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ABSTRACT

The objective of this case is to report the anatomopathological aspects of a chemodectoma in a dog diagnosed by the Laboratory of Veterinary Pathology (LVP) of the Federal University of Parana (UFPR) in Sector Palotina, Brazil. Chemodectomas are tumors located at the base of the heart, originating from aortic bodies, respiratory chemoreceptors located close to or inside the aortic arch, and/or receptors located in the carotid arteries. A 12-year-old male boxer dog, with a history of sudden death and without any previous clinical manifestations, was sent for postmortem examination at the LVP of UFPR, Sector Palotina, Brazil. Macroscopically, a firm mass was observed in the right atrium, with an irregular surface, blackened with multifocal to whitish coalescing areas, involving the pulmonary artery and aorta. When cut, it was smooth, blackened with multiple whitish areas. There was no intraluminal invasion, however, there was a stenosis of the pulmonary and aortic arteries. Microscopically, neuroendocrine neoplastic cells were seen to proliferate. They were well demarcated, highly cellular, with a comprehensive and encapsulated growth, not invading the wall of the atrium, aorta and pulmonary artery. Thus, concluding the diagnosis of malignant chemodectoma due to the presence of neoplastic emboli. Brachycephalic breeds are believed to be more susceptible to developing this type of neoplasm. Thus, chemodectomas may be asymptomatic since they are rare in their malignant form and the diagnosis is often only confirmed through necropsy followed by histopathological analysis.

Keywords: Chemoreceptors. Dog. Heart. Malignant. Neoplasm.

RESUMO

O objetivo do presente caso é relatar os aspectos anatomopatológicos de um quimiodectoma em um canino diagnosticado pelo Laboratório de Patologia Veterinária (LPV) da Universidade Federal do Paraná (UFPR), Setor Palotina. Os quimiodectomas são tumores localizados na base do coração oriundos de corpos aórticos, quimiorreceptores respiratórios situados próximos ou no interior do arco aórtico, e/ou receptores situados nas artérias carótidas. Foi enviado para o exame necroscópico no LPV da UFPR, Setor Palotina, um canino, macho, boxer, com 12 anos de idade, apresentando histórico de morte súbita e sem nenhuma manifestação clínica anteriormente. Macroscopicamente, observou-se, no átrio direito, uma massa firme, de superfície irregular, enegrecida com áreas multifocais a coalescente esbranquiçadas, envolvendo a artéria pulmonar e a aorta. Ao corte, era macia, enegrecida com múltiplas áreas esbranquiçadas. Não havia invasão intraluminal, porém estava estenosando as artérias pulmonar e aórtica. Microscopicamente, observou-se proliferação de células neoplásicas neuroendócrinas bem demarcadas, altamente celular, de crescimento expansivo e encapsulada, não invadindo a parede do átrio, aorta e artéria pulmonar. Assim, conclui-se o diagnóstico de quimiodectoma maligno devido à presença de êmbolos neoplásicos. Acredita-se que as raças braquicefálicas apresentam maior predisposição a desenvolver esse tipo de neoplasia. Desta forma, os quimiodectomas, os quais podem apresentar-se como assintomáticos, são raros na sua forma maligna e o diagnóstico muitas vezes apenas é confirmado por meio de necropsia, seguido de análise histopatológica.

Palavras-chave: Canina. Coração. Maligno. Neoplasia. Quimiorreceptores.

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INTRODUCTION

Chemodectomas or paragangliomas, better known as heart base tumors, often originate in the aortic and carotid bodies (Rosol & Meuten, 2017).

This tumor is considered rare and has been reported in cats, cattle, horses, ducks and dogs, the last species mentioned being the most frequent (Sah et al., 1974; Levy et al., 1990; Paltrinieri et al., 2004; Khodakaram-Tafti et al., 2011; Rosol & Meuten, 2017).

Usually, the most affected animals are elderly dogs from brachycephalic breeds, such as boxer, bulldog and Boston terrier (Ocarino et al., 2016).

Regarding macroscopic characteristics, single or multiple masses are observed, within the pericardial sac close to the base of the heart. Their size varies between 0.5 and 12.5 cm, and they present a smooth surface and a white coloration with reddish-brown areas when cut (Rosol & Grone, 2016).

Microscopically, cells with well-differentiated characteristics are observed, cuboidal in shape, round and dotted nuclei and cytoplasmic vacuoles. Cells are arranged in clusters, separated by a dense and fibrous stroma (Rosol & Meuten, 2017).

Most of these diagnosed tumors are benign, however, when malignant, they may have a metastasis. Clinical diagnosis is difficult, as most animals are asymptomatic and may die suddenly (Araújo et al., 2017). Thus, the findings are commonly observed in routine radiographic examination or during necropsy through direct observation of the tumor. Clinically, the patient may show changes in blood pressure and clinical signs secondary to the compression of nerves and structures adjacent to the tumor mass (Araújo et al., 2017).

The presumptive diagnosis of a chemodectoma is based on the history, physical examination, chest X-ray and echocardiographic findings (Coto et al., 2021). Its surgical treatment is generally impossible, due to its location and anatomical structures related/adjacent to its mass (Salomão et al., 2012).

In light of this, the anatomopathological aspects of a chemodectoma in a dog, diagnosed by the Laboratory of Veterinary Pathology (LVP) of the Federal University of Parana (UFPR), Sector Palotina, are reported.

CASE REPORT

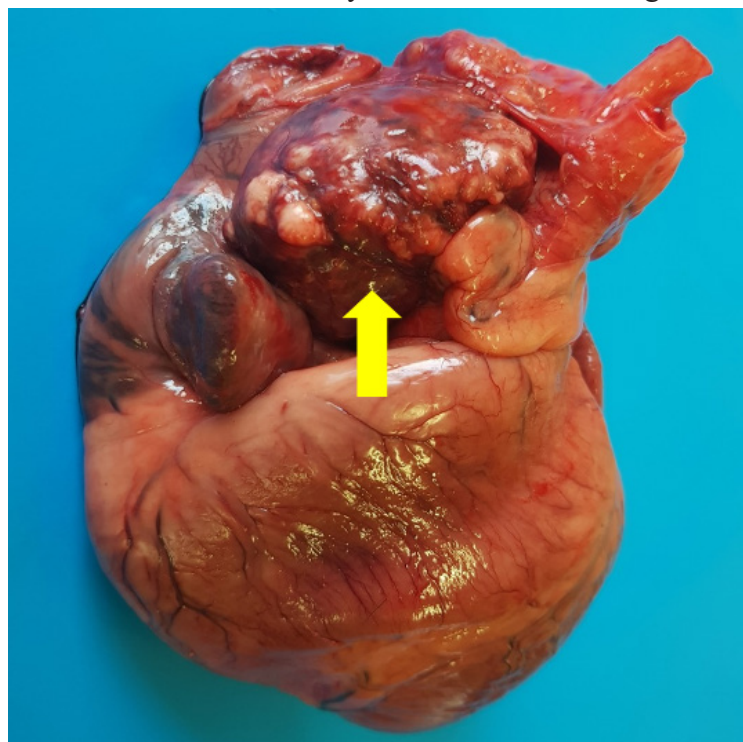
A 12-year-old male boxer dog, with a history of sudden death and without any previous clinical manifestations, was received for necroscopic examination at the LVP of UFPR, Sector Palotina, Brazil.

On macroscopic examination, there was a firm mass, with an irregular surface, blackened with multifocal to whitish coalescing areas in the right atrium of the heart, involving the pulmonary artery and aorta. When cut, it was soft, blackened with multiple whitish areas, as shown in Figure 1. There was no intraluminal invasion, however,

the mass caused stenosis of the pulmonary and aortic arteries. There was intense concentric hypertrophy of the left and right ventricles. No nodules were seen in other organs.

Figure 1

Heart, chemodectoma, 12-year-old male boxer dog.



Source: The authors.

Note. An irregular mass is seen in the right atrium, involving the pulmonary artery and aorta (yellow arrow).

Fragments of the cardiac mass were collected, fixed in 10% formaldehyde, processed according to techniques to prepare histological slides. Besides, hematoxylin and eosin (HE) staining were performed according to Luna (1968) for later analysis in the light microscope.

Microscopically, well demarcated, highly cellular proliferation of neuroendocrine neoplastic cells was observed, with expansive and encapsulated growth, not invading the wall of the atrium, aorta and pulmonary artery. Neoplastic cells were round to elongated or polyhedral, sometimes with distinct borders or indistinct, forming countless islands surrounded by trabeculae of delicate fibrous connective tissue composed of small capillaries.

The cytoplasm was mild to moderate, eosinophilic, finely granular and sometimes vesiculated; the nucleus was round to oval, central with dotted chromatin, and the nucleoli, when visible, numbered up to three.

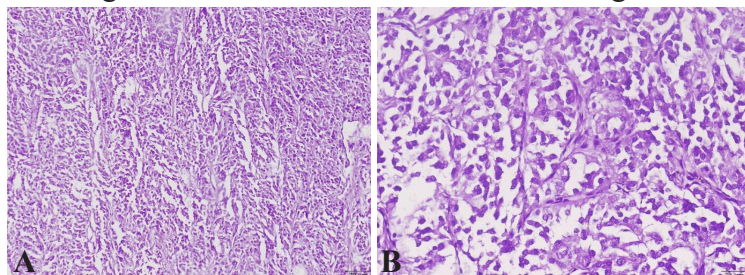
The figures of mitosis were rare. Anisocytosis and anisokaryosis were marked and pleomorphism was moderate, as shown in Figures 2A and 2B. Moderate neoplastic cells (neoplastic embolus) were noted in the lumen of blood vessels. There was an area of moderate focally extensive coagulation necrosis interspersed with the neoplasm, in addition to moderate multifocal

hemorrhage and mild multifocal hemosiderin, as shown in Figure 3.

Therefore, the macro and microscopic findings corroborated the diagnosis of malignant chemodectoma due to the presence of neoplastic emboli.

Figure 2

Histological slide of the chemodectoma in a dog.

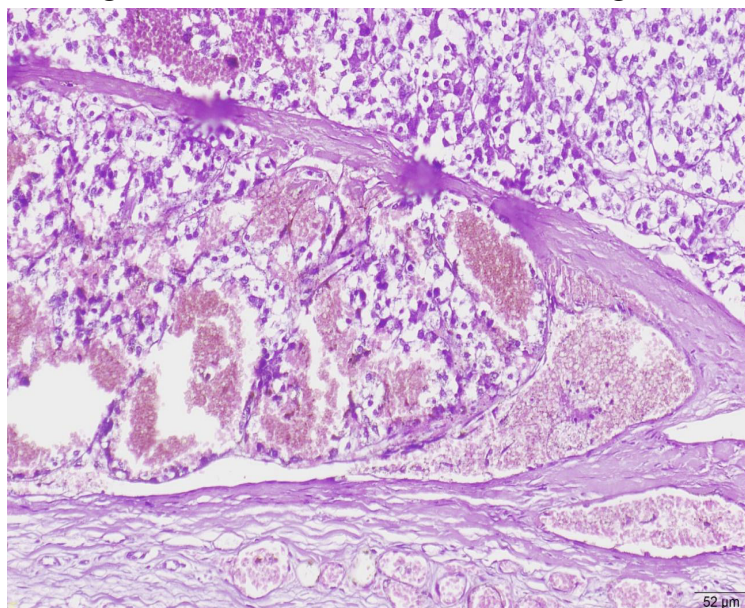


Source: The authors.

Note. (A) Well-demarcated, highly cellular, expansive growth, and encapsulated proliferation of neuroendocrine neoplastic cells is observed (HE, 8x). (B) Round to elongated neoplastic cells, sometimes with distinct, sometimes with indistinct borders, forming islands surrounded by trabeculae of delicate fibrous connective tissue (HE, 20x).

Figure 3

Histological slide of the chemodectoma in a dog.



Source: The authors.

Note. Areas of moderate focally extensive coagulation necrosis, moderate multifocal hemorrhage, and mild multifocal hemosiderin can be seen interspersed with the neoplasm (HE, 15x).

DISCUSSION

Chemodectomas are neoplasms arising from chemoreceptor organs, whose function is related to the detection of changes in pH, carbon dioxide and oxygen content, help in the regulation of circulation and breathing (Ocarino et al., 2016).

The carotid and aortic bodies are composed of chemoreceptor and supporting cells, and may cause an increase in depth, minute volume and respiratory rate and result in increased heart rate and blood pressure (Rosol & Gröne, 2016).

Among primary heart tumors, chemodectoma is the second most frequent (Aupperle et al., 2007). It is believed that brachycephalic breeds are more susceptible to developing this type of neoplasm.

In addition to the genetic factor, these breeds have airway restriction due to stenotic nostrils and elongated soft palate, which lead to increased respiratory effort and collapse of the larynx, causing chronic hypoxia that may result in hyperplasia of the chemoreceptor organs, followed by neoplasm (Hayes, 1975).

This report describes a chemodectoma in a boxer dog, which is the breed with the highest number of cases (Hayes, 1975; Noszczyk-Nowak et al., 2010; Mesquita et al., 2012).

As for the location of this neoplasm, tumors tend to occur more frequently in the aortic body than in the carotid body and can be single or multiple, varying in size, therefore carcinomas are usually larger than adenomas (Rosol & Meuten, 2017). In this case, neoplasm was not observed in the carotid body, it was only observed in the aortic body. Depending on the size of the neoplasm, displacement of the trachea may occur according to Rosol & Meuten (2017), however, this change was not observed in the present study.

According to the literature, tumors are firm, whitish with red areas when cut (Ocarino et al., 2016; Rosol & Meuten, 2017), which was also observed in the present report.

According to the literature, histologically, the cells are subdivided into lobules by trabeculae of fibrous connective tissue and capillaries. Neoplastic cells have shapes that vary from cuboid to polyhedral, with eosinophilic, finely granular cytoplasm, and may contain vacuoles.

Cells tend to undergo rapid autolysis (Rosol & Meuten, 2017), a feature observed in neoplastic cells, but not detected in other organs. Nevertheless, coagulation necrosis and hemorrhage, which are also common in chemodectomas, are observed (Rosol & Meuten, 2017).

Chemodectomas in the aortic and carotid bodies are nonfunctional, and their clinical manifestation is associated with the location and size of the tumor (Ocarino et al., 2016).

Animals usually present changes related to cardiac decompensation, such as dyspnea, cough, cyanosis, hydrothorax, hydropericardium, ascites, edema, and passive liver congestion (Rosol & Meuten, 2017). Besides, swallowing may be difficult when the esophagus is compressed. Cardiac hypertrophy and chamber dilation are some of the consequences of the tumor (Ocarino et al., 2016), since the tumor grows by expansion and may cause compression of the vena cava and atrium (Rosol & Gröne, 2016).

The animal in this report did not have a history of clinical signs related to cardiac alteration, however,

concentric hypertrophy was seen at necropsy, which may be related to cardiac decompensation.

As for the classification, malignant chemodectoma occurs less frequently than benign ones, and, when it occurs, atrial infiltration, and also in the wall of adjacent vessels, may occur.

Metastases are uncommon (Aupperle et al., 2007; Noszczyk-Nowak et al., 2010; Mesquita et al., 2012), however, when they occur, they are found in lymph nodes, lungs, kidneys, spleens and bones (Ocarino et al., 2016). Although no metastases were found, the tumor was considered malignant, due to the presence of neoplastic emboli in multiple blood vessels adjacent to the neoplasm.

Differential diagnoses are hemangiosarcomas, ectopic thyroid carcinomas, cardiac lymphomas and mesotheliomas, which frequently occur in dogs in common sites of chemodectomas. Differentiation is based on histological criteria as these tumors may also cause obstruction and heart failure due to their location (Mesquita et al., 2012).

CONCLUSION

Chemodectomas should always be included in the differentials of thoracic neoplasms, especially those close to the cardiac tissue. Although most of these tumors have benign cellular features, they are considered malignant due

to their location. In this case, the occurrence of malignant cells in vessels worsens the condition, considering that metastases may also occur. Thus, the importance of the histological characterization of these neoplasms in small animals is highlighted.

COMPETING INTERESTS

The authors declare that there are no conflicts of interest.

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The authors declare that they have no financial interests.

AUTHOR CONTRIBUTIONS

Conceptualization: J. C. S. J. L., K. C. P. M., J. C. G. e A. M. V. *Data curation:* J. C. S. J. L., K. C. P. M., M. M. B. e A. M. V. *Formal analysis:* J. C. S. J. L e A. M. V. *Investigation:* J. C. S. J. L., K. C. P. M., J. C. G., M. M. B. e A. M. V. *Methodology:* J. C. S. J. L., M. M. B. e A. M. V. *Project administration:* J. C. S. J. L. e A. M. V. *Resources:* J. C. S. J. L. e A. M. V. *Supervision:* A. M. V. *Validation:* J. C. S. J. L., M. M. B. e A. M. V. *Visualization:* J. C. S. J. L., J. C. G. e A. M. V. *Writing the initial draft:* J. C. S. J. L., K. C. P. M., M. M. B. e A. M. V. *Revision and editing of writing:* J. C. S. J. L e A. M. V.

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