

Canine fibroblastic osteosarcoma: case report and diagnostic approach

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Abstract. Osteosarcoma is the most common malignant bone neoplasm in dogs, particularly in large-breed animals, and is characterized by the proliferation of malignant mesenchymal cells with osteoid matrix production. This study aims to report a case of fibroblastic osteosarcoma in a male Flat-Coated Retriever, approximately 8 years old and weighing 33 kg, which presented with progressive lameness of the left thoracic limb. Clinical evaluation included physical examination, hematological tests, and radiographic, electrocardiographic, echocardiographic, histopathological, and immunohistochemical analyses. Radiographic findings revealed bone lysis associated with a proliferative reaction, while histopathology confirmed the presence of characteristic neoplastic cells, with a Ki-67 positivity index of 20%. Treatment consisted of amputation of the affected limb followed by carboplatin chemotherapy administered every 21 days, for a total of six cycles. The patient showed a favorable clinical response, with no radiographic evidence of metastasis to date. It is concluded that early diagnosis, combined with a multimodal therapeutic approach, is essential to improve survival and quality of life in dogs affected by osteosarcoma, and that the association of surgery and chemotherapy represents an effective treatment strategy.

Keywords: Carboplatin, histopathology, immunohistochemistry, limb lameness, bone tumor.

Osteossarcoma fibroblástico canino: relato de caso e abordagem diagnóstica

Resumo. O osteossarcoma é a neoplasia óssea maligna mais comum em cães, especialmente em animais de grande porte, sendo caracterizado pela proliferação de células mesenquimais malignas com produção de matriz osteoide. Este estudo tem como objetivo relatar um caso de osteossarcoma fibroblástico em um cão macho da raça Flat-Coated Retriever, com aproximadamente 8 anos de idade e peso de 33 kg, que apresentou claudicação progressiva do membro torácico esquerdo. A avaliação clínica incluiu exame físico, exames hematológicos e análises radiográfica, eletrocardiográfica, ecocardiográfica, histopatológica e imuno-histoquímica. Os achados radiográficos evidenciaram lise óssea associada a reação proliferativa, enquanto a histopatologia confirmou a presença de células neoplásicas características, com índice de positividade para Ki-67 de 20%. O tratamento consistiu na amputação do membro afetado, seguida de quimioterapia com carboplatina, administrada a cada 21 dias, totalizando seis ciclos. O paciente apresentou resposta clínica favorável, sem evidências radiográficas de metástase até o momento. Conclui-se que o diagnóstico precoce, associado a uma abordagem terapêutica multimodal, é essencial para melhorar a sobrevida e a qualidade de vida em cães acometidos por osteossarcoma, sendo a associação entre cirurgia e quimioterapia uma estratégia terapêutica eficaz.

Palavras-chave: Carboplatina, histopatologia, imuno-histoquímica, claudicação de membro, tumor ósseo.

Introduction

Osteosarcoma (OSA) is the most common primary bone neoplasm in dogs ([Troost et al., 2012](#)). It is characterized by the proliferation of malignant mesenchymal cells with osteoblastic differentiation and the production of an immature osteoid matrix, accounting for more than 85% of all skeletal tumors in this species ([Vail et al., 2019](#); [Withrow et al., 2020](#)). It is approximately 50 times more frequent in dogs than in humans, as reported by ([Kumar et al., 2021](#)), and predominantly affects large and giant breeds, although cases in young animals have also been described ([Evans, 1983](#); [Misdorp & Hart, 1979](#); [Phillips et al., 1986](#)).

Canine osteosarcoma most commonly affects the long bones of the appendicular skeleton, representing approximately 75% of cases, while about 25% occur in the axial skeleton and cranial bones ([Lacreta et al., 2002](#); [Lima et al., 2017](#); [Oliveira & Silveira, 2008](#)). Extraskkeletal forms are rare, accounting for approximately 1% of cases ([Stimson et al., 1978](#)). Although the etiology of osteosarcoma is not fully understood, genetic predisposition, repetitive trauma to metaphyseal regions, chronic osteomyelitis, and exposure to ionizing radiation have been suggested as contributing factors ([Gellasch et al., 2002](#); [Gillet et al., 1992](#)).

Clinically, affected dogs commonly present with lameness, localized pain, and progressive swelling, which may evolve to functional impairment in advanced stages. Pain is mainly associated with microfractures and periosteal involvement caused by tumor expansion ([Liu et al., 1977](#); [Vail et al., 2019](#); [Withrow et al., 2020](#)). Diagnosis is based on clinical history, physical examination, and radiographic findings, with definitive confirmation obtained through biopsy and histopathological evaluation ([Davis et al., 2002](#); [Jongeward, 1985](#); [Liu et al., 1977](#)). Complementary diagnostic methods, such as immunohistochemistry, computed tomography, and scintigraphy, may assist in lesion assessment and differential diagnosis, including fungal osteomyelitis and hypertrophic osteopathy ([Davis et al., 2002](#); [Lindenbaum & Alexander, 1984](#)).

Treatment generally consists of surgical removal of the primary tumor, most commonly by limb amputation, combined with adjuvant chemotherapy, which improves survival time and quality of life ([Fossum, 2021](#); [Oliveira & Silveira, 2008](#)). When amputation is performed alone, survival is usually limited to three to six months; however, combined treatment may extend survival to approximately 300 - 400 days ([Daleck et al., 2016](#)). Given the high incidence and clinical relevance of canine osteosarcoma, the present study aims to report a case of fibroblastic osteosarcoma, describing the diagnostic approach, therapeutic management, and clinical outcome.

Case description

A Flat-Coated Retriever dog was presented with a history of progressive lameness affecting the left thoracic limb. According to the owner, the initial clinical signs were subtle and included frequent licking of the affected limb, followed by mild lameness that gradually worsened over time. No history of trauma was reported. On physical examination, marked lameness of the left thoracic limb was observed, with pain on palpation of the distal region and reduced weight bearing. Due to the orthopedic nature of the complaint, diagnostic imaging was requested.

Initial radiographic examination of the left thoracic limb revealed cortical thinning, central bone lysis, and irregular periosteal proliferation, consistent with an aggressive expansile bone lesion located in the distal third of the radius ([Figure 1](#)).

With clinical progression characterized by worsening lameness and complete absence of limb support, additional radiographs were obtained in mediolateral and craniocaudal projections, allowing better characterization of the lesion ([Figure 2](#)). The images demonstrated a mixed bone reaction, predominantly lytic, with a circumscribed area of decreased radiopacity extending from the distal diaphysis to the metaphysis and distal epiphysis of the left radius.

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Proliferative periosteal reaction was observed on the medial aspect of the distal diaphysis, along with mild adjacent soft tissue swelling, features commonly associated with aggressive bone neoplasms. The carpal, metacarpal, and digital bones were preserved, and no significant alterations were observed in other skeletal structures. For tumor staging and evaluation of possible pulmonary metastases, thoracic radiographs were obtained in right and left anterolateral projections ([Figure 3](#)) and in the ventrodorsally projection ([Figure 4](#)).



Figure 1. Radiograph of the metacarpal region of the thoracic limb of a dog showing bone changes compatible with osteosarcoma

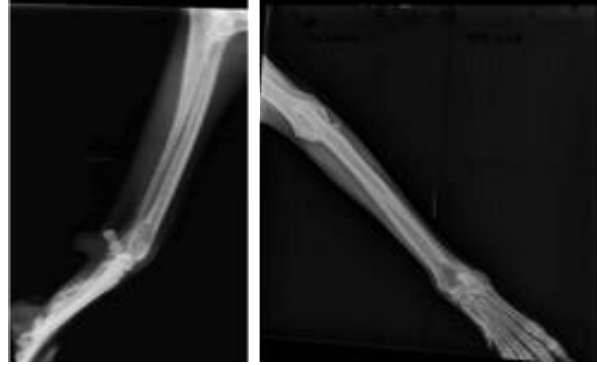


Figure 2. Mediolateral and craniocaudal radiographic projections of the left thoracic limb.

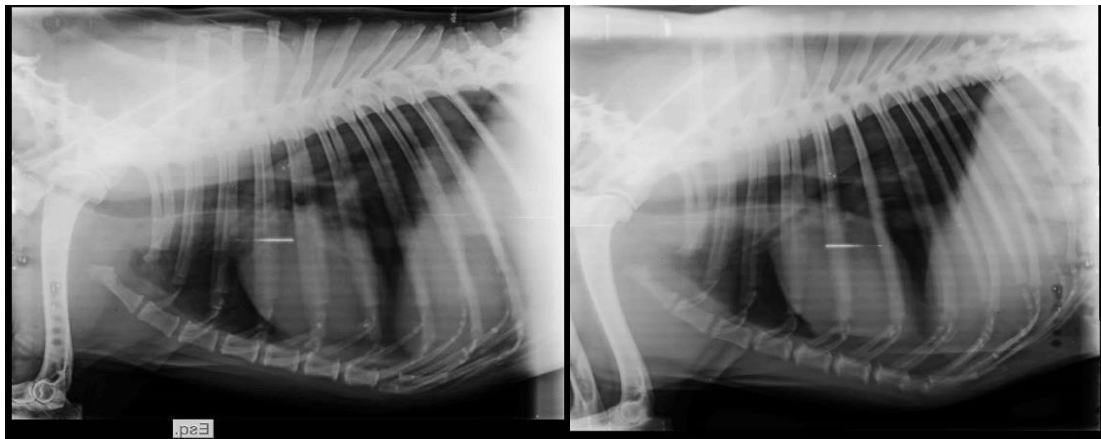


Figure 3. Right and left laterolateral thoracic radiographic projections.



Figure 4. Ventrodorsal thoracic radiographic projection

No pulmonary nodules or intrathoracic lymphadenopathy were identified. The cardiac silhouette was within normal limits, pulmonary vessels had preserved caliber, diaphragmatic contours were intact, and no significant radiographic alterations were observed in the pulmonary parenchyma. A mild reduction of the tracheal lumen in the cervicothoracic region was noted, compatible with mild tracheal collapse. The radiographic findings were essential to support the presumptive diagnosis of appendicular osteosarcoma, highlighting the presence of aggressive bone lysis, irregular periosteal reaction, mild soft tissue involvement, and absence of detectable pulmonary metastases at the time of evaluation.

Prior to the initiation of chemotherapy, cardiological evaluation was performed due to the potential cardiotoxic effects of antineoplastic agents, particularly doxorubicin ([Billingham, 1978](#)). Electrocardiographic examination revealed isolated ventricular premature complexes and increased QRS duration, suggesting possible left ventricular overload ([Figure 5](#)). Two-dimensional echocardiography demonstrated normal cardiac chamber dimensions and physiological transvalvular flow patterns ([Figure 6](#)), confirming preserved cardiac function and suitability for chemotherapy.



Figure 5. Electrocardiographic examination showing ventricular premature complexes.

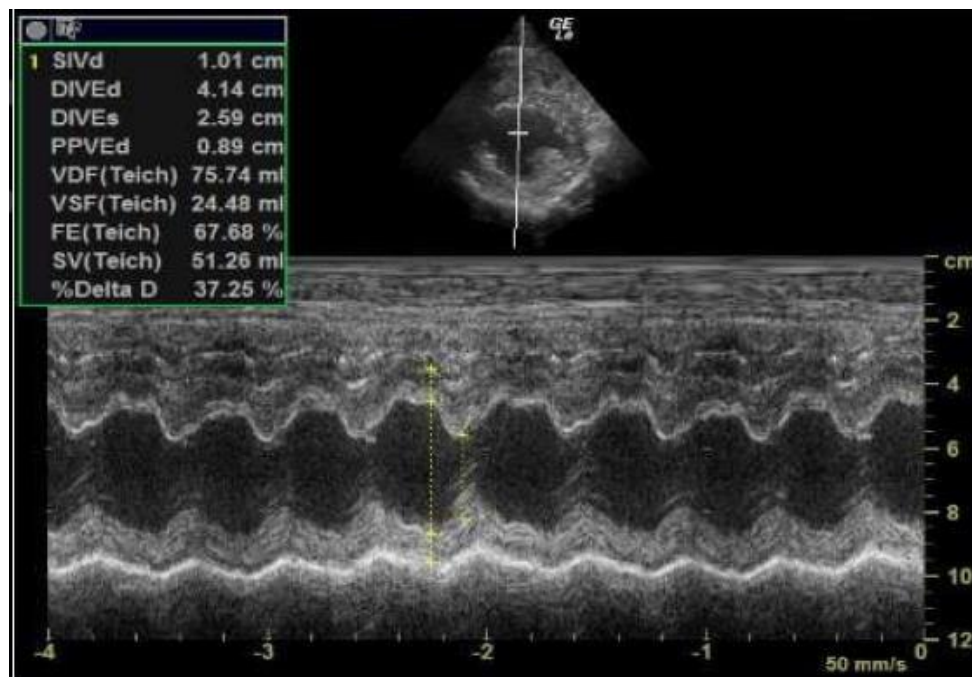


Figure 6. M-mode echocardiographic image of the left ventricle within normal limits

Discussion

Canine osteosarcoma (OSA) is recognized as the most prevalent primary malignant bone neoplasm in dogs, particularly affecting large and giant breeds ([Daleck et al., 2016](#); [Vail et al., 2019](#); [Withrow et al., 2020](#)). The clinical presentation described in the present case, involving a male Flat-Coated Retriever approximately eight years of age, is consistent with the epidemiological profile reported in the literature, in which middle-aged to older dogs of large body mass are disproportionately represented ([Kumar et al., 2021](#); [Misdorp & Hart, 1979](#)).

The anatomical location of the lesion in the distal radius corroborates the classical distribution pattern of appendicular osteosarcoma, frequently summarized as occurring “away from the elbow and toward the knee” ([Lacreta et al., 2002](#); [Vail et al., 2019](#); [Withrow et al., 2020](#)). The distal radial metaphysis is one of the most commonly affected sites, a finding that may be associated with increased biomechanical stress and intense metaphyseal vascularization ([Gillet et al., 1992](#)). Radiographically, the findings of cortical thinning, central bone lysis, and irregular periosteal proliferation are consistent with an aggressive bone process, as previously described for osteosarcoma ([Brian, 1995](#); [Liu et al., 1977](#)). These imaging characteristics are essential for differentiating osteosarcoma from infectious osteomyelitis, fungal bone disease, and other primary skeletal tumors ([Davis et al., 2002](#); [Lindenbaum & Alexander, 1984](#)).

Definitive diagnosis was established through histopathological examination, which confirmed the fibroblastic subtype of osteosarcoma. The defining feature of this neoplasm is the production of malignant osteoid by neoplastic mesenchymal cells ([Vail et al., 2019](#); [Withrow et al., 2020](#)). Although the prognostic significance of histological subtype in canine osteosarcoma remains controversial, histopathological confirmation is indispensable for accurate diagnosis and therapeutic planning ([Daleck et al., 2016](#)).

Immunohistochemical evaluation demonstrated a Ki-67 proliferation index of 20%, indicating moderate proliferative activity. Ki-67 is widely employed as a marker of cellular proliferation in oncologic pathology and has been associated with tumor aggressiveness in various neoplasms ([Davis et al., 2002](#)). Although standardized prognostic cutoffs for Ki-67 expression in canine osteosarcoma have not been definitively established, increased proliferative indices are generally correlated with higher biological aggressiveness ([Fossum, 2021](#)).

Thoracic radiographic staging did not reveal evidence of pulmonary metastasis at the time of diagnosis. However, it is well documented that most dogs with appendicular osteosarcoma present with micrometastatic disease at diagnosis, even when thoracic imaging findings are unremarkable ([Daleck et al., 2016](#); [Fossum, 2021](#); [Vail et al., 2019](#); [Withrow et al., 2020](#)). The lungs represent the primary site of metastatic dissemination due to hematogenous spread. Therefore, the absence of radiographically detectable metastasis should not be interpreted as the absence of systemic disease.

The therapeutic approach adopted, consisting of limb amputation followed by adjuvant chemotherapy with carboplatin administered every 21 days for six cycles, is consistent with current treatment recommendations ([Daleck et al., 2016](#); [Fossum, 2021](#)). Amputation alone provides effective pain relief; however, survival time is generally limited to approximately three to six months when no adjuvant therapy is employed ([Daleck et al., 2016](#)). The addition of platinum-based chemotherapy significantly increases median survival time, which may range from 300 to 400 days in treated patients ([Fossum, 2021](#)).

In the present case, the patient demonstrated favorable clinical evolution, with satisfactory tolerance to chemotherapy and no radiographic evidence of metastasis to date. Although long-term monitoring remains essential due to the high metastatic potential of this neoplasm, the outcome observed reinforces the importance of early diagnosis and multimodal therapy in improving survival and quality of life ([Daleck et al., 2016](#)).

Conclusion

This case report emphasizes the clinical relevance of fibroblastic osteosarcoma as an important, though less frequently described, histological subtype of canine osteosarcoma. The diagnostic approach adopted in this case, combining thorough clinical assessment with radiographic evaluation, histopathological examination, and immunohistochemical analysis, was fundamental for achieving an accurate diagnosis and distinguishing this neoplasm from other aggressive bone lesions.

Furthermore, the therapeutic strategy based on limb amputation followed by adjuvant carboplatin chemotherapy proved to be effective in controlling local disease and maintaining the patient's quality of life during the follow-up period. These findings reinforce the importance of early diagnosis and a multimodal treatment approach in dogs with osteosarcoma and highlight the value of detailed case reports in expanding current knowledge on the biological.

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