Case Report

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Nasal telangiectatic osteosarcoma with direct extension to the brain in a domestic shorthair cat

Anahi Souza Silva[1,2], Ana Lívia Vasconcelos de Sousa[1,2], Nanci Sousa Nilo Bahia Diniz[2,3], Isabel Luana de Macêdo[1,2], Jair Duarte da Costa Júnior[2,3], Christine Souza Martins[2,3], Cristiano Barros de Melo[2] and Márcio Botelho de Castro[1,2,3]

Abstract

Case summary This case report describes the clinical and pathological features of telangiectatic osteosarcoma (TOS) with brain invasion in a 4-year-old female domestic shorthair cat. The cat presented with respiratory distress, epistaxis, anorexia and significant nasal obstruction. A rhinoscopy revealed an amorphous white neoformation in the left nasal cavity. Despite treatment, the cat's condition deteriorated and it succumbed to the disease. Necropsy and histopathologic examination revealed an infiltrative malignant neoplasm with osteoid matrix and sarcomatous cells surrounding blood-filled non-vascular spaces. Immunohistochemistry showed positive staining for bone cell markers and vimentin, while endothelial markers were negative, confirming TOS.

Relevance and novel information Nasal diseases in cats present significant diagnostic challenges due to similar clinical signs, such as respiratory distress and nasal discharge. Nasal osteosarcomas are rare, and TOS is the rarest subtype, characterized by blood-filled spaces within an aggressive osteolytic lesion. This case highlights the diagnostic complexities and poor prognosis associated with TOS in cats, emphasizing the need for advanced imaging and immunohistochemical tests for accurate diagnosis. Given the aggressive nature and rapid progression of TOS, it should be considered in differential diagnoses of feline nasal obstructive lesions.

Keywords: Tumor; neoplasm; bone; immunohistochemistry

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Introduction

Cats have gained increasing prominence as companion animals, a trend which is driven by modern lifestyles, urbanization and societal advancements. This closer relationship with humans has allowed for more comprehensive health monitoring and a growing demand for specialized treatments for feline-specific diseases. In feline practice, nasal disorders present unique challenges for owners and clinicians, as many common conditions affecting the nasal cavity manifest with similar clinical signs, including respiratory distress, stridor, sneezing and nasal discharge.[1]

Epithelial neoplasms and lymphomas are among the most common neoplasms of the nasal cavity in cats.[1,2]

[1]Laboratory of Veterinary Pathology and Forensics, College of Agronomy and Veterinary Medicine (FAV), University of Brasília (UnB), Asa Norte, Federal District, Brazil
[2]Graduate Program in Animal Sciences, University of Brasília (UnB), ICC Sul, Asa Norte, Brasilia, Federal District, Brazil
[3]Veterinary Teaching Hospital, College of Agronomy and Veterinary Medicine (FAV), University of Brasília (UnB), Asa Norte, Federal District, Brazil

Corresponding author:
Márcio Botelho de Castro DVM, PhD, Laboratory of Veterinary Pathology and Forensics, College of Agronomy and Veterinary Medicine (FAV), University of Brasília (UnB), Via L4 Norte, Asa Norte, Federal District, 70910-900, Brazil
Email: mbcastro@unb.br

In contrast, nasal osteosarcomas (OSs) are exceedingly rare in domestic cats.[3] OSs are the most common primary bone tumors in domestic animals and humans,[4] constituting the majority of primary bone tumors in cats (70–80%),[5,6] with an estimated incidence of 4.9 per 10,000 cases.[7] The preferred anatomical sites for OS in cats are not well established owing to the limited number of large-scale studies,[4] though they have been reported in both the axial skeleton (including the skull, maxilla, mandible and vertebrae) and the appendicular skeleton (such as long bones and stifle joints).[5,6] Histopathologically, OS subtypes are categorized as osteoblastic (productive or non-productive), poorly differentiated, chondroblastic, fibroblastic, telangiectatic and giant cell types.

Telangiectatic osteosarcoma (TOS) is the rarest subtype of OS, and is characterized by large, blood-filled cavities within an aggressive osteoproliferative and osteolytic lesion.[4,8] TOS is an infrequent tumor in the veterinary literature, with only two cases previously documented in cats.[9,10] This report presents, for the first time, a detailed description of the clinical, cytological, pathological and immunohistochemical findings of TOS with brain invasion in a domestic shorthair cat.

Case description

A 4-year-old female spayed cat with a body weight of 3.4 kg was referred for treatment for respiratory distress, epistaxis, anorexia and dark stools for 2 months at the Small Animal Veterinary Teaching Hospital, University of Brasilia (UnB), Brazil. In the clinical assessment, the animal showed nasal secretion with streaks of blood and respiratory stridor. Lymphopenia was detected (1344 cells/µl, reference interval 1500–7000), and urinalysis and blood chemistry (urea, creatinine, alanine aminotransferase, alkaline phosphatase, bilirubin, phosphorus, total protein and fractions) were unremarkable.

CT of the face and skull revealed a significant nasal cavity obstruction (Figure 1a), affecting 90% of the left side and 40% of the right side (Figure 1b). The thoracic radiograph was unremarkable. A rhinoscopy evaluation detected an amorphous white neoformation in the left nasal cavity (Figure 1c). Fine-needle biopsy aspiration of the nasal mass and cytological examination showed round to spindle-shaped atypical cells with poorly defined eosinophilic cytoplasm, nuclei with coarse chromatin and multiple small nucleoli, consistent with a malignant mesenchymal neoplasm (Figure 1d).

After this evaluation, the cat experienced profuse bleeding from the left nostril and marked respiratory distress, necessitating a cricothyroidotomy to relieve the dyspnea. Despite treatment with dipyrone (25 mg/kg q24h) and methylprednisolone succinate (2 mg/kg IM once a week), the cat's condition worsened, with increased respiratory distress, serosanguineous secretion from the left eye and an ulcerated lesion on the nasal plane. A follow-up CT scan showed the progression of the neoplasm and osteolysis of the left maxilla, palate and cribriform plate, including invasion into the cranial vault. After a 15-day clinical course following the initial assessment, the cat's condition continued to deteriorate. As a result, euthanasia was elected 12 h after the CT to avoid further suffering.

During necropsy, a focally extensive, circular and diffusely ulcerated lesion with abundant mucopurulent secretion was found on the nasal plane, with bone lysis communicating with the left nasal cavity (Figure 2a). An infiltrative dark red mass affected the nasal cavity, primarily on the left side, completely replacing the nasal turbinates and extending caudally toward the larynx. The cribriform plate exhibited complete bone lysis, with the neoplasm infiltrating the frontal lobe of the brain (Figure 2b). Tissue samples were collected, fixed in 10% buffered formalin (pH 7.0), routinely processed, embedded in paraffin and sectioned at 5 µm thickness for staining with hematoxylin and eosin (H&E).

Histologically, an unencapsulated, infiltrative and expansive malignant neoplasm was observed, characterized by trabeculae of osteoid and mineralized matrix and bundles of sarcomatous cells surrounding and lining blood-filled spaces (Figure 2c). The neoplastic cells were immersed within a matrix, displaying round central nuclei with finely stippled chromatin and poorly defined basophilic cytoplasm (osteoblasts) or composing some bundles of atypical spindeloid cells (Figure 2d). In addition, a mild lymphohistiocytic and plasmacytic inflammatory infiltrate permeated the neoplastic proliferation. The brain's left frontal lobe showed extensive infiltration by neoplastic cells around large vascular beds and bone trabeculae. No other gross or histologic findings were observed in other organs and tissues in the cat.

Tumor samples were also submitted for immunohistochemistry using the biotin peroxidase–streptavidin method (ImmunoDetector DAB, HRP; BioSB). CD31 (dilution 1:100, CD31, Clone JC/70A; Dako), Von Willebrand factor (VWF; dilution 1:400 dilution, Clone F8/86; Dako), osteoblast marker (OBM; dilution 1:200, Clone ZNS-5; Abcam), osteopontin (OSP; dilution 1:400, Polyclonal; Abcam) and vimentin (VIM; dilution 1:400, Clone Vim 384; Dako) antibodies were used on neoplasm histological sections after antigen unmasking was performed in a pressure cooker and incubated overnight. Neoplastic cells showed immunostaining for OBM (Figure 3a), OSP (Figure 3b) and VIM (Figure 3c). Cells lining the blood-filled spaces within the neoplasm revealed no immunoreactivity for CD31 and VWF (Figure 3d).

Discussion

OS is the most common primary bone neoplasm in cats, accounting for approximately 80% of feline bone tumors.[2,11] Neoplasms involving the nasal cavity and

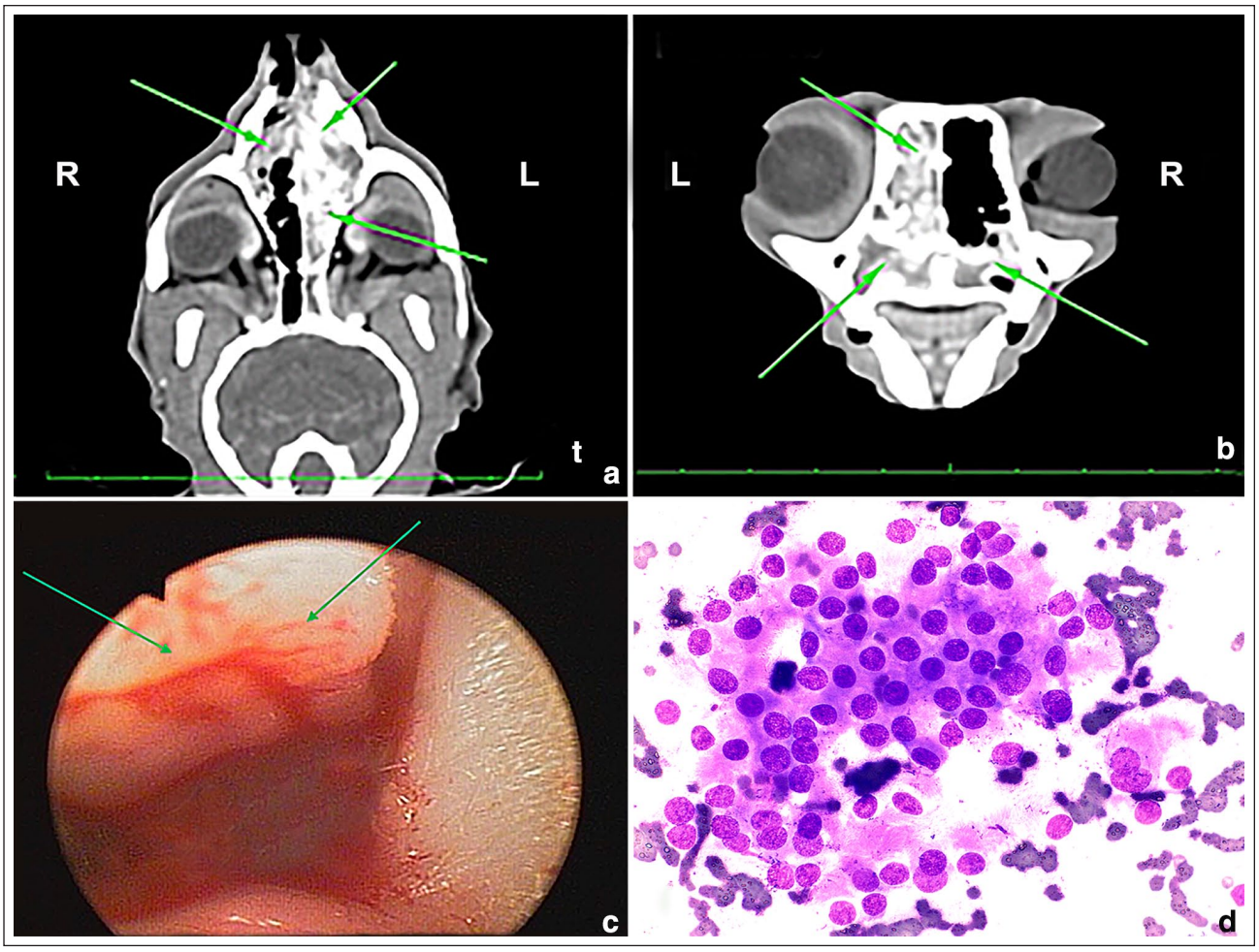

Figure 1 Domestic shorthair cat with nasal telangiectatic osteosarcoma. (a) CT, dorsal plane. Areas of high uptake in the region of the nasal and ethmoid sinuses (arrows) are associated with isodense content and mural thickening of the nasal turbinates. (b) CT, transverse plane. Involvement of both nasal cavities (arrows), with severe obstruction of the left side. (c) Rhinoscopy of the left nasal cavity. White mass occluding the airway (arrows). (d) Fine-needle biopsy aspiration of the nasal mass. A cluster of round to spindle-shaped atypical cells with nuclei with coarse chromatin, multiple small nucleoli, moderate anisocytosis and poorly defined eosinophilic cytoplasm (Panotic stain, objective × 40)

paranasal sinuses are even more uncommon in this species, representing only approximately 1–5% of feline tumors,[12] and are typically lymphomas or have an epithelial origin.[13] While facial sarcomas are rare, they should be considered in the differential diagnosis of facial deformity, bone lysis or proliferation, unilateral or bilateral epistaxis, and upper airway stridor.[3,13] Nasal OS in cats is particularly rare,[3] and the telangiectatic subtype is exceptionally uncommon, with only two cases reported in the veterinary literature.[9,10]

The cat in this study was older than the one in a previously reported case of TOS,[9] but younger than in a case of undifferentiated OS,[3] suggesting that age has not yet been established as a predisposing factor for TOS. The clinical signs observed in this cat, including facial swelling, asymmetry and nasal obstruction, were consistent with those reported in other TOS cases.[3,9,10] Generally, clinical signs are primarily attributed to nasal obstruction, and despite cerebral tumor invasion in this case, the cat did not exhibit any neurologic signs.

Cytologic evaluation of the nasal mass in this cat did not provide a definitive diagnosis of TOS but did indicate a malignant neoplasm of mesenchymal origin. Cytologic evaluation can be challenging in differentiating between various mesenchymal tumors, often requiring histopathologic analysis for definitive classification, as many of these neoplasms lack distinctive cytologic characteristics.[14] In contrast, cytologic diagnosis of bone lesions in dogs has shown a tumor-type identification rate of 50% and an accuracy of up to 80% in detecting lesions.[15] Similarly, in this case, cytology identified a neoplasm of mesenchymal origin in the cat.

Grossly, TOS can resemble hemangiosarcoma (HS) owing to its multilocular hemorrhagic formations. This

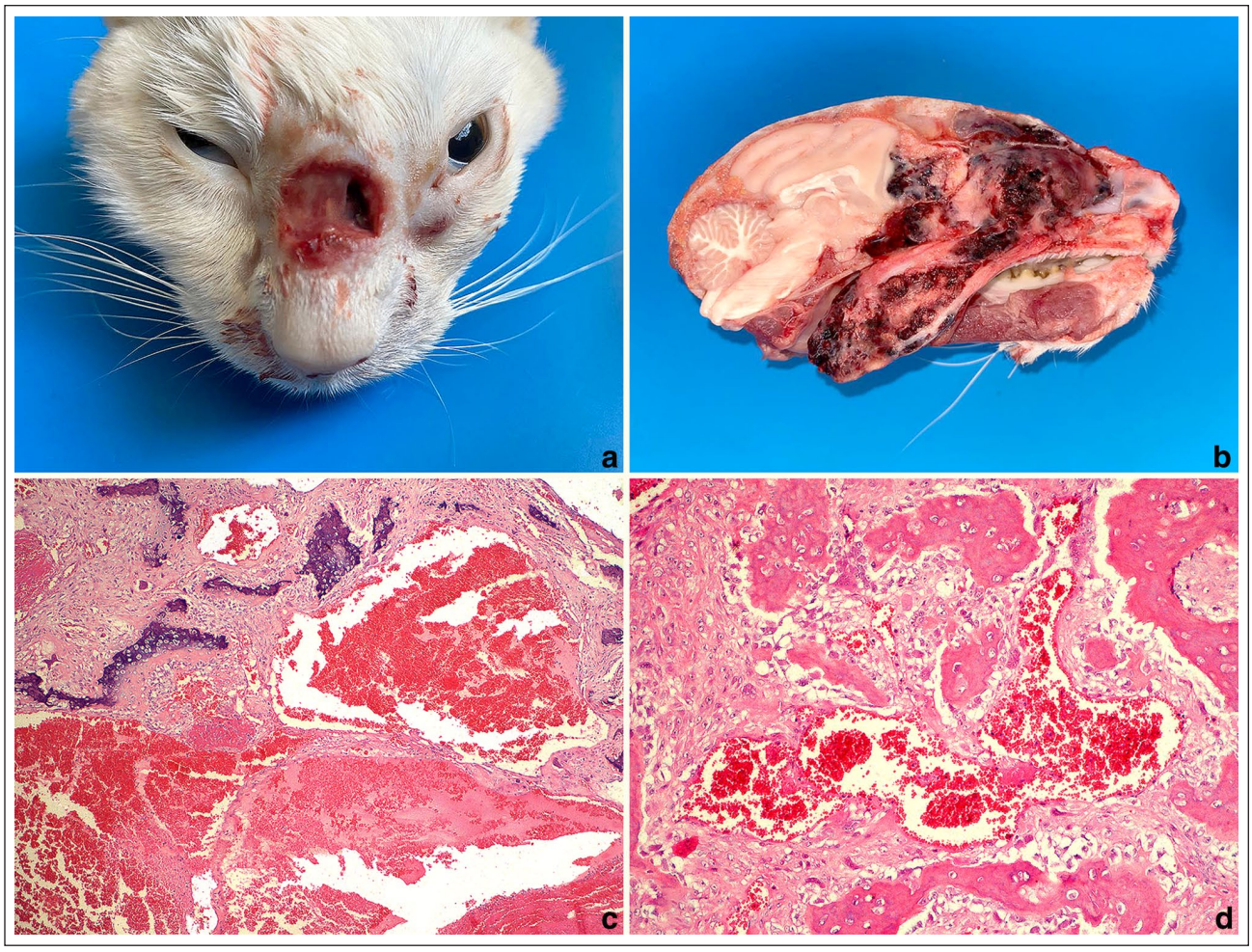

Figure 2 Domestic shorthair cat with nasal telangiectatic osteosarcoma. (a) Ulcerated skin lesion with bone exposure and lysis, communicating with the left nasal cavity. (b) Dark red neoplastic mass in the left nasal cavity, mainly replacing the nasal turbinates, expanding caudally toward the larynx and infiltrating the brain's frontal lobe. (c) Blood-filled non-vascular spaces within neoplastic bone proliferation (hematoxylin and eosin [H&E], objective × 4). (d) Trabeculae and bundles of neoplastic cells surrounding blood-filled non-vascular spaces (H&E, objective × 10)

similarity may account for the significant bleeding observed during the biopsy procedure and the stenosis of the left nasal passage in this case. However, the differentiation between TOS and HS is achieved microscopically by identifying an osteoid matrix interspersed among the variably sized vascular spaces lined with malignant pleomorphic mesenchymal cells.[4] The negative immunostaining of neoplastic cells lining blood-filled spaces for VWF[16] and the endothelial marker CD31 was crucial in distinguishing TOS from HS and supported the diagnosis in this cat. In addition to the typical histologic features of OS, the immunolabeling of neoplastic cells with the OBM,[17] bone protein OSP[18] and VIM confirmed the bone origin of the nasal neoplasm. These findings are also significant in diagnosing highly vascularized OS, which is differentiated by vascular spaces lined by endothelial cells immunostained for VWF, which was not observed in this cat.

Although metastasis was not reported in the two previously documented cases of TOS in cats,[9,10] there was a notable direct extension of the neoplasm into the central nervous system in this case. This form of neoplastic invasion, characterized by direct extension into the nervous system, is more commonly observed in tumors originating from the pituitary gland and nasal cavity.[19] In contrast, OS typically disseminates via the hematogenous route to the lungs.[4,20]

The definitive diagnosis of nasal and paranasal tumors poses significant challenges because of their location and the need for specific examinations such as CT and immunohistochemical tests,[2] which are often conclusive only through necropsy. In this case, the

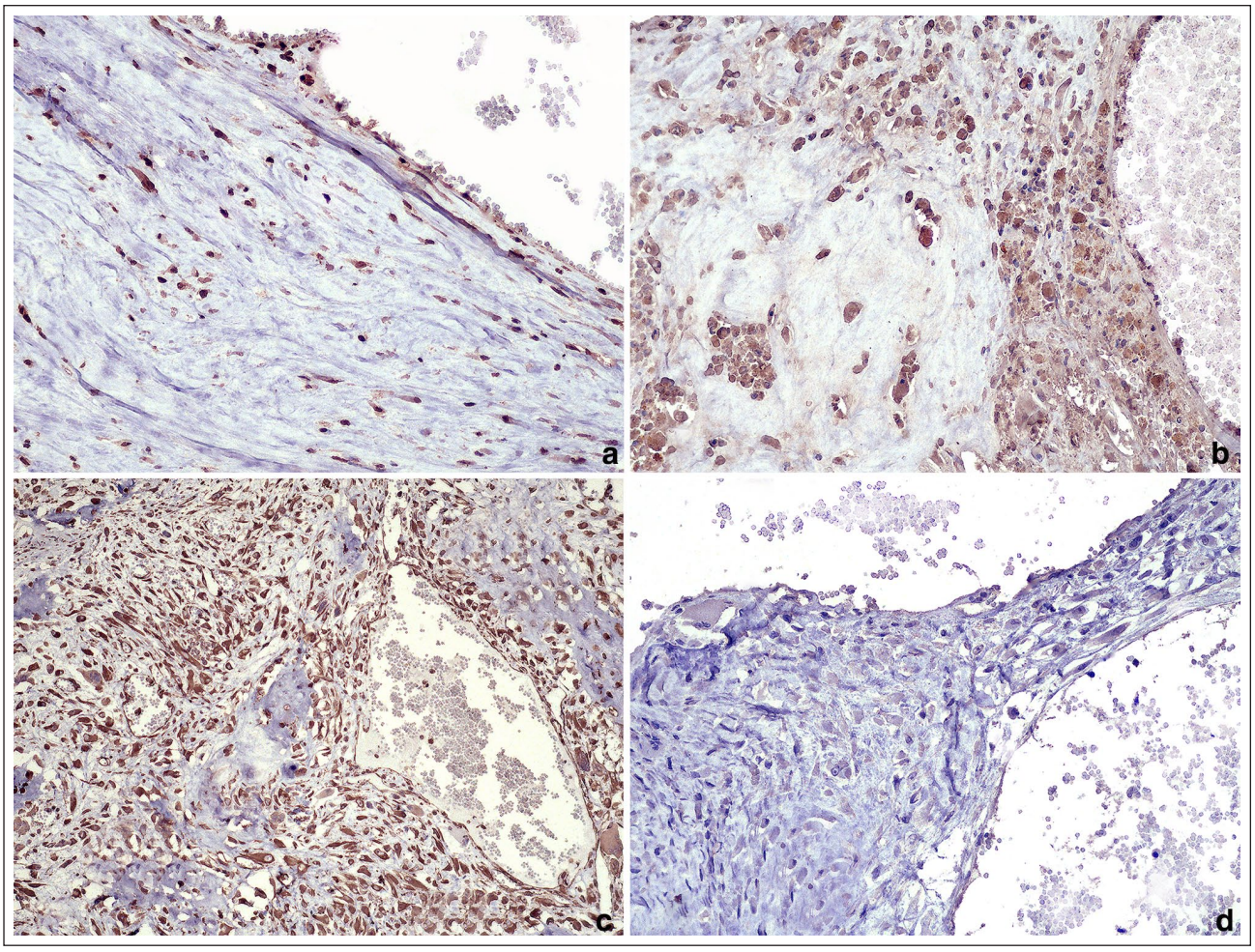

Figure 3 Domestic shorthair cat with nasal telangiectatic osteosarcoma: immunoperoxidase stain. (a) Immunostaining of tumoral cells within the neoplasm and lining blood-filled non-vascular spaces (osteoblast marker, objective × 20). (b) Tumoral cells within the trabecula strongly immunoexpressing bone protein (osteopontin, objective × 20). (c) Neoplastic cells showing marked immunostaining for a mesenchymal marker (vimentin, objective × 10). (d) Lack of immunostaining of cells lining blood-filled non-vascular spaces (Von Willebrand factor, objective × 20)

diagnosis was guided by imaging examinations combined with cytopathology, histopathology and immunohistochemistry. The careful interpretation of tests is crucial when assessing nasal proliferative lesions as they may be secondary or concomitant to other conditions, such as inflammatory processes with opportunistic infections, which could lead to misdiagnosis. In addition, it is essential to differentiate between nasal proliferative lesions and other conditions, such as lymphomas, adenocarcinomas, nasopharyngeal polyps[1] and even cryptococcosis,[21,22] especially in cases presenting with epistaxis and respiratory difficulty with stridor.

Although the biological behavior of OS in cats, characterized by relatively low metastasis rates, differs from that observed in dogs,[11] TOS is associated with a poor prognosis in both dogs and humans.[4] In cats, further studies are needed owing to the limited information available on TOS affecting the nasal cavity and head. In this case, euthanasia was elected to avoid further suffering, given the unfavorable prognosis.[10]

Conclusions

The involvement of nasal, facial or other head structures presents a significant obstacle in the prognosis and treatment of TOS cases, as it often impairs essential functions such as breathing and eating, leading to rapid debilitation of the patient and worsening prognosis, ultimately resulting in rapid death. Despite its rarity, TOS should be considered a differential diagnosis in cats with obstructive processes of the nasal cavity. Moreover, this case of TOS offers a valuable opportunity for a comparative view of the neoplasm between cats and humans. This could provide valuable insights for both veterinary and human oncology, advancing our understanding of the diagnosis, prognosis and potential treatment strategies for this rare and aggressive neoplasm.

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical approval The work described in this manuscript involved the use of non-experimental (owned or unowned) animals. Established internationally recognized high standards ('best practice') of veterinary clinical care for the individual patient were always followed and/or this work involved the use of cadavers. Ethical approval from a committee was therefore not specifically required for publication in *JFMS Open Reports*. Although not required, where ethical approval was still obtained, it is stated in the manuscript.

Informed consent Informed consent (verbal or written) was obtained from the owner or legal custodian of all animal(s) described in this work (experimental or non-experimental animals, including cadavers, tissues and samples) for all procedure(s) undertaken (prospective or retrospective studies). No animals or people are identifiable within this publication, and therefore additional informed consent for publication was not required.

ORCID iDs Isabel Luana de Macêdo https://orcid.org/0000-0001-7327-9143
Márcio Botelho de Castro https://orcid.org/0000-0002-3996-0856

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