

Malignant perivascular wall tumor in a rainbow boa (*Epicrates cenchria*)¹

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ABSTRACT.- Silva M.B.G., Melo E.T., Rodrigues V.G., Frota M.L.S.L., Santos J.R.P., Evêncio-Neto, J., Souza F.A.L., & Mendonça, F.S. **Malignant perivascular wall tumor in a rainbow boa (*Epicrates cenchria*)**. *Pesquisa Veterinária Brasileira* 46:e07856, 2026. Universidade Federal Rural de Pernambuco, Rua Dom Manoel de Medeiros, s/n, Dois Irmãos, Recife, PE, 52171-900, Brasil. E-mail: francisco.alsouza@ufrpe.br, fabio.mendonca@ufrpe.br

A case of malignant perivascular wall tumor is described in a 20-year-old male rainbow boa (*Epicrates cenchria*) from a zoological collection. Due to the growth of a multilobulated neoplasm in the gingiva of the left upper maxillary region and the poor prognosis, the snake was euthanized. Grossly, other findings included multiple white, well-demarcated nodular masses within the subcutaneous tissue of the head and involving several blood vessels. Histologically, the masses consisted of neoplastic cells arranged in interwoven bundles and loosely organized streams supported by a variably collagenous stroma. Based on histomorphology, the neoplasm was classified as a grade II soft tissue sarcoma. Immunohistochemical evaluation for vimentin, pancytokeratin, Iba-1, S-100 and SOX10 did not demonstrate immunolabeling of neoplastic cells, while the immunolabeling was positive for α -SMA. These histomorphological features were consistent with those of a malignant perivascular wall tumor. To the authors' knowledge, this is the first report of a metastatic malignant perivascular wall tumor reported in a rainbow boa.

INDEX TERMS: Reptiles, oral cavity tumors, mesenchymal soft tumors, oncology.

RESUMO.- [Tumor de parede perivascular maligno com metástase na cavidade oral em jibóia-arco-íris (*Epicrates cenchria*).] Descreve-se um caso de tumor maligno da parede perivascular em uma jibóia-arco-íris macho, com 20 anos de idade (*Epicrates cenchria*), proveniente de uma coleção zoológica. Devido ao crescimento de uma neoplasia multilobulada na gengiva da região maxilar superior esquerda e ao prognóstico desfavorável, a serpente foi eutanasiada. Macroscopicamente, outros achados incluíram múltiplas massas nodulares brancas, bem delimitadas, no tecido subcutâneo da cabeça e envolvendo vários vasos sanguíneos. Histologicamente, as massas eram constituídas por células neoplásicas organizadas em feixes entrelaçados e frouxamente dispostos, sustentados por um estroma variavelmente colagenoso. Com base na histomorfologia, a neoplasia foi classificada como sarcoma de tecidos moles grau II. A avaliação imunohistoquímica para vimentina, pancitoqueratina, Iba-1, S-100 e SOX10 não demonstrou marcação imunológica das células neoplásicas, enquanto foi positiva para α -SMA. Essas características histomorfológicas são consistentes com um tumor maligno da parede perivascular. Este é o primeiro relato de um tumor maligno da parede perivascular metastático descrito em uma jibóia-arco-íris.

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INTRODUCTION

The rainbow boa (*Epicrates cenchria*) belongs to the genus *Epicrates* within the family Boidae, which also includes the genera *Boa* (e.g., *Boa constrictor*, common boa), *Chilabothrus* (e.g., *Chilabothrus angulifer*, Cuban boa), *Corallus* (e.g., *Corallus batesii*, emerald tree boa), and *Eunectes* (e.g., *Eunectes murinus*, green anaconda) (Itis 2014). Members of the family Boidae are primarily distributed throughout the American continent, with records registered on all continents (GBIF Secretariat 2026a). In contrast, the genus *Epicrates* has a more restricted distribution, occurring in Florida (USA), Costa Rica, Panama, Central and South America (except Chile and Uruguay), and Poltava (Ukraine) (GBIF Secretariat 2026b). In Brazil, *Epicrates cenchria* is widely distributed throughout the Amazon region and the northern portion of the Atlantic Forest (Nogueira et al. 2019).

Although neoplasms are considered uncommon in snakes, their occurrence has been increasingly recognized in both free-ranging and captive animals. Among boid snakes, neoplasms affecting the oral cavity represent one of the most frequently reported anatomical presentations (Garner et al. 2004). In these snakes, oral neoplasms are often diagnosed at advanced stages, potentially impairing food intake and leading to malnutrition or death, depending on the location and biological behavior of the tumor (Pereira et al. 2022). In addition, therapeutic approaches for these neoplasms remain poorly documented, and prognosis is largely influenced by tumor location, degree of malignancy, and stage of disease.

Among the neoplasms reported in reptiles, soft tissue sarcomas (STS) comprise a heterogeneous group of mesenchymal spindle-cell tumors for which definitive classification may be difficult based solely on histomorphology, particularly in highly anaplastic lesions. This group mainly includes fibrosarcomas, myxosarcomas, peripheral nerve sheath tumors (PNST), malignant peripheral nerve sheath tumors (MPNST), perivascular wall tumors (PWT), liposarcomas, malignant mesenchymomas, and undifferentiated pleomorphic sarcomas (UPS). Due to the considerable overlap in histological patterns, especially in poorly differentiated tumors, the term STS is widely adopted as a standard histopathological diagnosis (Dietz et al. 2016, Fonseca-Alves et al. 2026). In such cases, immunohistochemistry is frequently required to further characterize the cellular origin of the neoplasm and establish a more specific diagnosis (Kwon et al. 2021).

Within the spectrum of STS, perivascular wall tumors (PWT) are extremely rare neoplasms derived from the cellular components of the vascular wall, excluding endothelial cells (Avallone et al. 2007). The present study describes the pathological aspects of a metastatic malignant perivascular wall tumor involving the oral cavity of a rainbow boa.

MATERIALS AND METHODS

This study was exempt from approval by an Animal Ethics Committee because it involved the use of an animal carcass, in accordance with the annex of CONCEA Normative Resolution No. 55, of October 5, 2022, which establishes the Brazilian Guidelines for the Care and Use of Animals in Teaching or Scientific Research Activities (DBCA). In addition, according to Article 22, Section V, of ICMBio Ordinance No. 748/2022, SISBIO authorization was not required because the biological samples originated from a wild animal maintained under *ex situ* conditions.

A 20-year-old male rainbow boa (*Epicrates cenchria*) from a zoological collection was presented with progressive swelling of the left maxillary region associated with an ulcerative oral lesion. The lesion showed rapid progression over approximately 10 days and was accompanied by anorexia and progressive clinical deterioration. Due to the unfavorable clinical condition and evident signs of distress, euthanasia was elected as a humane measure. The carcass was submitted to a complete necropsy workup, and samples from the neoplasms, as well as samples from the CNS, heart, lungs, liver, small and large intestines, kidneys, and testes, were collected, fixed in 10% neutral buffered formalin, and routinely processed for histopathology.

Immunohistochemistry (IHC) was performed on formalin-fixed, paraffin-embedded tissue sections using the following primary antibodies: anti-vimentin, anti-pancytokeratin, anti-Iba-1, anti-SOX10, anti-S-100 and anti-smooth muscle actin. Information regarding clones, dilutions, and manufacturers is provided in Table 1. For anti-vimentin, anti-pancytokeratin, anti-Iba-1, and anti-SOX10, the following protocol was performed: After deparaffinization and rehydration, antigen retrieval was performed according to the manufacturer's recommendations for each antibody (Target Retrieval Solution High pH, K800021-2 EnV FLEX+, High pH Link, Agilent DAKO). Endogenous peroxidase activity was blocked with hydrogen peroxide, followed by incubation with the primary antibodies at the respective working dilutions (EnVision™ FLEX Peroxidase-Blocking Reagent SM801, K800221-2 EnV FLEX+, High pH Link, Agilent DAKO). Afterward, the sections were rinsed in Tris solution (pH 7.4) and treated with a serum-free protein block to prevent non-specific reactions (Agilent Dako, X0909). The primary antibodies were incubated for 18 hours at 4°C. For amplification and detection, EnVision FLEX/HRP, K800221-2 (Agilent Dako), and diaminobenzidine chromogen (EnVision FLEX DAB+ Chromogen, DM827, K800221-2 Agilent DAKO) were used. Appropriate positive and negative controls were included in all reactions, and slides were counterstained with Harris hematoxylin. Staining for anti-S-100 and anti-smooth muscle actin was performed on histological sections 2,5 µm thick using the BenchMark GX system (Ventana Medical Systems, Roche Diagnostics) and the ultraView Universal DAB Detection Kit (Ventana Medical Systems, Roche Diagnostics). Ready-to-use (RTU) primary antibodies were used in accordance with the respective manufacturers' specifications. The steps of

deparaffinization, antigen retrieval, endogenous peroxidase blocking, primary antibody incubation, and detection were performed automatically by the instrument, following standardized protocols for each antibody. Incubation with the primary antibody was performed for 4 and 16 minutes for anti-S-100 and anti-smooth muscle actin, respectively. Immunoreactivity was visualized using the 3,3'-diaminobenzidine (DAB) chromogen, followed by hematoxylin counterstaining. Reaction controls included positive control tissues for each marker and negative controls, in which the primary antibody was replaced by the corresponding diluent. The slides were evaluated via light microscopy, assessing the presence, distribution, and localization of immunostaining against the expected pattern for each marker.

RESULTS

Grossly, a multilobulated gingival neoplasm was observed in the region of the left mucocutaneous junction of the upper maxilla, extending to and firmly attached to the palate (Fig. 1 and 2). The mass measured $1.5 \times 1.2 \times 0.6$ cm and was firm, pink, and markedly vascularized, with multifocal ulcerated areas on the surface. On cut section, the neoplasm was homogeneous and white. An additional nodular lesion was identified within the subcutaneous tissue of the head, located dorsolaterally and caudal to the left eye, measuring $1.2 \times 1.4 \times 0.5$ cm.

Similar nodular lesions were also observed associated with large vessels at the base of the heart. In the left aortic arch, there was an expansive, irregular, firm, white nodule measuring $2.5 \times 1.5 \times 1.0$ cm, with a smooth and homogeneous cut surface. In the right aortic arch, two nodules with similar gross characteristics were present, the largest measuring $2.0 \times 2.1 \times 2.0$ cm (Fig. 3). Additionally, in the dorsal aorta near the stomach, there was an expansive white nodule measuring $1.5 \times 1.0 \times 0.6$ cm. The mass was firm, smooth, and, after formalin fixation and sectioning, displayed a homogeneous white cut surface, with the affected vessel observed traversing the center of the lesion (Fig. 4 and 5).

Histologically, all lesions, including those affecting gingiva, subcutaneous tissue, and arteries, shared a similar morphological pattern characterized by a well-demarcated, nodular, non-encapsulated, expansile mesenchymal neoplastic proliferation (Fig. 6). Neoplastic cells were arranged in interwoven bundles and loosely organized streams supported by a mildly eosinophilic fibrillar stroma (Fig. 7). In the arterial lesions, the neoplasm was primarily located within the tunica adventitia, with infiltrative extension into the tunica media (Fig. 8). The neoplastic cells were pleomorphic, ranging from spindle-shaped to stellate, with indistinct cell borders and scant to moderate amounts of eosinophilic fibrillar cytoplasm. Nuclei were centrally located, elongated to spindle-shaped, basophilic, and contained finely stippled to coarsely clumped chromatin with prominent nucleoli. Marked anisocytosis and anisokaryosis were observed. Occasionally, multinucleated neoplastic cells were present. Multifocal areas of necrosis affected less than 50% of the tumor mass, and mitotic figures were infrequent, ranging from 0 to 2 per high-power field (Fig. 9). Immunohistochemically, the neoplastic cells showed no immunoreactivity for vimentin, pancytokeratin (AE1/AE3), Iba-1, S-100 or SOX10, while the immunolabeling was positive for α -SMA. No significant macroscopic or histological changes were observed in the remaining examined organs.

DISCUSSION

This report describes a rare malignant mesenchymal neoplasm with morphological features consistent with malignant perivascular wall tumor (MPWT). Mesenchymal neoplasms represent the most prevalent tumor category reported in boid snakes, accounting for 62.5% (45/72) of neoplasms diagnosed in this family, whereas STSs corresponded to 26.7% (12/45) of these mesenchymal tumors (Garner et al. 2004; Duke et al. 2022). Despite this relatively high frequency among boid neoplasms, reports of MPWTs in snakes remain extremely rare and poorly characterized histologically. A survey including 133 snakes from 65 species identified only nine neoplasms in Boidae, four of which were mesenchymal and three classified as STS, with no representatives of the genus *Epicrates* included (Duke et al. 2022).

Within the spectrum of STS, MPWTs originate from mural cells of blood vessels, excluding endothelial cells, and include neoplasms such as hemangiopericytoma, myopericytoma, angioleiomyoma, angiomyofibroblastoma, and angiofibroma (Avallone et al. 2007; Hendrick 2016; Fonseca-Alves et al. 2026). In domestic animals, these tumors are typically described in middle-aged to older dogs and are considered uncommon in other species (Hendrick 2016). Similarly, the advanced age of the snake described herein may have contributed to the development of the neoplasm. Histologically, the present case showed morphological features comparable to those described in canine PWTs, including interwoven bundles of spindle cells supported by a collagenous stroma and infiltrative growth associated with vascular structures (Fonseca-Alves et al. 2026). In addition, the multifocal vascular involvement and metastatic pattern observed in this case reinforce the malignant biological behavior of the neoplasm, a finding rarely documented in snakes, particularly in *Epicrates cenchria*.

STSs in reptiles may be histologically graded using the canine grading system proposed for cutaneous and subcutaneous STSs, which is based on the combined assessment of three parameters: tumor differentiation, mitotic count, and tumor necrosis. Tumor differentiation is scored according to the degree of resemblance between neoplastic cells and their normal mesenchymal counterparts, with scores of 1 for well-differentiated tumors, 2 for poorly differentiated but still classifiable neoplasms, and 3 for undifferentiated sarcomas. Mitotic activity is evaluated in 10 high-power fields ($400\times$ magnification; total area of 2.37 mm^2), with scores assigned as

follows: 1 for 0–9 mitoses, 2 for 10–19 mitoses, and 3 for more than 20 mitoses. Tumor necrosis is scored as 0 when absent, 1 when necrosis involves $\leq 50\%$ of the tumor, and 2 when necrosis exceeds 50% of the neoplastic mass. The final histological grade is determined by summing the individual scores, resulting in low-grade (Grade I; total score 2–3), intermediate-grade (Grade II; score 4–5), or high-grade (Grade III; score ≥ 6) sarcomas (Fonseca-Alves et al. 2026). Based on these criteria, the neoplasm described in the present case was classified as an intermediate-grade (Grade II) STS, with a total score of 5, characterized by poor differentiation, low mitotic activity, and necrosis affecting less than 50% of the tumor mass.

In dogs, PWTs are usually solitary, multilobulated, and range from circumscribed to infiltrative, with rare cases of metastasis. Microscopically, these tumors present variable arrangements, including nests or intertwined bundles of mesenchymal cells within a collagenous stroma and, occasionally, myxoid change (Ossiboff 2018). Cells can vary from thick to thin, spindle-shaped to almost pyriform; cellular atypia, the number of mitoses, and multinucleated forms are uncommon in the primary tumor but can increase with each recurrence. The neoplasm may be well demarcated from the surrounding tissue, but it often invades along fascial planes, leading to frequent recurrences (Hendrick 2016). Although, in the present case, all lesions shared the same histomorphology despite being metastatic lesions. In snakes, neoplastic spindle cells often organize in short fascicles or spirals around blood vessels, occasionally accompanied by a loosely organized mucinous matrix, features observed in the present case (Dietz et al. 2016).

In reptiles, neoplastic diagnoses of STSs are primarily histopathological, as immunohistochemical markers tend to have limited expression and patterning. As a result of these diagnostic challenges, STSs are frequently reported in snakes (Ossiboff 2018). As in the present case, there was cytoplasmic staining only for α -SMA. This marker is used to identify smooth muscle cells; literature suggests that some STSs may involve more than one cell lineage. There are reports of neoplasms with histopathological features suggestive of PWT that tested positive for neural markers but negative for SMA, allowing for a diagnosis of peripheral nerve sheath tumor in those instances (Loures et al. 2019). This was not the case here, however; the S-100 marker, used to identify nervous tissue, was negative, while the only positive marker was SMA, thereby helping to confirm the diagnosis of PWT. Nonreactivity to pancytokeratin confirms that the tumor has no epithelial origin. Although vimentin should label mesenchymal cells, some tumors may be negative or exhibit false-negative results, as previously described in a report of a leiomyosarcoma negative for vimentin. Some possibilities may explain this finding in the present case, including antibody nonspecificity or origin of the neoplasm from muscularis propria cells (Kwon et al. 2021). Another possible cause of false-negative results is pre-analytical errors, specifically during sample fixation or antigen retrieval, since some markers are more sensitive to the effects of formalin.

Ionized calcium-binding adapter molecule 1 (Iba1) is a protein used as a marker for microglial cells and cells of the monocyte/macrophage lineage and can be used in the characterization of canine and feline inflammatory, proliferative, and neoplastic conditions, allowing differentiation between histiocytic tumors and other round cell tumors, as well as melanomas (Pierezan 2014). The use of SOX10 is well established in human melanomas and has recently been investigated in animals, especially dogs, in which it has also been expressed by a subset of oral sarcomas (Nelissen & Miller 2024). Thus, the morphological characteristics were considered consistent with MPWT.

In one study, one-third of sarcomas in snakes involved the skin or subcutaneous tissue, and two of these metastasized to internal organs. Although metastasis is uncommon, it was observed in the present case. The oral cavity lesion was the first to be clinically recognized, and only after necropsy was the possibility of metastasis from other internal neoforations considered. It was not possible to confirm the primary lesion because no diagnosis had been established before the appearance of the oral mucosal lesion. Regardless of the site of origin, metastasis, as observed in this type of neoplasia, is infrequently reported, especially in this species (Garner et al. 2004).

The advanced age of the snake in this case may be considered an important factor in the development of the neoplasm. Neoplastic disease in snakes is more common with advancing age, particularly in captive snakes, because the absence of predators and the availability of regular food supply contribute to improved husbandry conditions and increased longevity. Even when surgical intervention is possible, malignant neoplasms may recur in the absence of chemotherapy or other supportive therapies (Page-Karjian et al. 2017).

Information regarding the biological behavior and clinical progression of oral soft tissue sarcomas in snakes remains limited. However, as observed in the present case, oral neoplasms in snakes may exhibit rapid progression and extensive local invasion, resulting in severe anorexia and progressive clinical deterioration. Metastatic behavior is considered uncommon in snake sarcomas, although dissemination of internal organs has been previously documented in some cases involving cutaneous and subcutaneous sarcomas (Garner et al. 2004). In the present case, the oral lesion was the first clinically recognized mass, whereas additional nodular lesions involving the subcutaneous tissue and large arteries were only identified during necropsy, highlighting the difficulty in detecting internal neoplastic lesions in snakes during life. Neoplasms affecting the oral cavity are often diagnosed at advanced stages, particularly because their anatomical location may remain clinically unapparent until feeding impairment, anorexia, or visible oral distortion develops (Pereira et al. 2022). Therefore, systematic oral examination and careful physical evaluation may facilitate earlier detection of proliferative lesions in captive snakes and potentially improve clinical management and therapeutic decision-making.

CONCLUSION

The diagnosis of MPWT in this case was established based on the consistent morphological characteristics observed macroscopically and microscopically. Although mesenchymal tumors are more commonly reported in snakes, MPWTs remain rare. In the present case, it was not possible to determine the primary site of the neoplasm; however, metastatic involvement of the oral cavity appears to be an uncommon presentation. Therefore, to the authors' knowledge, this study represents the first report of metastatic MPWT involving the oral cavity in *Epicrates cenchria*.

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Credit author statement.- Melina B. G. Silva – Data analysis and manuscript writing. Elizandra T. Melo – Performed necropsies and histopathological evaluations. Vitor Gomes Rodrigues, – responsible for clinical management and data collection. Maria Luiza S. L. Frota and José R. P. Santos – Performed necropsies and processed samples. Joaquim Evêncio-Neto, Francisco A. L. Souza, and Fábio S. Mendonça – Diagnostic validation and manuscript review.

Conflict of interest statement.- The authors declare that they have no conflicts of interest.

Data availability statement. The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Figures

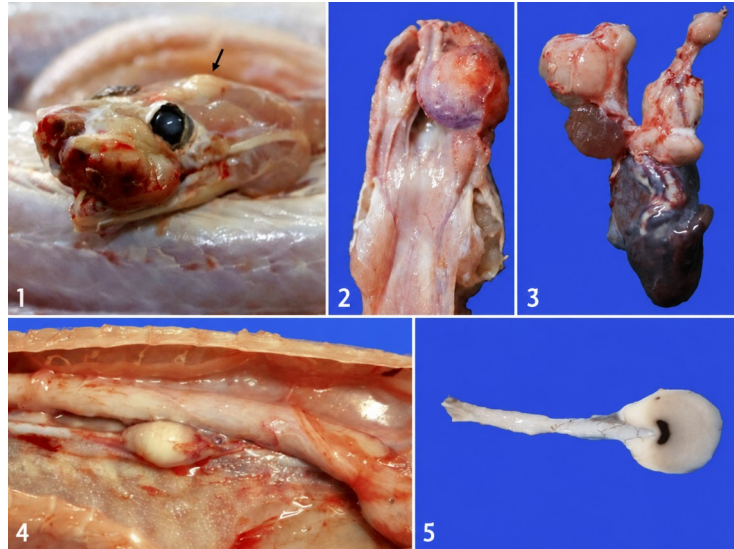


Fig. 1-5. Malignant Peripheral Wall Tumor (MPWT) in a Rainbow boa (*Epicrates cenchria*). (1) Left maxilla, a multilobulated mass located on the gingiva, measuring $1.5 \times 1.2 \times 0.6$ cm, firm, pink, with a smooth surface and well vascularized, with multifocal ulcerative areas. Another smaller mass located on the head (black arrow). (2) Ventral view of the maxilla where a focal, round and firm neoplasm is noted effacing oral tissues. (3) Heart, on the left aortic arch, multinodular irregular, firm, white, expansile nodule with a smooth surface and measuring $2.5 \times 1.5 \times 1.0$ cm. On the right aortic arch, expanding from the heart base through the blood vessel, two nodules with similar characteristics were observed, the largest measuring $2.0 \times 2.1 \times 2.0$ cm. (4) Dorsal artery, attached to the blood vessel, a white, expansile nodule measuring $1.5 \times 1.0 \times 0.6$ cm, firm, with a smooth surface. (5) Cut surface of the same mass observed in 4, after formalin fixation, showing white homogeneous mural proliferation.

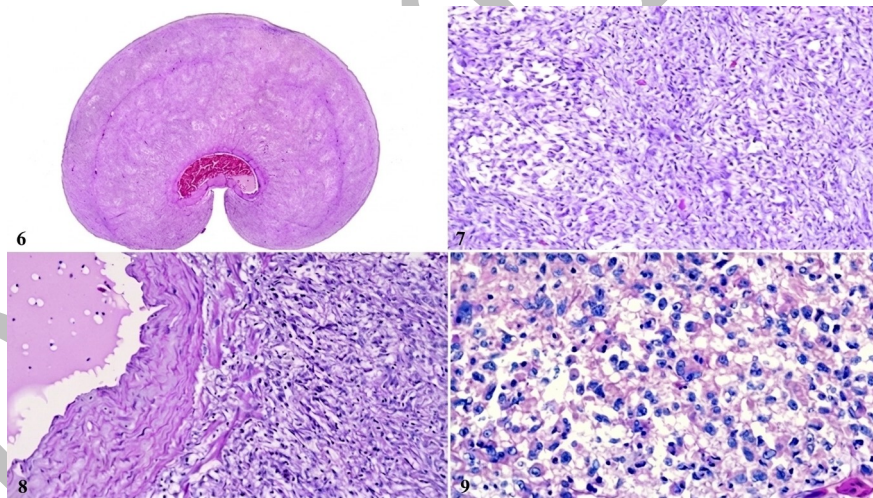


Fig. 6-9. Malignant Peripheral Wall Tumor (MPWT) in a Rainbow boa (*Epicrates cenchria*). (6) Subgross view of the neoplasm observed in Figures 4 and 5. Note that the neoplasm develops around and completely involves the artery. (7) Gingiva. Neoplastic cells are pleomorphic, ranging from spindle-shaped to stellate, with indistinct cell borders and moderate to scant amounts of eosinophilic, fibrillar cytoplasm. Nuclei are centrally located, basophilic, and elongated to fusiform, exhibiting finely to coarsely stippled chromatin and prominent nucleoli. Occasional multinucleated cells are present, along with marked anisocytosis and anisokaryosis. HE, obj.10x. (8) Artery. There is a prominent mesenchymal cell proliferation confined to the vascular wall, presenting as an expansile lesion. The mass is centered within the adventitia, with infiltrative extension into the tunica media. HE, obj.20x. (9) Gingiva. Neoplastic cells are pleomorphic, ranging from spindle-shaped to stellate, with indistinct cell borders and moderate to scant amounts of eosinophilic, fibrillar cytoplasm. Nuclei are centrally located, basophilic, and elongated to fusiform, exhibiting finely to coarsely stippled chromatin and prominent nucleoli. Occasional multinucleated cells are present, along with marked anisocytosis and anisokaryosis. HE, obj.40x.

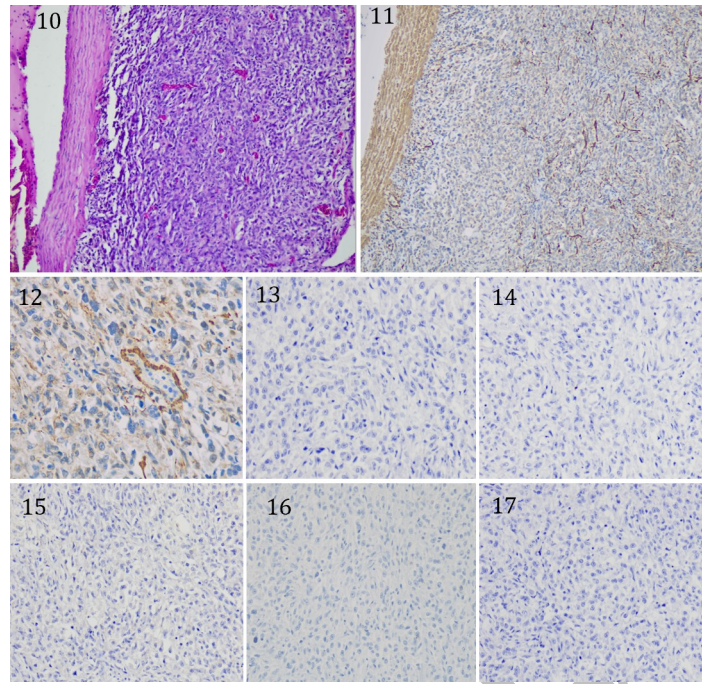


Fig. 10-17. Malignant Peripheral Wall Tumor (MPWT) in a Rainbow boa (*Epicrates cenchria*). (10) Hematoxylin and eosin-stained histological section showing the neoplasm adjacent to the artery. HE, obj.4x. (11) Same section as the previous image, now with α -SMA immunohistochemical staining, intense positive labeling is visible in the arterial wall, with mild to moderate multifocal labeling in the neoplastic cells. IHC α -SMA, obj.4x. (12) Higher magnification of the same neoplasm, showing multifocal cytoplasmic immunostaining of mild to moderate intensity in the neoplastic cells. IHC α -SMA, obj.20x. Same neoplasm, showing negative staining for: (13) Vimentin. IHC, obj.20x. (14) Pan-cytokeratin. IHC, obj.20x. (15) Iba-1. IHC, obj.20x. (16) S-100. IHC, obj.20x. (17) SOX10. IHC, obj.20x.

Table 1. Table detailing the primary antibodies used in the immunohistochemistry reaction for the case, as well as their final dilution and brand

Antibody	Clone	Dilution	Brand
Vimentina	clone V9	1:200	Invitrogen
CK Pan	clone AE1/AE3	ready-to-use	Agilent Dako
Iba-1	polyclonal	1:500	Wako
SOX10	clone EP268	1:50	Cell Marque
S100	4C4.9	ready-to-use	Roche
alfa-SMA	1A4	ready-to-use	Roche

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