



## Metastatic Osteosarcoma in a Kangal Breed Dog

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### Abstract

In our study, we aimed to evaluate findings of osteosarcoma detected in a Kangal breed dog for the histopathological and radiographic aspects. The material of the study consisted of a male, 8 years old Kangal breed dog with a weight of 50 kg. There was no information about the history of the patient who was brought to the Surgical Clinic of the Faculty of Veterinary Medicine of Kafkas University with complaints of swelling in the left anterior extremity, lameness and respiratory weakness. Clinical examination revealed that the general condition of the patient was poor and there was a hard and painful swelling at the carpal joint level. Euthanasia was performed due to old age, poor condition and suspicious prognosis. Then, systemic necropsy was performed. After routine tissue follow-up procedures, 5 µm thick sections were taken from paraffin blocks for Hematoxylin Eosin staining. Sections were examined under light microscope to determine the histopathologic changes. Based on radiographic and histopathologic findings of the tumors in the left anterior extremity and metastatic foci in the lung, osteosarcoma was diagnosed.

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### Key words:

Dog, histopathology, metastasis, osteosarcoma, radiography.

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### Kangal Irkı Bir Köpekte Metastatik Osteosarkom

#### Özet

Bu çalışmamızda, Kangal ırkı bir köpekte saptanan osteosarkom vakasının histopatolojik ve radyografik açıdan değerlendirilmesi amaçlanmıştır. Çalışmanın materyalini 8 yaşında erkek 50 kg ağırlığında Kangal ırkı bir köpek oluşturdu. Sol ön ekstremitede şişlik, topallık ve solunum güçlüğü şikayetleri ile Kafkas Üniversitesi Veteriner Fakültesi Cerrahi Kliniği'ne getirilen hastanın geçmişine ilişkin bilgi edinilemedi. Klinik muayenede hastanın genel durumunun bozuk olduğu, karpal eklem seviyesinde, sert ve ağrılı bir şişliğin bulunduğu belirlendi. Hastanın yaşlı olması, genel durum bozukluğu ve prognozun kuşkuyla görülmesi üzerine ötenazisi yapıldı. Takibinde sistemik nekropsisi gerçekleştirildi. Rutin doku takip işlemlerinin ardından hazırlanan parafin bloklardan, Hematoksilin Eozin boyaması için 5 µm kalınlığında kesitler alındı. Histopatolojik değişikliklerin belirlenmesi amacıyla kesitler ışık mikroskopunda incelendi. Elde edilen radyografik ve histopatolojik bulgular ışığında sol ön ekstremitedeki tümoral kitle ve akciğerdeki metastatik odaklara osteosarkom tanısı konuldu.

**Anahtar sözcükler:** Histopatoloji, köpek, metastaz, osteosarkom, radyografi.

### Introduction

Osteosarcoma, the most common primary bone tumor of the appendicular skeleton in dogs (85 %), originates from mesenchyme (McNeill et al. 2007; Cristo et al. 2017; Murphy et al. 2017). This tumor, which accounts for approximately 70 % in cats of primary bone tumors, is rare in other animals (Kutsal et al. 2003; Gebhard et al. 2016; Thompson & Dittmer 2017). Osteosarcoma is formed especially in long bones such as radius, humerus, tibia and femur and more common in the anterior limbs (Sarierler et al. 2003; Erer & Kıran 2009; Altuğ & Deveci 2016). In rare cases, osteosarcomas are

observed in the ribs and skull bones (Erer et al. 1998). Osteosarcomas are osteolytic, osteoblastic and mixed according to their radiographic appearance (Erer et al. 1998; Aydoğan & Metin 2013); microscopically can be classified as osteoblastic, chondroblastic, fibroblastic, telangiectatic, and giant cell types depending on their matrix appearance in domestic animals (Boerman et al. 2012; Farjanikish et al. 2018). These tumors are locally aggressive and rapidly spread (McNeill et al. 2007, Sennazli et al. 2013). Osteosarcomas, which are highly metastatic, have a high recurrence rate and long-term

survival rates of this tumor are low (Gebhard et al. 2016, Leonardo et al. 2018; Withers et al. 2019). Cases originating from long bones in dogs usually metastasize to organs such as the lung, regional lymph nodes, liver and kidney (Kutsal et al. 2003; Murphy et al. 2017). It has rarely been reported to metastasize to the central nervous system, especially to the brain tissue (Pazzi et al. 2013; Cristo et al. 2017). It breaks down normal bones and metastasizes to the lung at a rate of 75% as a result of disease progression (Baştan 2013), and it is thought that this rate will increase to 100 % if dogs are death (Milli & Hazıroğlu 1997). Pulmonary metastases are similar to the primary tumor foci (Erer et al. 1998). Risk factors of this tumor were determined as age, race, body weight and sterilization status. (Tez et al. 2019). Osteosarcoma is more common in large breed dogs such as Ireland Setter, St. Bernard, Great Dane, Boxer and German Shepherd (Cristo et al. 2017; Murphy et al. 2017; Thompson & Dittmer 2017). There are some literature data indicating that some dog breeds such as Greyhound and Rottweiler are more prone to osteosarcoma (McNeill et al. 2007; Cristo et al. 2017). Male dogs are more sensitive than female dogs (Thompson & Dittmer 2017). The age of occurrence of the tumor is between 1 and 15 years of age (average 7.5) (Kutsal et al. 2003; Erer & Kıran 2009). Although the etiology of osteosarcoma has not been fully established in dogs; it is thought that metal implants used in fracture treatment, ionizing radiation and chronic osteomyelitis play a major role in the development of the tumor (Sarierler et al. 2003). Age progression and sterilization in dogs are the most important factors that increase the risk of osteosarcoma (Baştan 2013, Tez et al. 2019). Pathologic fractures, painful swelling and lameness are observed clinically in osteosarcoma (Kutsal et al. 2003; Altuğ & Deveci 2016; Thompson & Dittmer 2017).

In our study, we aimed to evaluate a case of osteoblastic osteosarcoma with lung metastasis in a Kangal breed dog with histopathological and radiographic parameters.

### Case Report

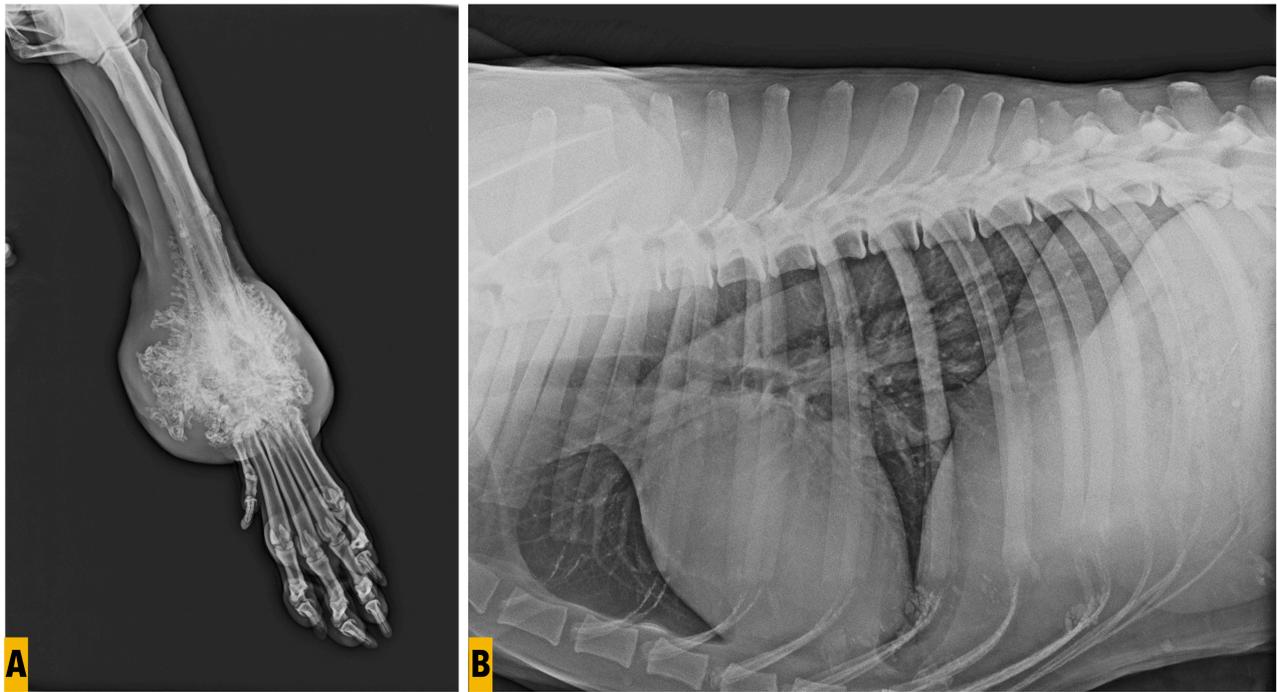
The material of the study consisted of a male, 8 years old Kangal breed dog with a weight of 50 kg. There was no information about the history of the patient who was brought to the Surgical Clinic of the Faculty of Veterinary Medicine of Kafkas University with complaints of swelling in the left anterior extremity, lameness and respiratory weakness. Clinical examination revealed that the general condition of the

patient was poor and there was a hard and painful swelling at the carpal joint level. Euthanasia was performed due to old age, poor condition and suspicious prognosis. Subsequently, systemic necropsy was performed. Some of the tissue samples taken from the animal were fixed in decalcified solution and another part was fixed in buffered formaldehyde solution. From the paraffin blocks prepared following routine tissue procedures, 5 µm-thick sections were obtained for Hematoxylin-Eosin staining. To determine the histopathological changes, the sections were examined by light microscope.

On the radiological examination, osteolysis including the carpal joint and distal condensation starting from 1/2 part of the radius were determined. We observed that degeneration, which started as diaphyseal osteophytic growths in the bone cortex, extended into the soft tissue by the destruction of the cortex in the metaphyseal and epiphyseal region. We noted that it continued as a lesion that forming severe periosteal reaction without borders. Due to the specific localization of the lesion, we suspected that the mass could be a bone tumor (Figure 1a). Thoracic radiography was performed to investigate the presence of metastasis. Peribronchiolar thickening and increased opacity were observed in the lungs. In addition suspicious radiopaque foci were detected in some areas (Figure 1b).

In the necropsy, hard body growths surrounded by connective tissue which 13\*15\*16 cm in size were observed at the level of the left carpal joint, including the distal parts of the radius and ulna (Figure 2a). The surface of this mass was yellowish white, and connective tissue and bone growth were observed in some places (Figure 2b). In addition, we detected a large number of solid nodular areas which in size ranging from 1 to 3 mm in the lung and we thought that they were metastatic foci (Figure 2c). Black areas were observed in the medial portion of the bronchiolar lymph node. Significant growth was detected in the right and left prescapular lymph nodes.

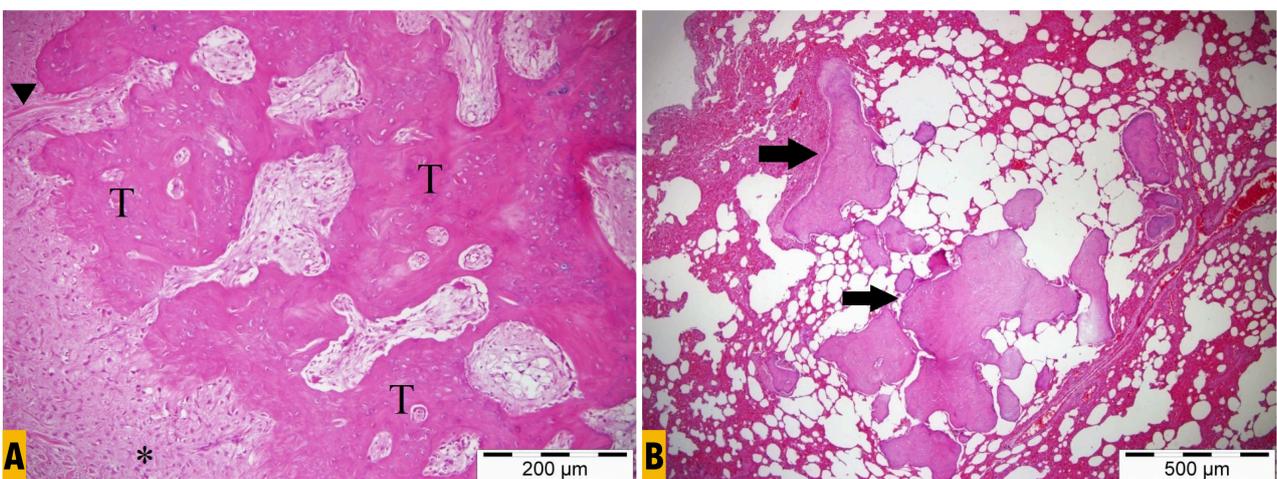
In the histopathological examination of the tumoral mass, we observed atypical osteoblasts with hyperchromatic nuclei, trabecular matrix formations, whorling structures formed by fibrosis and fibroblasts and osteoid areas (Figure 3a). Additionally large and small metastatic foci were detected in the lung tissue. Metastatic foci were similar to the primary tumoral mass (Figure 3b).



**Figure 1.** A) Radiographic appearance of the lesion in the left anterior limb, B) Thoracic radiography, suspicious radiopaque foci in the lung.



**Figure 2.** A) Swelling in the left anterior extremity, B) Macroscopic appearance of the tumor; The surface of this mass was yellowish white and connective tissue and bone growth were observed in some places, C) Lung metastasis; a large number of solid nodular areas with diameters ranging from 1 to 3 mm.



**Figure 3.** A) Trabecular matrix formations (T), whorling structures formed by fibrosis and fibroblasts (\*), osteoid (arrowhead), H&E, Bar= 200 µm, B) Metastatic areas (arrows) in lung, H&E, Bar= 500 µm.

## Discussion and Conclusion

Osteosarcomas are frequently observed in large breeds of dogs such as Ireland Sets, St. Bernard, Great Dane, Boxer, German Shepherd, Doberman, Pinscher, Golden Retriever, Rottweiler and Greyhounds (McNeill et al. 2007; Cristo et al. 2017; Murphy et al. 2017; Thompson & Dittmer 2017). This tumor is more common in male dogs than female dogs (Kutsal et al. 2003). The most common age range of this tumor from 1 to 15 years (Erer & Kıran 2009; Thompson & Dittmer 2017). In this study, similar to literature data (Kutsal et al. 2003; Güneş et al. 2009; Erer & Kıran 2009) osteosarcoma was observed in a male, 8 years old Kangal breed dog with a weight of 50 kg. Osteosarcomas are formed especially in metaphyseal region of the long bones such as distal radius, proximal humerus, proximal or distal tibia and distal femur and it is more common in the anterior limbs (Sarierler et al. 2003; Hoenerhoff et al. 2004; Erer & Kıran 2009; Altuğ & Deveci 2016). The recurrence rate of osteosarcoma is quite high, the prognosis is very poor; and less than 20 % of the affected dogs do not live for more than 2 years (Wilson et al. 2008, Leonardo et al. 2018, Withers et al. 2019). Amputation and chemotherapy are the most commonly used treatment modalities (Farese et al. 2004). The rate of metastasis of osteosarcoma to the lung is 75% and it is thought that this rate will increase to 100 % if the dogs are death (Milli & Hazıroğlu 1997; Baştan 2013). Pulmonary metastases show a similarity to the primary tumor foci from which they originate (Erer & Kıran 2009). Osteosarcomas microscopically can be classified as osteoblastic, chondroblastic, fibroblastic, telangiectatic, and giant cell types depending on their matrix appearance in domestic animals (Boerman et al. 2012; Farjanikish et al. 2018). In our study, parallel to previous works (Kutsal et al. 2003; Erer & Kıran 2009; Altuğ & Deveci 2016), we detected the tumoral mass at the level of the left carpal joint, including the distal parts of the radius and ulna. In addition we observed metastatic areas in the lungs, which we believe were originated from the primary tumor focus of varying sizes, large and small solid consistency. In the histopathological examination of the tumoral mass atypical malign osteoblasts with hyperchromatic nuclei and matrix formed trabecular structures, swirl structures fibrocytes and fibroblast infiltrations and irregular osteoid islands were observed similar to literature data (Thompson & Dittmer 2017). Additionally large and small metastatic foci were detected in the lung tissue. Metastatic foci were similar to the primary tumoral mass.

In conclusion, we diagnosed osteoblastic osteosarcoma in the tumor mass taken from the left anterior extremity and metastatic areas of the lung based on the light of radiographic and histopathological findings. In the literature search, we observed that there are very few cases of osteosarcoma detected in Kangal breed dog (Erer et al. 1998) and we thought that the findings in our will contribute to the literature data in the context of native breeds.

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