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Case report

Metastatic extramedullary plasmacytoma in a canine

Plasmocitoma extramedular metastático em um canino

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Abstract
Plasmocytomas are neoplasms originating from plasma cells and can be subdivided into cutaneous extramedullary, non-cutaneous and multiple myeloma. The involvement of vertebrae can generate clinical signs of pain and neurological alterations according to the affected segment. The present study aims to report a case of extramedullary plasmacytoma in the thoracic spine and with consequent spinal cord compression in addition to metastasis sites, characterizing its clinicopathological aspects. The canine patient was hospitalized, submitted to laboratory and imaging tests, and medicated due to incoordination and loss of perception of limb positioning, but his clinical picture worsened, progressing to loss of movement and fecal and urinary incontinence, resulting in death. The main necropsy findings were the presence of a tumor mass along the external surface of the body of the fifth thoracic vertebra, in addition to light brown foci in the thoracic spinal cord and in the pulmonary and splenic parenchyma. Histologically, the tumor mass and light brown foci consisted of malignant cell proliferation, of plasmacytic origin, densely cellular and largely infiltrative. Thus, through the clinical picture presented, imaging tests and anatomopathological analysis, it was shown that it was a case of extramedullary plasmocytoma originating in the thoracic spine, with sites of metastasis in the spinal cord, lung and spleen.
Keywords: canine; vertebra; neoplasm; plasma cells; metastasis

Resumo
Plasmocitomas são neoplasmas originados de plasmócitos e podem ser subdivididos em extramedular cutâneo, não cutâneo e mieloma múltiplo. O envolvimento de vértebras pode gerar sinais clínicos de dor e alterações neurológicas de acordo com o segmento afetado. O presente estudo tem como objetivo relatar um caso de plasmocitoma extramedular em coluna vertebral torácica e com consequente compressão medular além de sítios de metástases, caracterizando seus aspectos clínico-patológicos. O paciente canino foi hospitalizado, submetido a exames laboratoriais e de imagem, e medicado devido a incoordenação e perda da percepção do posicionamento dos membros, mas apresentou piora do quadro clínico evoluindo para perda dos movimentos e incontinência fecal e urinária, ocorrendo o óbito. Os principais achados de necropsia foram a presença de massa tumoral junto à superfície externa do corpo da quinta vértebra torácica, além de focos pardo-claros na medula espinhal torácica e no parênquima pulmonar e esplênico. Histologicamente, a massa tumoral e os focos pardo-claros consistiam em proliferação celular maligna, de origem plasmocitária, densamente celular e amplamente infiltrativa. Assim, através do quadro clínico apresentado, exames de imagem e da análise anatomopatológica evidenciou tratar-se de um caso de plasmocitoma extramedular originado em coluna vertebral torácica, com sítios de metástase em medula espinhal, pulmão e baço.
Palavras-chave: canino; vértebra; neoplasia; plasmócitos; mestástase

1. Introduction

Plasmacytomas, originating from plasmocytes, are considered infrequent in canine and feline species, presenting in extramedullary cutaneous, non-cutaneous, and multiple myeloma forms[(1)]. Extramedullary plasmacytoma represents approximately 2.5% of neoplasms diagnosed in dogs[(2,3)]. It has been reported in the oral cavity, trachea, esophagus, stomach, intestine, skin[(2,4)], spine[(4)], penile bulb, mucosa[(6,7)], as well as renal[(8)] and pulmonary[(9)] manifestations. Metastasis associated with more than one organ is considered uncommon. Only one report exists of a canine with extramedullary plasmacytoma in the colon and rectum, with metastasis to the lymph node and spleen[(10)].

The clinical signs of extramedullary plasmacytomas located in the spine depend on the bone segment involved and are associated with pain and neurological alterations resulting from spinal cord compression[(11)]. The diagnosis of this neoplasm is achieved through radiographic evaluation, and

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confirmation is obtained through anatomopathological analysis[5]. Surgical and/or chemotherapy therapies can be adopted for this neoplasm. However, the therapeutic decision, as well as the patient's prognosis, depend on the location and degree of infiltration[12].

This study aims to report and characterize the clinical and pathological aspects of a case of extramedullary plasmacytoma in the thoracic spine of a canine, with spinal cord compression and metastasis sites.

2. Case report

A nine-year-old male, castrated, mongrel canine weighing 17 kg presented with a chief complaint of paraplegia and was treated at the Veterinary Hospital of the University of Passo Fundo, Rio Grande do Sul, Brazil. The owner reported that the patient had suffered a fall two weeks before and subsequently began experiencing incoordination associated with loss of perception of the positioning of the pelvic limbs. Later, it evolved to loss of movement, fecal and urinary incontinence, and hematuria. Treatment was performed with dipyrone (25mg/kg), three times a day (TID) associated with tramadol (4mg/kg), TID for seven days, with no improvement in the clinical condition. The vaccination protocol against the main Brazilian viral diseases was outdated, as well as the control of endoparasites and ectoparasites. On clinical examination, the canine appeared hydrated, with a normal body condition score, capillary reperfusion time of 2 seconds, as well as normal heart rate, respiratory rate, and rectal temperature and absence of lymph node enlargement[13]. During abdominal palpation, mild pain was observed in the mesogastric and hypogastric regions. The neurological examination revealed bilateral paresis in the pelvic limbs, presence of patellar and flexor reflexes, and absence of a panniculus response in the fourth lumbar vertebra. Due to the suspicion of intervertebral disc disease in the lumbar region, imaging and laboratory tests were requested, along with hospitalization for better monitoring of the clinical condition. During hospitalization, the patient's treatment consisted of the use of methadone (0.3 mg/kg), subcutaneously (SC), four times a day (QID), dipyrone (25 mg/kg), intravenously (IV), TID; ketamine (1 mg/kg), SC, TID; enrofloxacin (5 mg/kg), IV, twice daily (BID); fluid therapy with Ringer Lactate at the rate of 60 ml/kg/day; and bladder lavage, TID.

In the right lateral projection of the thoracic spine radiograph, a delimited, radiopaque structure was observed in the fifth thoracic vertebra (Figure 1), initially raising suspicion of a neoplastic process. Thus, cerebrospinal fluid (CSF) collection was carried out in the great cistern, and its laboratory analysis did not show any alterations. Serum protein electrophoresis also yielded results within the reference range for the species[14]. The hemogram showed an acute inflammatory leukogram and no changes in biochemical levels. Urinalysis, performed on urine collected through cystocentesis, there was a cloudy appearance, 3+ protein, 3+ bacteriuria, >100 leukocytes, 0 to 3 squamous cells, 0 to 2 transitional cells, and rare caudate cells, which are compatible findings with bacterial cystitis[16].

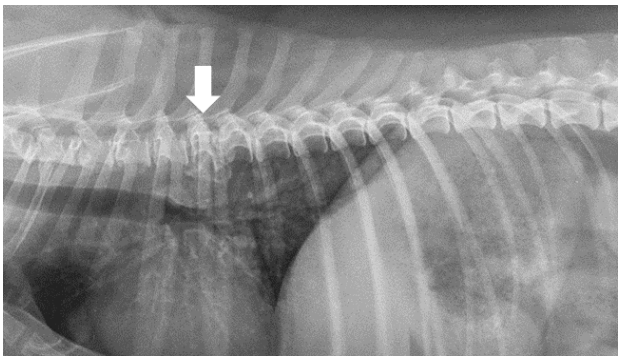

Figure 1. Metastatic extramedullary plasmacytoma in a canine. Radiograph of the right lateral projection of the thoracic spine displaying a delimited and radiopaque structure suggestive of neoplasia in the fifth thoracic vertebra (white arrow).

After three days of hospitalization, the patient developed severe dyspnea and assumed a lateral decubitus position, which progressed to cardiorespiratory arrest and resulted in death. During necropsy, a prominent tissue mass measuring 5x5x1.5 cm was found in the thoracic spine, characterized by a firm to stone-like consistency. It was located adjacent to the body of the fifth thoracic vertebra, but externally to it (Figure 2A). Upon sectioning, the mass exhibited a white coloration, and the intervertebral disc displayed significant peripheral bone fragility (Figure 2B). The thoracic spinal cord showed congestion due to compression in both the cranial and caudal regions of the mass (Figure 2C). The lung surface displayed areas of congestion and multiple foci with white coloration and firm consistency (Figure 2D). Upon sectioning, the lung parenchyma shows white nodules up to 0.5 cm in diameter, in addition to edema and hemorrhage. Multiple white, firm nodules, up to 0.5 cm in diameter were found in the spleen. The liver showed a surface with an accentuated lobular pattern, associated with pale areas and, in the sections, there was congestion of the parenchyma. The kidneys displayed congestion on their capsular surfaces and parenchyma. The other organs showed no changes. During necropsy, samples from all organs were collected, fixed in 10% formalin, processed by conventional methods, and stained with hematoxylin and eosin for histopathological analysis.

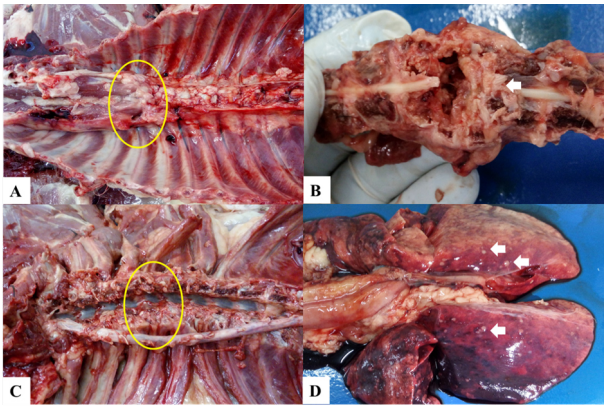

Figure 2. Metastatic extramedullary plasmacytoma in a canine. **(A)** Ventral view of the macroscopic appearance of the prominent tissue mass in the thoracic region next to the body of the fifth thoracic vertebra (circle). **(B)**. Dorsal view of the interior of the thoracic cavity, of the white neoplastic mass associated with intense peripheral bone fragility seen in a longitudinal section of the thoracic spine (arrow). **(C)** Ventral view of the spinal cord showing congestion due to compression in the region cranial and caudal to the tumor mass. Detail stresses understanding point (circle). **(D)** Dorsal view of the lung surface showing multiple, white, nodular foci of firm consistency (arrows).

Microscopically, the tumor mass present on the surface of the fifth thoracic vertebra consisted of densely cellular and largely infiltrative plasma cell proliferation, accompanied by intense osteolysis (Figures 3A and 3B). Cells were ovoid to polygonal and exhibited variably distinct cell borders, with scant to abundant eosinophilic, finely granular cytoplasm, and with moderate karyomegaly. The nuclei were round to ovoid, sometimes vesiculated, hyperchromatic, and generally located eccentrically. Nucleoli were small to medium in size and mostly single, occasionally quite distinct and hyperchromatic. The mitotic count was 14 mitoses in a total microscopic area of 2.37 mm^2. The neoplasm also exhibited foci of tumor necrosis and multifocal hemorrhage, along with a mixed inflammatory infiltrate (predominantly macrophage), which was dispersed throughout the tumor stroma. Given these findings, the diagnosis was extramedullary plasmacytoma.

In the thoracic spinal cord, pulmonary parenchyma (Figure 3C and 3D), and spleen, a dense and infiltrative proliferation of malignant plasma cells was also observed, consistent with the previously described tumor mass in the body of the fifth thoracic vertebra, confirming it as sites of extramedullary plasmacytoma metastasis. In the lung, there was also diffuse edema, mixed chronic interstitial pneumonia, interstitial hemorrhage (sometimes intra-alveolar), and multifocal congestion, in addition to intra-alveolar eosinophilic fibrillar amorphous content. The liver exhibited diffuse and marked cellular degeneration and necrosis, diffuse and marked atrophy of hepatocyte cords, mononuclear pericolangitis, mild fibrosis, and mild bile duct hyperplasia were observed. In the kidneys, marked diffuse nephrosis, interstitial nephritis, multifocal mononuclear pyelonephritis, multifocal glomerulosclerosis, as well as interstitial hemorrhage and congestion were observed. There were also extracellular deposits of amorphous, homogeneous, and eosinophilic material, suggesting protein content in the lumen of the tubules and amyloid in the glomeruli, confirmed by Congo red staining.

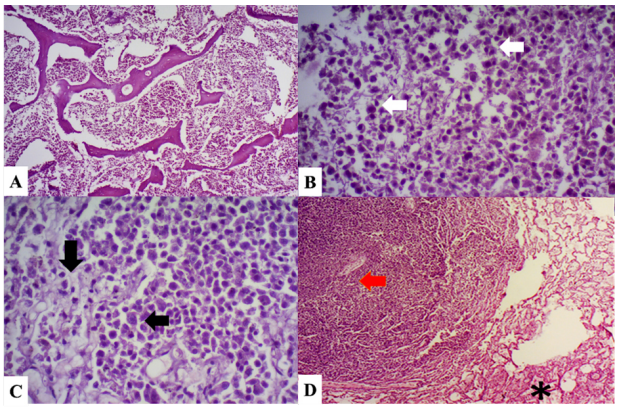

Figure 3. (A) Tumor mass in the thoracic spine composed of malignant cell proliferation of plasmacytic origin associated with osteolysis. H&E, 100x. **(B)** Tumor mass in the thoracic spine showing neoplastic proliferation composed of multiple malignant round cells (arrows) separated by a delicate fibrovascular stroma. H&E, 200x. **(C)** The focus of lung metastasis (arrows) shows the proliferation of malignant plasma cells supported by a delicate fibrovascular stroma. H&E, 200x. **(D)** Focus of lung metastasis (arrows) showing proliferation of malignant plasma cells supported by a delicate fibrovascular stroma. H&E, 200x.

3. Discussion

Oncological disorders related to plasma cells, as described in veterinary medicine, encompass a group of diseases with highly variable clinical behavior. According to recent literature on hematopoietic tumors, clonal neoplastic disorders of plasma cells include multiple myeloma (MM), solitary bone plasmacytoma (POS), extramedullary plasmacytoma (EMP), and less commonly reported Waldenström's macroglobulinemia and plasma cell leukemia [6, 11, 16].

Extramedullary plasmacytomas account for approximately 2.5% of all neoplasms in dogs[17] and are commonly associated with senile dogs[18, 19], particularly Terriers, Cocker Spaniels, and Poodles[11]. The reported case is a metastatic and non-cutaneous extramedullary plasmacytoma located on the surface of the thoracic spine, causing spinal cord compression due to its growth. Its location in vertebrae is exceptionally rare and infrequently reported[19], with only a few cases described

in the literature to date[12]. Other atypical locations have already been described, namely renal extramedullary plasmacytoma [8] and pulmonary extramedullary plasmacytoma [9]. It is known that in dogs, extramedullary plasmacytomas of internal organs metastasize more easily when compared to mucocutaneous plasmacytomas[11]. Metastasis to more than one organ has already been described in a case of extramedullary plasmacytoma in the colon and rectum of a canine, with metastasis to regional lymph nodes and spleen[10]. In the present study, considering the classification of plasmacytoma as extramedullary, and its origin in the thoracic spine, the metastases in multiple organs such as the spinal cord, lung, and spleen make this report unique in the veterinary literature. Clinical signs of plasmacytoma when located in vertebrae include pain and neurological alterations related to spinal cord compression[11], as observed in the present case. The clinical picture manifested by the patient is compatible with alteration in the thoracolumbar spine, causing signs of upper motor neuron lesions, paresis, and/or ataxia in the pelvic limbs. These signs started suddenly. This can be justified since the clinical signs of spinal cord compression can be progressive or even clinically silent[11]. The main aggravating factors of neurological alterations included urinary and fecal incontinence, as observed in 24% of the cases in a study carried out by Santoro; Arias[20]. Urination/defecation disorders are common in animals with neurological problems and may be caused by abnormal activity of the detrusor muscle[21]. Failure to empty the urinary bladder can cause serious problems such as cystitis, pyelonephritis, and nephritis[20], as presented by the patient in this report.

The radiographic examination played a crucial role in identifying the presence and location of the tumor mass. However, myelography or tomography is necessary to identify the degree of spinal cord compression, as well as the dimensions of the neoplasm[22]. These exams were not performed due to the critical clinical picture faced by the patient, making anesthesia impossible to perform them. Laboratory findings suggest that the observed acute inflammatory leukogram could be attributed to the production of inflammatory cytokines resulting from spinal cord compression[23]. The urinalysis findings are consistent with bacterial cystitis and suggest possible extension to the renal pelvis, indicated by the presence of intense bacteriuria, inflammatory cells, transitional cells, and caudate cells. The presence of more than 100 leukocytes in the urine, called pyuria, needs to be taken into account in this case as important data for the diagnosis of cystitis, associated with the presence of intense bacteriuria and the method of urine collection being performed by cystocentesis[15]. In addition, the occurrence of pyelonephritis could also explain the findings of the patient's leukogram.

The result of protein electrophoresis is crucial in determining the most appropriate therapeutic approach. In the present case, there were no alterations in the exam, and this is described for patients who present with non-immunoglobulin-secreting extramedullary plasmacytoma, according to the study by Barroco-Neto et al.[5]. In this same study, the differentiation between plasmacytoma and multiple myeloma was established, with plasmacytomas occurring mainly in a localized and non-secretory form, while multiple myelomas present as a proliferation of plasmocytes in the bone marrow with intense secretion of immunoglobulins, generating a monoclonal gammopathy.

The definitive diagnosis of the neoplasm was confirmed through anatomopathological analysis. The macroscopic aspect of a plasmacytoma is characterized by a solitary or multiple solid mass, and, upon sectioning, the tumor is generally not encapsulated, with a color that varies from white to red[19]. Additionally, in the histopathological analysis, round cells with pleomorphic and hyperchromatic nuclei can be observed[19], as seen in the present case. In human medicine, deposits of amyloid substances in the kidneys and other organs are regarded as poor prognostic indicators for patients with plasmacytoma, impacting patient survival[24], thereby underscoring the malignant and atypical nature of the reported plasmacytoma.

Serum and urinary protein electrophoresis is a test strongly recommended to rule out the possibility of multiple myeloma, especially in cases with an unusual location and with a prediction of surgical intervention. Surgical excision of oral and cutaneous extramedullary plasmacytoma demonstrates resolution in 95% of cases[25]. However, due to the low number of cases of extramedullary plasmacytoma in atypical locations, there is no defined treatment protocol, but complete surgical resection can be curative[26, 27]. In cases in which excision is incomplete or in which surgical treatment is not feasible, systemic radiotherapy and/or chemotherapy are recommended[28]. In the present case, due to the patient's clinical condition, surgical intervention was unfeasible, with palliative chemotherapy being the best option. However, the patient died before the institution of the chemotherapy protocol.

According to the veterinary medical literature, extramedullary plasmacytoma is a rare neoplasm in canines, generally associated with a favorable prognosis and rare reports of recurrence and/or metastases[1, 19]. The present report partially challenges the existing knowledge on neoplasms in canines to date since our case is the first report of non-cutaneous extramedullary plasmacytoma with a primary site on the surface of the thoracic spine and metastases in the thoracic spinal cord, lung, and spleen.

4. Conclusion

The clinical presentation of the canine, along with laboratory and imaging tests, as well as the anatomopathological analysis, was crucial to establishing that this is the first reported case of non-cutaneous extramedullary plasmacytoma with a primary site on the surface of the thoracic spine, leading to spinal cord compression. Additionally, metastases were observed in the thoracic spinal cord, lung, and spleen. Therefore, this neoplasm should be considered in the differential diagnosis for cases involving tissue masses causing spinal cord compression and neurological signs in dogs.

Declaration of conflict of interest

The authors declare no conflicts of interest.

Author contributions

Investigation: R. S. da Silva, R. do N. Libardoni, C. Garcia, E. D. dos Santos and T. P. Machado. *Methodology*: R. S. da Silva and R. do N. Libardoni. *Visualization*: R. S. da Silva, E. D. dos Santos, T. P. Machado and A. C. da Motta. *Writing (original draft):* R. S. da Silva, C. Garcia, R. do N. Libardoni, E. D. dos Santos, T. P. Machado, J. T. da Silva and A. C. da Motta. *Writing (review & editing)*: R. S. da Silva, C. Garcia, R. do N. Libardoni, E. D. dos Santos, B. W. Klaser, C. E. Bortolini and A. C. da Motta

References

1. Silva C, Lara K, Andrade AC, Francisco GL, Guedes RL. Plasmocitoma extramedular em região perineal de cão–relato de caso. Biociências, Biotecnologia e Saúde Paraná. 2017;10(19):129-31.

2. Rakich, PM, Latimer, KS, Weiss, R, Steffens, WL. Mucocutaneous plasmacytomas in dogs: 75 cases (1980-1987). Journal of the American Veterinary Medical Association, 1989;194 (6), 803-810.

3. Clark, GN, Berg, J, Engler, SJ, Bronson, RT. Extramedullary plasmacytomas in dogs: results of surgical excision in 131 cases. American Animal Hospital Association (USA), 1992.

4. Morton LD, Barton CL, Elissalde GS, Wilson SR. Oral extramedullary plasmacytomas in two dogs. Veterinary Pathology, 1986, 23(5),637-639. Doi: http://doi.org/10.1177/030098588602300519

5. Barroco-Neto R, Mello C, Rocha A, Sembenelli G, Sueiro F, Jark P. Plasmocitoma ósseo solitário em cães: Relato de três casos. Ars Veterinaria. 2017;33(1):37-43. Doi: http://doi.org/10.15361/2175-0106.2017v33n1p37-43

6. Gorenstein T, Jark P, Feliciano M, Sueiro F, Anai L, Fenerich M, et al. Extramedullary plasmacytoma in the penile bulb of a dog: case report. Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 2016:292-8. Doi: 10.1590/1678-4162-8411

7. Wypij JM, de Lorimier LP. Surgery and radiation therapy for extramedullary plasmacytoma of the penile mucosa in a dog. Canadian Veterinary Journal, 2012;53(9):992.

8. Johnson J, Hung G, Larson V, Manasse J, Spotswood T. Renal extramedullary plasmacytoma in a dog. Canadian Veterinary Journal, 2021;62(10):1077.

9. Ipek V, Acar H, Kocaturk M, Salci H, Sonmez G. Extramedullary pulmonary plasmacytoma in a dog. Acta Veterinaria Brno, 2019;69(2):244-50. Doi: http://doi.org/10.2478/acve-2019-0020

10.Trevor P, Saunders G, Waldron D, Leib M. Metastatic extramedullary plasmacytoma of the colon and rectum in a dog. Journal of the American Veterinary Medical Association, 1993;203(3):406-9.

11. Vail DM, Thamm DH, Liptak JM. Hematopoietic tumors. In: Vail DM, Thamm DH, Liptak JM. Withrow and MacEwen's Small animal clinical oncology. 6ed. St Louis: Elsevier; 2019, p. 688.

12.Milken VMF, Cursino LH, Menegon FG, Parisi GG, Braga KM, Medeiros-Ronchi AA. Intradural Extramedullary Plasmacytoma in a Dog. Acta Scientiae Veterinariae, 2020;48. Doi: http://doi.org/10.22456/1679-9216.97756

13.Feitosa FLF. Exame Físico Geral ou de Rotina. In: Feitosa FLF. Semiologia Veterinária, a arte do diagnóstico. 4ed. Rio de Janeiro; Roca; 2020.

14.Tappin SW, Taylor SS, Tasker S, Dodkin SJ, Papasouliotis K, Murphy KF. Serum protein electrophoresis in 147 dogs. Veterinary Record, 2011,168(17), 456–456. Doi: http://doi.org/10.1136/vr.d88

15.Meuten D, Sample S. Laboratory Evaluation and Interpretation of the Urinary System. In: Thrall MA, Weiser G, Alisson RW, Campbell TW. Veterinary Hematology, Clinical Chemistry, and Cytology. Wiley Blackwell, 2022. p. 343-401.

16.Hayes-Lattin B, Blanke CD, Deloughery TG. Pulmonary and intracerebral plasmacytomas in a patient without multiple myeloma: a case report. American Journal of Hematology, 2003;73(2):131-4. Doi: http://doi.org/10.1002/ajh.10330

17.Cangul I, Wijnen M, Van Garderen E, Van Den Ingh T. Clinico-pathological aspects of canine cutaneous and mucocutaneous plasmacytomas. Journal of Veterinary Medicine Series A, 2002;49(6):307-12. Doi: http://doi.org/10.1046/j.1439-0442.2002.00456.x

18.Majzoub M, Breuer W, Platz S, Linke R, Hermanns W. Histopathologic and immunophenotypic characterization of extramedullary plasmacytomas in nine cats. Veterinary Pathology, 2003;40(3):249-53. Doi: http://doi.org/10.1354/vp.40-3-249

19.Hendrick MJ. Mesenchymal Tumors of the Skin and Soft Tissues. In: Meuten DJ. Ed.Tumors in domestic animals. 5ed. John Wiley; Sons; 2016. p. 142-175.

20.Santoro MB, Bahr Arias MV. Complicações observadas em cães e gatos com doenças neurológicas. Pesquisa Veterinária Brasileira, 2018;38:1159-71. Doi: http://doi.org/10.1590/1678-5150-PVB-4968

21.Lorenz MD, Kornegay JN. Neurologia veterinária. Barueri: Manole; 2006. p.467.

22.Thrall ED. Diagnóstico de Radiologia Veterinária. Rio de Janeiro: Elsevier; 2014. p.131-175.

23.Stockham SL, Scott MA. Leucócitos. In: Stockham SL, Scott MA. Ed. Fundamentos de Patologia Clínica Veterinária. Rio de Janeiro: Guanabara Koogan; 2011. p. 45-89.

24.Madan S, Dispenzieri A, Lacy MQ, Buadi F, Hayman SR, Zeldenrust SR, et al. Clinical features and treatment response of light chain (AL) amyloidosis diagnosed in patients with previous diagnosis of multiple myeloma. Mayo Clinic Proceedings, 2010. Doi: http://doi.org/10.4065/mcp.2009.0547

25.Sternberg R, Wypij JM, Barger AM. Extramedullary and solitary osseous plasmacytomas in dogs and cats. Veterinary

Medicine, 2009;104(10):477-9.

26.Adelman L, Larson V, Sissener T, Spotswood T. Extramedullary plasmacytoma in the lung of a Doberman pinscher dog. Canadian Veterinary Journal, 2014;55(1):1237. Doi: http://doi.org/10.2478/acve-2019-0020

27.Wang J, Pandha H, Treleaven J, Powles R. Metastatic extramedullary plasmacytoma of the lung. Leuk Lymphoma, 1999;35(3-4):423-5. Doi: http://doi.org/10.3109/10428199909145749

28.Rusbridge C, Wheeler SJ, Lamb CR, Page RL, Carmichael S, Brearley MJ, et al. Vertebral plasma cell tumors in 8 dogs. Journal of Veterinary Internal Medicine, 1999;13(2):126-33. Doi: http://doi.org/10.1892/0891-6640(1999)013<0126:vpctid>2.3.co;2