

## Humeral chondrosarcoma associated with lung metastases in a young dog – case report

[*Condrossarcoma em úmero associado a metástases pulmonares em cão jovem – relato de caso*]

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### ABSTRACT

Chondrosarcoma, an unusual malignant neoplasm, develops in cartilaginous tissue and presents low rate of metastasis, mainly affecting the axial skeleton from the adult to senile dogs. In the face of unusual occurrence of chondrosarcoma in the long bones of young dogs, the present report aimed to describe it in the right humerus of a two-and-a-half-year-old Siberian Husky, attended at the Veterinary Hospital of the University of Franca, with limping of the right thoracic limb, for 20 days. The radiographic examination of the humerus showed bone lysis and periosteal proliferation. In the incisional biopsy, proliferation of atypical chondrocytes with diffuse distribution, interspersed with compact bone matrix, was observed. The amputation of the limb was performed, and the fragment histopathological analysis showed grade I chondrosarcoma. Periodic returns were made for neoplastic staging, and at 240 days after surgery lung metastases were detected, however, the tutor did not authorize chemotherapy and radiotherapy for financial reasons and due to the absence of respiratory symptoms so far (410 days after surgery). Although uncommon, chondrosarcoma can affect the long bones of young dogs, with clinical signs similar to other bone neoplasms, and, even with the radical limb amputation, can demonstrate systemic metastasis.

Keywords: atypical chondrocytes, bone lysis, bone neoplasm, veterinary oncology

### RESUMO

*O condrossarcoma, neoplasia maligna incomum, desenvolve-se em tecido cartilaginoso e apresenta baixo índice de metástases, acometendo principalmente o esqueleto axial de cães adultos a senis. Diante da ocorrência incomum de condrossarcoma em ossos longos de cães jovens, o presente relato teve como objetivo descrevê-lo no úmero direito de um Husky Siberiano de dois anos e meio de idade, atendido no Hospital Veterinário da Universidade de Franca, com claudicação do membro torácico direito, há 20 dias. O exame radiográfico do úmero mostrou lise óssea e proliferação periosteal. Na biópsia incisional, observou-se proliferação de condrócitos atípicos com distribuição difusa, intercalados com matriz óssea compacta. Foi realizada a amputação do membro, e a análise histopatológica do fragmento evidenciou condrossarcoma grau I. Foram feitos retornos periódicos para estadiamento neoplásico e, aos 240 dias após a cirurgia, foram detectadas metástases pulmonares. O tutor não autorizou quimioterapia e radioterapia por motivos financeiros e por ausência de sintomas respiratórios até o momento (410 dias após a cirurgia). Apesar de incomum, o condrossarcoma pode acometer os ossos longos de cães jovens, com sinais clínicos semelhantes a outras neoplasias ósseas, e, mesmo com a amputação radical do membro, pode demonstrar metástase sistêmica.*

Palavras-chave: condrócitos atípicos, lise óssea, neoplasia óssea, oncologia veterinária

### INTRODUCTION

Chondrosarcoma is characterized by malignant primary bone neoplasm (Kleiner and Silva 2003), of mesenchymal or myxoid origin

(Garcez *et al.*, 2009; Filgueira *et al.*, 2016), originated from cartilaginous cells, that is, without the formation of osteoid or bone from neoplastic cells (Araújo *et al.*, 2006; Hahe *et al.*, 2020).

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Submitted: August 9, 2022. Accepted: April 27, 2023.

It presents slow progression and low metastatic index (Gonçalves *et al.*, 2012), mainly affecting the skeletal system of dogs (Andrade, 2008; Prestes *et al.*, 2017), with the axial skeleton being the most affected (Garcez *et al.*, 2009). However, the penile bone and extra skeletal region, such as mammary glands, omentum, larynx, trachea, lung, aorta, and heart valves can also be affected (Munday and Prah, 2002).

The incidence of chondrosarcoma in dogs is uncommon, corresponding to 10% of bone tumors reported in this species (Kleiner and Silva 2003; Araújo *et al.*, 2006), causing local destruction and invasion of adjacent tissues. The etiology is unknown; however, it is believed that it can be developed from multiple osteochondroma or multiple cartilaginous exostosis (Filgueira *et al.*, 2016).

Chondrosarcoma demonstrates predisposition for medium to large dogs and usually affects adults to senile, with no sexual predilection (Andrade, 2008).

Clinical manifestations are varied and dependent on the affected area, including touch sensibility and local swelling, lameness, pathological fractures, anorexia, weight loss, nasal discharge, pleural effusion (Andrade, 2008), sneezing, coughing, dyspnea, convulsions, coagulation disorders and paraneoplastic syndrome (Munday and Prah, 2002).

The diagnosis of chondrosarcoma should be based on anamnesis, physical examination, imaging tests such as radiography, magnetic resonance imaging and computed tomography to help identify bone lysis and invasion of adjacent soft tissues; nonetheless, the definitive diagnosis must be made by cytological examination followed by histopathological examination (Vinayak *et al.*, 2018).

The prognosis is established after evaluating the degree of differentiation of the neoplasm, the affected region, and the possibility of surgical intervention (Gonçalves *et al.*, 2012).

Regarding treatment, tumor resection is the option of choice. Chemotherapy and radiotherapy may be used as adjuvants, as there is no scientific proof of their effectiveness (Carvalho *et al.*, 2013).

In view of the malignancy and uncommon occurrence of chondrosarcoma in the long bones of young dogs, the present report aimed to describe this neoplasm in the right humerus of a two-and-a-half-year-old canine, emphasizing the clinical, diagnostic, therapeutic and evolutionary aspects and, nevertheless, make veterinarians aware that chondrosarcoma should be included in the differential diagnosis of other neoplasms that cause similar clinical signs, such as osteosarcoma.

## CASE REPORT

A two-and-a-half-year-old intact male Siberian Husky, weighing 50.7 pounds, was treated at the Veterinary Hospital of the University of Franca, with limping of the right appendicular thoracic limb, for 20 days.

During physical examination, the patient had sensibility to palpation and swelling of the limb in the proximal region of the right humerus, followed by lameness and no support on the ground. The right axillary lymph node was not reactive, and the other physiological parameters were within the normal range for the species.

Radiographic examination of the affected limb, performed on the same day as the consultation, showed signs compatible with bone lysis associated with irregular periosteal proliferation in the proximal right humerus region, suggestive of bone neoplasm (Fig. 1). Additional imaging tests, as chest radiographs and abdominal ultrasonography were requested for tumor staging but did not indicate the presence of metastases.

Hematological parameters were within the normal range for the species, except for a slight increase in the hepatic enzyme alanine aminotransferase (167 U/L).

After three days of the complementary exams, the patient was submitted to inhalational general anesthesia to perform an incisional biopsy of the right humeral region, with the aid of a surgical punch. The fragments obtained were sent for microscopic analysis, which showed proliferation of atypical chondrocytes with diffuse distribution, interspersed with compact bone matrix, and extending to the limits of the histological sections. Furthermore, the cells were

large, rounded, with ample cytoplasm, rounded nuclei, and evident nucleoli, which was compatible with chondrosarcoma.



Figure 1. Mediolateral radiographic image of a young dog's right humerus, demonstrating bone lysis in the proximal region associated with irregular periosteal proliferation (arrow).

In view of the histopathological report, amputation of the affected limb was performed (ten days after the incisional biopsy), following conventional surgical technique (Fossum, 2014) to control the primary neoplasm and pain relief.

The irregular neoformation in the proximal region of the right humerus measured approximately 7.0 x 4.0 x 6.0cm in diameter, and at cut, was well delimited, whitish in color, firm in consistency and without apparent bone destruction (Fig. 2).

Fragments of the neoformation were again sent for histopathological analysis, which showed proliferation of malignant mesenchymal cells forming chondroid cartilage (Fig. 3), causing disorganization in the hyaline cartilage. The neoplastic cells had ample, delimited, and vacuolated cytoplasm, round, eosinophilic, central, sometimes pyknotic or absent nuclei, loose chromatin, and indistinct nucleoli (Fig. 4), in addition to marked pleomorphism, anisocytosis and anisokaryosis. Furthermore, the presence of trabeculae of disorganized bone matrix in hyaline cartilage and discrete lymphoplasmacytic inflammatory infiltrate. The findings confirmed the diagnosis of grade I chondrosarcoma.

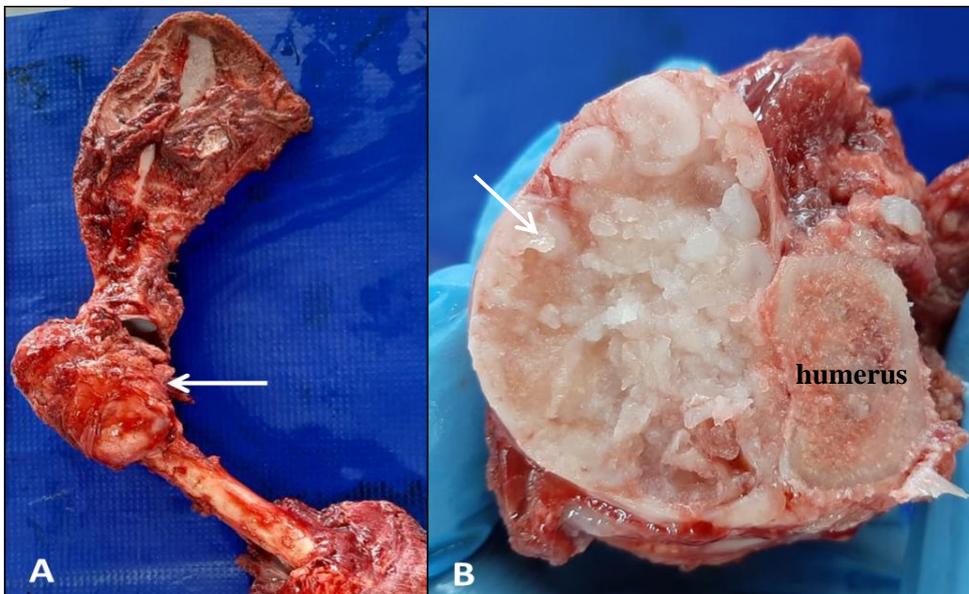


Figure 2. Macroscopic images after amputation of the right appendicular thoracic limb of a young dog, showing in A: increase in volume in the proximal region of the humerus (arrow) and B: right humeral neoformation of irregular appearance, measuring approximately 7.0 x 4.0 x 6.0 cm in diameter; when cut, whitish and delimited.

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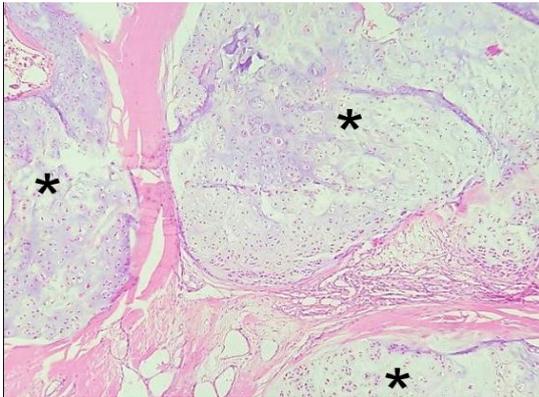


Figure 3. Photomicrograph of a bone fragment from the proximal region of the right humerus of a young dog, demonstrating multifocal areas of proliferation of malignant mesenchymal cells forming chondroid cartilage (asterisks) H.E., 100x magnification.

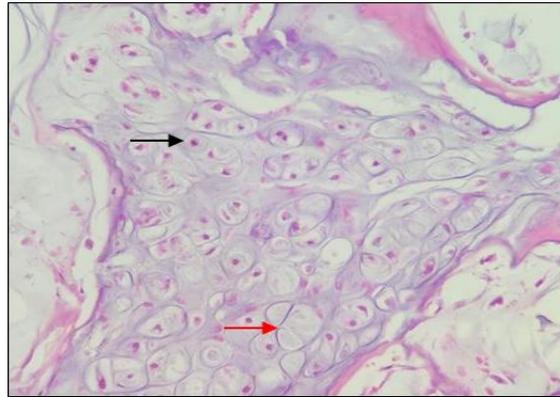


Figure 4. Photomicrograph of a bone fragment from the proximal region of a young dog's right humerus, demonstrating neoplastic cells with ample, delimited, and vacuolated cytoplasm, round, eosinophilic and central nuclei (black arrow), sometimes pyknotic or absent (red arrow), loose chromatin and indistinct nucleoli. H.E., 400x magnification.

In the immediate postoperative period, the patient was treated with antibiotics (Cephalexin 25mg/kg, orally, every 12 hours, for 7 days), anti-inflammatory (Meloxicam 0.1mg/kg, orally, per day, for 4 days) drugs, analgesics (Tramadol 5mg/kg, orally, every 8 hours, for 7 days and Dipyrrone 25mg/kg, every 8 hours, for 7 days) and gastric protectors (Omeprazole 1mg/kg, orally, every 12 hours, for 7 days), in addition to daily dressings. Returning on the 14th postoperative day, for the removal of the stitches, the animal was well adapted to the new physical condition.

Due to the classification of chondrosarcoma grade I, it was decided not to perform adjuvant

chemotherapy and radiotherapy and the tutor was aware of the importance of periodic returns for neoplastic staging. In this sense, the patient returned five months (150 days) after the surgical procedure, and no neoplastic recurrence or distant metastases were detected in the chest radiography and abdominal ultrasound exams. However, in the following return visit, 240 days after the surgery, pulmonary metastasis were detected (Fig. 5) such as nodular radiopaque areas, characterizing a structured interstitial pulmonary pattern. The tutor did not authorize complementary therapies due to financial reasons and because the animal, so far (410 days after the surgery), has apparently no respiratory symptoms.

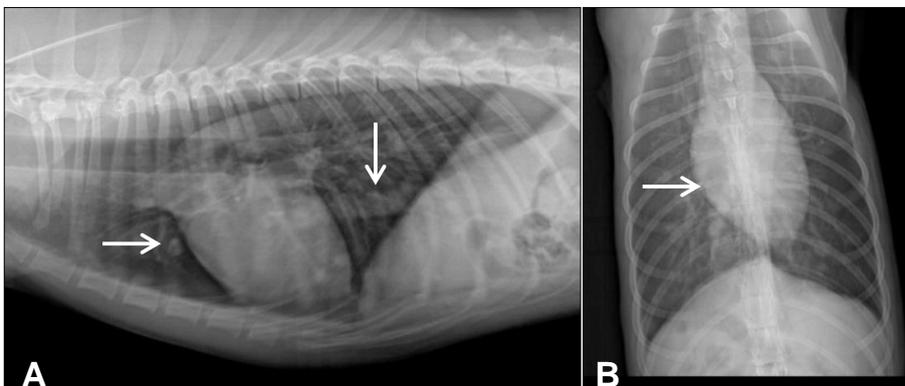


Figure 5. Radiographic images of a young dog's chest, in latero-lateral (A) and ventro-dorsal (B) views, demonstrating metastatic foci (arrows) with nodular radiopaque areas, the largest measuring approximately 5 cm, characterizing a structured interstitial pulmonary pattern.

## DISCUSSION

The described canine is medium-sized, corroborating the descriptions of Andrade (2008), however, it is a Siberian Husky, which differs from the reports of Kleiner and Silva (2003), that the most affected breeds by chondrosarcoma are German Shepherds, Boxers and Golden Retrievers. Furthermore, the patient was young (two-and-a-half-years-old), not coinciding with the scientific literature that the most affected are adults to senile, with an average of 7.2 years, ranging from 6 to 14 years (Andrade, 2008), thus highlighting the particularity of this report.

Although chondrosarcomas have a higher incidence in flat bones of the axial skeleton, in the present case, the neoplasm developed in the appendicular skeleton, specifically in the humerus (long), causing bone lysis, as described by Garcez *et al.* (2009). Boudrieau *et al.* (1994) also described the occurrence of chondrosarcoma in the proximal portion of the left radius bone in an adult dog, and Carvalho *et al.* (2013), in the proximal third of the right tibia of a one-and-half-year-old dog.

The symptoms and behavior of patients with chondrosarcoma are diversified according to the affected region; on this topic, Carvalho *et al.* (2013) reported similar clinical signs (increase in volume and limb lameness) in the dog diagnosed with the neoplasm in the tibia, as well as in the mixed breed and adult female cat, with involvement of the scapula, described by Araújo *et al.* (2006).

As for the diagnosis, chondrosarcoma may show a variable appearance on radiographs and can be easily confused with osteosarcoma (Gonçalves *et al.*, 2012), however, it has osteolysis and smaller areas of bone loss compared to osteosarcoma (Carvalho *et al.*, 2013). In this context, it is justified to carry out other complementary tests to define the diagnosis, including the histopathological one (Vinayak *et al.*, 2018), as performed in the reported patient, which also guides the therapeutic approach. Even though it was not performed on the reported patient for financial reasons of the tutor, the computed tomography demonstrates high sensitivity in detecting morphological changes, extension and depth of the lesion and involvement of other

tissues such as the lungs, in addition to differences in radiopacity that can differentiate sarcomas (Tossato *et al.*, 2002).

Through the histopathological examination, it was possible to classify the chondrosarcoma in grade I, because, according to Fletcher *et al.* (2002), the neoplasm was well differentiated, with a structure similar to hyaline cartilage, but with increased cellularity, occasionally binucleated, hyperstained and polymorphic; differently from grade II (moderate differentiation, greater number of cells per gap and high polymorphism and cellular disarrangement) and grade III (myxoid areas, undifferentiated cells and scarce hyaline matrix). Still in this sense, Vinayak *et al.* (2018) reported that chondrosarcoma can be classified, even if rare, as undifferentiated, when it has areas of clear mature cartilage and others with immaturity, high cellularity, and atypical mitoses.

In view of the diagnosis of grade I chondrosarcoma, the treatment instituted was radical amputation of the affected limb, associated with scapulectomy, following the recommendations of Garcez *et al.* (2009) and Carvalho *et al.* (2013) for cases of bone tumors without surgical margin, aiming at neoplastic and local sensitivity control. In this regard, despite the patient's size, he quickly adapted to the condition of the limb amputation, supporting his weight, and maintaining normal habits with perfect balance and without compromising the remaining contralateral limb; for this, the tutor was asked to keep him on a non-slip floor and not offer too much food, avoiding obesity. This satisfying result corroborated the descriptions by Kirpensteijn *et al.* (2000) and Galindo-Zamora *et al.* (2016). This excellent adaptation is probably due to the non-acting of psychological factors, unlike what was reported in humans by Schulz (2009).

Despite the low metastatic rate of chondrosarcoma (Garcez *et al.*, 2009), when they occur, they usually affect the lungs (Filgueira *et al.*, 2016), coinciding with the reported dog, even though it was classified as grade I. On the other hand, Farese *et al.* (2009) described absence of metastases in 25 dogs with grade I appendicular involvement treated with limb amputation alone.

Still referring to the prognosis of chondrosarcoma, Boudrieau *et al.* (1994) reported that after six months of local excision in the proximal portion of the left radius bone, a canine patient demonstrated metastasis in the subcutaneous tissue, thoracic and abdominal cavity, but not locally. Downey *et al.* (2022) reported that internal hemipelvectomy associated with radiotherapy promoted a survival of 1271 days in a canine patient with grade II iliac chondrosarcoma.

Thus, although surgical treatment with a wide margin of safety has provided quality of life and thirteen-month survival (until the moment), it is believed that the chemotherapy and radiotherapy as adjuvants could have been beneficial in prolonging the life of the patient in question (Carvalho *et al.*, 2013).

### CONCLUSION

Considering the case report, it is possible to admit that chondrosarcoma, although uncommon in the long bones of young dogs, can compromise the appendicular system and demonstrate clinical signs similar to other bone neoplasms, thus emphasizing the importance of precocious complementary exams to define the diagnosis and the grade of classification. Furthermore, even grade I chondrosarcoma treated with radical limb amputation can demonstrate pulmonary metastasis.

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