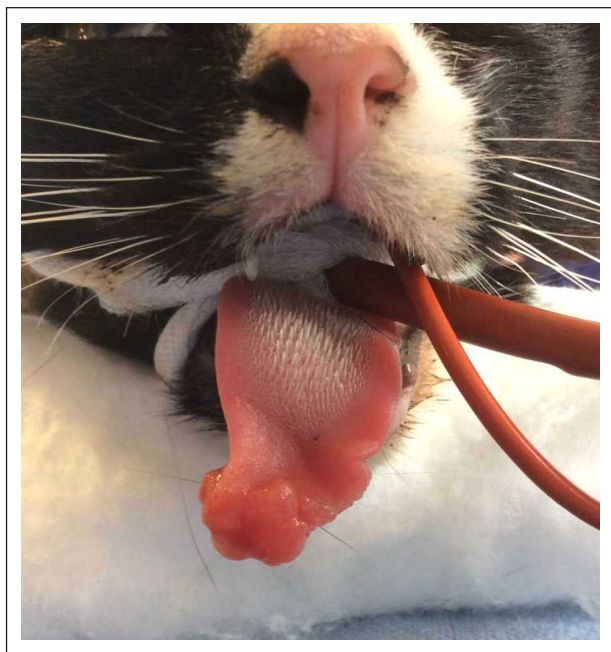
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**Figure 1** Gross appearance of the lingual mass preoperatively (case 1)

While fibrosarcomas are not infrequently diagnosed within the feline oral cavity, including the tongue,<sup>1</sup> sarcomas of neural origin appear to be rare. In one study of 59 feline peripheral nerve sheath tumours (PNSTs), two affected the tongue and were histologically benign.<sup>11</sup> The current case report describes two lingual sarcomas arising in cats, with histological and immunohistological characteristics suggestive of a perineural origin, and one of which appeared histologically malignant. To our knowledge, such a case has not been described in the veterinary literature to date.

## Case description

### Case 1

A female neutered domestic shorthair cat, 11 years and 2 months of age, underwent a partial glossectomy to remove a partly exophytic, reasonably well demarcated, partially lobulated mass arising on the rostral aspect of the tongue (Figure 1). The mass was causing difficulties in eating, drinking and grooming. Physical examination at the time of presentation was otherwise unremarkable. Further investigation and staging were declined by the owner.

This excisional biopsy was submitted for histopathological assessment. Haematoxylin and eosin-stained 4 µm sections of the mass were reviewed by a pathologist (MJD), revealing a non-encapsulated, variably well demarcated, partially lobulated and infiltrative neoplastic mass, which was associated with focal areas of ulceration. The tumour cells were arranged in storiform and

interlacing bundles and streams, some with a wavy appearance, infiltrating between and sometimes entrapping pre-existing tissue structures, as well as extending along the interface with the surface epithelium in places. These tumour cells were spindle shaped, elongated or ovoid, and medium-to-large in size, with a small-to-moderate amount of cytoplasm and variably distinct cell margins (Figure 2). Their nuclei were ovoid-to-elongated and medium-to-large in size, with finely stippled chromatin and 1–2, sometimes fairly prominent, nucleoli. There was mild-to-moderate anisokaryosis and anisocytosis, with 22 mitotic figures seen in 10 high-power fields (HPFs;  $\times 400$ ). The mass appeared separated from the surgical margins in the sections examined, with caudal margins measuring a minimum of approximately 2 mm.

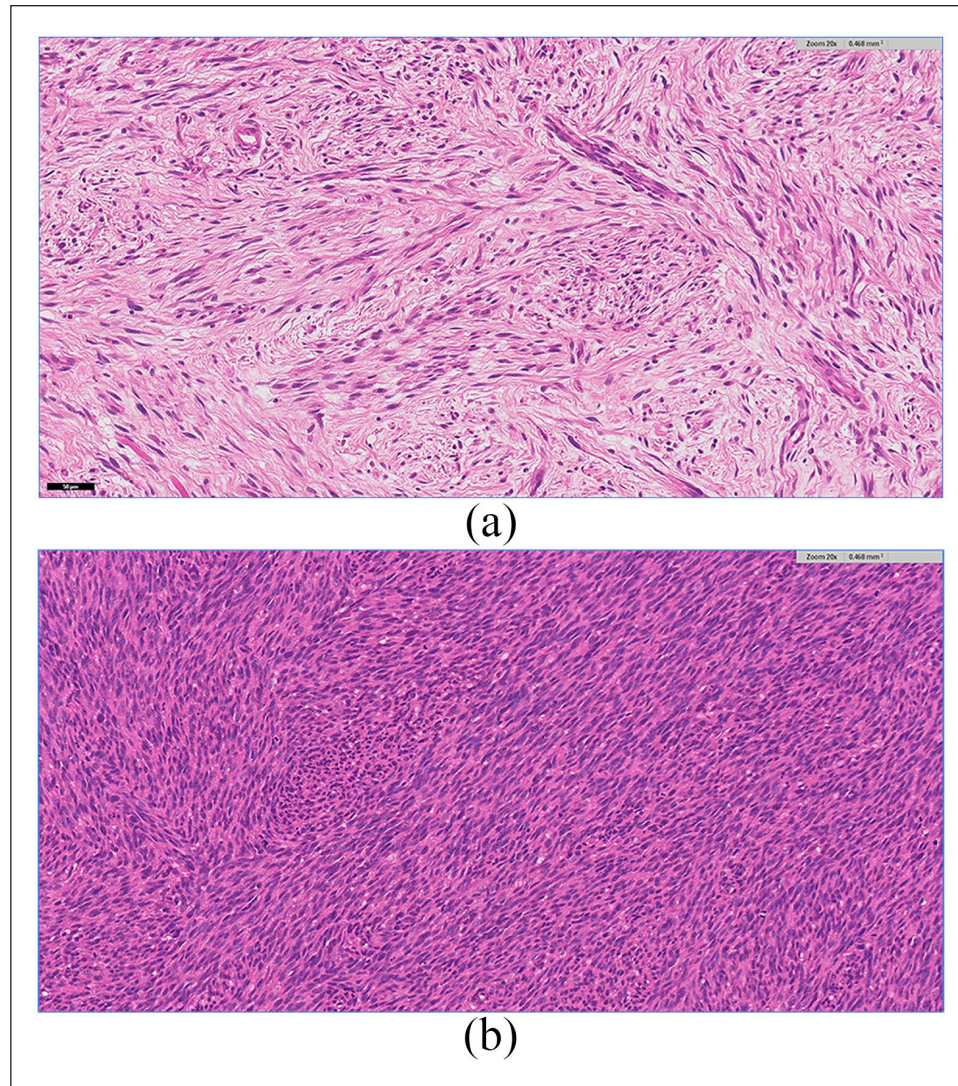
Immunohistochemical (IHC) staining of these sections revealed that the tumour cells demonstrated diffuse, strong positive cytoplasmic staining for the mesenchymal cell marker vimentin (monoclonal mouse antibody, 1:200), and were negative staining for the epithelial cell marker pancytokeratin (clone AE1/AE3, monoclonal mouse antibody, 1:200), consistent with a sarcoma. The tumour cells also demonstrated strong positive cytoplasmic staining for S100 (polyclonal rabbit antibody, 1:800), but were negative staining for the melanocytic marker MelanA (monoclonal mouse antibody: 1:800), the smooth muscle marker actin (monoclonal mouse antibody, 1:400) and the non-specific muscle marker desmin (monoclonal mouse antibody, 1:100), making an amelanotic melanoma, leiomyo/sarcoma and rhabdomyosarcoma unlikely, respectively (Figure 3). The histological appearance and IHC staining pattern were most suggestive of a feline PNST, with histological features suggestive of malignancy (based on a mitotic count of  $>4$  per 10 HPFs).<sup>11</sup>

The patient recovered well postoperatively and its ability to eat, drink and groom was improved compared with the preoperative period. Healing of the surgical site post-partial glossectomy was uneventful. The patient presented 6 months later owing to the recurrence of a mass, similar to that previously resected, at the rostral part of the tongue. The mass was interfering with eating and grooming, and the patient was euthanased; no post-mortem examination or biopsies were performed.

### Case 2

A male neutered domestic shorthair cat, 13 years and 4 months of age, underwent incisional biopsies for a mass arising on the rostral aspect of the tongue, to determine the nature of the mass. This was followed by an excisional biopsy with 1 cm gross margins, with curative intent (Figure 4). The mass had first been noted by the owner 1 week prior to initial presentation. Grossly, this mass measured approximately 1 cm in diameter, and was firm and well-demarcated from the surrounding





**Figure 2** (a,b) Histopathological appearance of the mass from case 1; two fields of varying cellularity, demonstrating spindle-shaped cells arranged in interlacing bundles and streams. Haematoxylin and eosin stain ( $\times 20$  magnification)

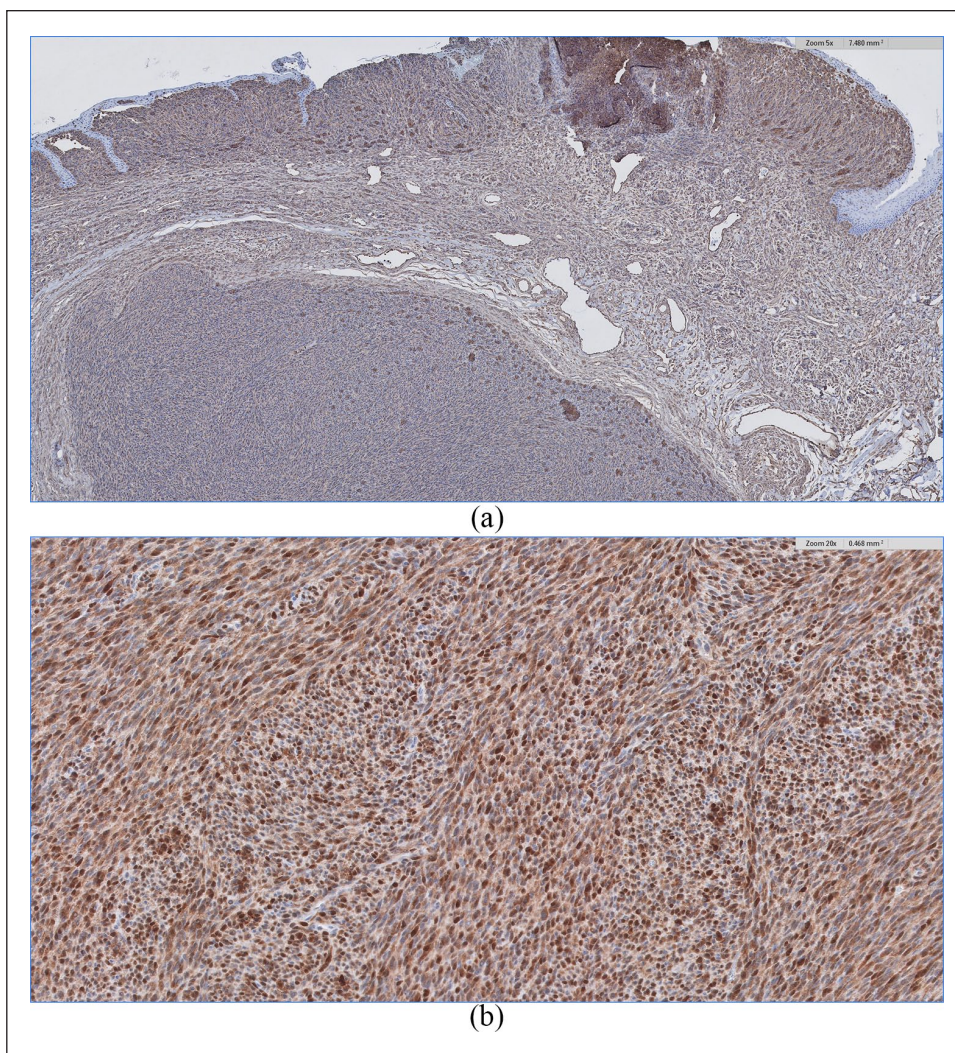
tissues, partly raised above the lingual mucosa, and with a smooth, although focally ulcerated surface. The cat was in good body condition and physical examination at the time of presentation was unremarkable. Preoperative blood screening revealed a mild azotaemia, with urinalysis demonstrating a specific gravity of 1.041. Further investigation and staging were declined by the owner.

Both sets of samples underwent histopathological assessment as described above, followed by IHC staining of the original incisional biopsy samples. Microscopic examination revealed a non-encapsulated, moderately cellular and infiltrative neoplastic mass, composed of tumour cells arranged in storiform and interlacing bundles and streams. Very similar in appearance to those described previously, these tumour cells were also spindle-shaped, elongated or ovoid, and medium-to-sometimes large in size, with a small-to-moderate

amount of cytoplasm and variably distinct cell borders. Nuclei were ovoid-to-elongated and medium-to-large, with finely stippled chromatin and 1–2 variably prominent nucleoli. Within this mass two mitotic figures were seen in 10 HPFs ( $\times 400$ ), and there were occasional small foci of necrosis also present. IHC staining revealed the tumour cells demonstrated positive staining for vimentin and for S100, and were negative staining for pancytokeratin, smooth muscle actin and desmin. The histological appearance and IHC staining pattern are most suggestive of a feline PNST.

Following the results of the initial incisional biopsy, this patient was anaesthetised 3 weeks later and a partial glossectomy was performed, with an oesophageal feeding tube placed at the time of surgery. During recovery, the patient excessively chewed at the tongue, resulting in haemorrhage from the wound and self-removal of the





**Figure 3** Positive immunohistochemical staining of the neoplastic cells from the mass from case 1. (a) Vimentin ( $\times 5$  magnification); and (b) S100 ( $\times 20$  magnification)

sutures; the cat was sedated to allow examination of the wound and subsequently re-anaesthetised for re-suturing of the surgical site. The following day, the patient developed hypersalivation followed by an increased respiratory effort, and thoracic radiography under sedation revealed a diffuse alveolar pattern. Treatment with intravenous cefuroxime (Zinacef; GlaxoSmithKline) and enrofloxacin (Baytril; Bayer) was initiated and the patient stabilised overnight. The following morning, the patient developed open-mouth breathing and was placed in an oxygen cage; it subsequently became apnoeic. On intubation, large volumes of pulmonary fluid were apparent; cardiopulmonary resuscitation was unsuccessful. A lateral thoracic radiograph taken post mortem showed changes suggestive of marked pulmonary oedema but no mass lesions. The owner declined further post-mortem investigations.

## Discussion

These two feline lingual sarcomas have striking gross, histological and immunohistological staining characteristics in common, despite such tumours being rarely described in the veterinary literature. Both masses arose on the rostral tongue, were partly raised above the surface and were roughly spherical in shape. Their histological and IHC staining features are most suggestive of a perineural origin, and at least one (if not both) appears to be histologically malignant.<sup>11</sup> The cat with the histologically malignant neoplasm presented 6 months after resection with apparent local recurrence (although no biopsy was performed to confirm this), which would be consistent with the expected biological behaviour of these tumours. To our knowledge, this is the first report of a malignant PNST arising in the tongue of a cat.



**Figure 4** Gross appearance of the lingual mass preoperatively (case 2)

Two cases of feline PNSTs involving the tongue are described in Schulman et al,<sup>11</sup> both of which were histologically benign. In the current report, one case had a mitotic count of 22 per 10 HPFs, which would be classified as histologically malignant. The second mass had a mitotic count of just two per 10 HPFs but with areas of necrosis and high cellularity; these are subjective criteria that might also indicate malignancy.

Regardless of histological malignancy, in cats these tumours have the potential for local recurrence but appear very unlikely to metastasise. Therefore, complete excision where anatomically feasible is likely to prove curative for these patients, with careful monitoring for any evidence of local recurrence. Partial glossectomy provides a reasonable chance of cure, assuming that tongue functionality can be maintained and hence quality of life.

As illustrated by these two cases, undertaking a partial glossectomy is not without the potential for a significant impact on the quality of life for the patient postoperatively; however, the very presence of the mass itself may cause difficulty in eating, drinking and grooming, and thus may also have a negative impact on quality of life. Therefore, in such cases, it is the primary veterinarian's responsibility to assess the potential benefits and risks to any individual presenting with such a lingual mass and to proceed accordingly, taking into account the owner's wishes, financial restraints and the feasibility of the surgery, as well as the possible benefits and risks to the patient.

PNSTs are subclassified based on their presumed cell of origin, in humans, into several distinct entities including schwannoma (and malignant schwannoma), neurofibroma (neurofibrosarcoma) and malignant PNSTs, as these tumours may potentially arise from Schwann cells, perineural cells or intraneural fibroblasts. Feline PNSTs do not fit well into this classification system, as the precise cell of origin is often uncertain in veterinary

species and criteria for their subclassification are not well established. Veterinary classification systems tend to simply subdivide these tumours into benign or malignant, with both sets demonstrating S100 positivity but variable staining glial fibrillary acidic protein on IHC staining.

In cats, PNSTs most commonly arise in the skin and subcutis of the head, neck and limbs, including the periocular region, lips and the paws,<sup>11</sup> less often within skeletal muscle, mucosal membranes, in the perirenal region and from spinal canal,<sup>12</sup> with case reports of such tumours also arising within the gastrointestinal tract and urinary bladder.<sup>13,14</sup> Based on larger-scale studies of feline PNSTs arising at various anatomical sites, the malignant form appears more likely to recur, although local recurrence is a feature of benign forms also, and the mitotic count is not predictive of potential for local recurrence.<sup>11</sup> Metastasis is rarely reported for these tumours; when it does occur, there is potential for involvement of the regional lymph nodes and lung.<sup>15</sup>

Oral forms of PNSTs in other veterinary species also appear rare, with one canine case of a lingual PNST included in Schöniger and Summers' study,<sup>6</sup> one case report of a canine lingual ganglioneuroma,<sup>5</sup> and various neoplastic or atypical perineural cell proliferative disorders described in horses, although some are of uncertain cell origin.<sup>8–10</sup> In humans, in addition, there are also non-neoplastic mass lesions that arise on the tongue and are associated with the taste buds, which need to be histologically differentiated from PNSTs, termed subgemmal neurogenous plaques.<sup>16</sup>

## Conclusions

Although the tongue is an unusual site, PNSTs can occur and should be considered as a potential differential diagnosis for lingual masses in the cat. Histopathological assessment and potentially immunohistochemical staining are required for a diagnosis, and to subclassify into benign and malignant forms. Based on larger-scale studies of feline PNSTs arising at various sites, these tumours have the potential for local recurrence but are unlikely to metastasise; therefore, complete excision can prove curative if the location of the mass on the tongue makes this feasible.

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**Ethical approval** This work involved the use of non-experimental animal(s) only (owned or unowned), and followed established internationally recognised high standards ('best practice') of individual veterinary clinical patient care. Ethical approval from a committee was not necessarily required.

**Informed consent** Informed consent (either verbal or written) was obtained from the owner or legal custodian of all animal(s) described in this work for the procedure(s) undertaken. For any animals or humans individually identifiable within this publication, informed consent for their use in the publication (verbal or written) was obtained from the people involved.

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