



*Veterinary Medical Case Study*

**OSTEOSARCOMA SECONDARY TO INTRAMEDULLARY  
OSTEOSYNTHESIS IN DOGS – CLINICAL CASES**

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**ABSTRACT**

Canine osteosarcoma is a malignant neoplasm characterised by local lytic or plastic processes and a high degree of metastases. In 2 dogs, we observed tibial osteosarcomas after intramedullary osteosynthesis. The clinical appearance of osteosarcoma was at 8.5 years and 8.3 years. In one case, lung metastases were present two months after amputation.

**Key words:** dogs, intramedullary osteosynthesis, osteosarcoma

**INTRODUCTION**

Bone tumours could be primary, secondary, metastatic or of soft-tissue origin, affecting bone as well. About 98% of primary tumours are malignant. Osteosarcomas amount to about 80–90% of all bone malignant neoplasms [1]. They are most commonly encountered in long bones in middle-aged giant-size canine breeds. A great part of tumours affect the metaphyses of long bones (the commonest localization is the distal part of the radius) although diaphyseal osteosarcomas are also reported [2, 3]. The risk of osteosarcomas in large and giant breeds is about 150 times higher than in animals weighing less than 10 kg [4].

The aetiology of osteosarcoma is unknown. In most cases, it occurs spontaneously. It could be observed in bone infarction [5], at the site of preceding fractures [6, 7] or following radiation therapy [8].

**MATERIAL AND METHODS**

*Case No 1*

On September 26 2003, a mixed-breed dog, aged 8 years, was referred to our clinic in Sofia. This dog presented high-grade lameness and oedema of left lower thigh. When it was 6 months old it had tibial fracture; intramedullary osteosynthesis with the Kuntcher nail had been performed. The

fixing material was not removed.

Radiography and blood analysis were done. On September 30, 2003, the affected limb was amputated and material for histopathological analysis obtained.

The dog was referred for another examination on November 16 2003. Lateral chest radiography was done.

*Case No 2*

On June 22, 2005 a 9-year old German Shepherd was examined and found to have high-grade lameness and oedema in the distal region of the tibia.

Radiography and blood analysis were performed. The next day the limb was amputated and material for histopathological study was collected. The biopsies were fixed in 10% formalin, decalcinated with 10% formic acid and then processed by the routine paraffin method. The cross-sections were stained with haematoxylin-eosin.

**RESULTS**

In the first dog the clinical examinations showed a painful, slightly temperate oedema in the tibial region and body temperature of 40°C. The chest auscultation revealed lung sounds on both sides. During the next examinations, the body temperature ranged between 39.6°C and 39.8°C. The haematological and blood biochemical data were as follows:

RBC – 4.64 T/l ;

MCV /mean corpuscular volume/ – 66 fl;

Haematocrit – 30.7 %;

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WBC – 14.1 G/l;  
 MCHC /mean corpuscular haemoglobin content/ - 36 g/dl;  
 Platelet counts - 75110/mm<sup>3</sup>;  
 MPV /mean platelet volume/ – 11 fl;  
 PCT / relative volume of thrombocytes, plateletcrit/ – 0.862 %;  
 Total protein – 62.5 g/l; albumin – 19.2 g/l;  
 ASAT – 68 U/L;  
 ALAT – 108.9 U/L;  
 Gamma GT – 0.75 U/L;  
 Alkaline phosphatase – 787.3 U/L.

The German Shepherd (case No 2), when 8 months old, was hit by a car and the accident resulted in fragmented fracture of the tibia. An intramedullary osteosynthesis with Steinmann pins and cerclage was done.

The dog manifested high-grade lameness. The palpation revealed temperate and painful oedema in the distal region of the tibia.

Blood analysis gave the following data:

WBC – 15.4 G/l;  
 St – 0.07 %;  
 Sg – 0.60 %;  
 Eo – 0.06 %;  
 Ba – 0 %;  
 Mo – 0.12 %;  
 Ly – 0.15 %;  
 Pl – 0 %.;  
 RBC – 5 T/l;  
 Hgb (Hb) – 127 g/l;  
 Haematocrit 0.37 L/L;  
 Platelet counts – 251 G/l;  
 Creatinine – 58.5 µmol/l;  
 ASAT – 77.6 U/l;  
 ALAT – 14.2 U/l;  
 Alkaline phosphatase – 112.9 U/l;  
 Creatine phosphokinase – 600 U/l.

### **Radiological findings**

In the first clinical case, the new bone formation prevailed (sunburst spiculation). The osteolytic processes were insignificant. The dense shadow of the Kuntcher nail was visualized in the medullary channel (**Figure 1**).

In lungs, multiple nodular formations with a different size and density were observed. In the region of tracheal bifurcation, there is an intensive shadow with irregular shape and size of 3/2 cm (**Figure 2**).



**Figure 1.** Radiograph of affected bone, case No. 1



**Figure 2.** Pulmonary radiograph, case No. 1



**Figure 3.** Left hindlimb of a German Shepherd dog with osteosarcoma of the tibia

In the German Shepherd, osteolysis in the distal part of the tibia was dominant. The soft tissue oedema was also clearly visible (**Figure 3**). In the middle of the tibia, an osteolytic focus with a size of 10/30 mm and three wire cerclages were visualized (**Figure 4**).

### Histopathological findings

Macroscopically, thickening of affected areas was observed. On the cross section, the bone compacta was thinned and cancellous bone tissue embedding the medullary channel was seen, infiltrated with rose tissue. Microscopically, fusiform and polygonal hyperchromatic cells with round nuclei, located to zones with osteoid tissue, were observed.



**Figure 4.** Radiograph of affected bone, case No. 2

### DISCUSSION

The development of osteosarcoma after bone fracture is observed in fractures with complicated healing (fragmented fractures, osteomyelitis, cortical allografting, delayed callus formation). The internal and external methods of bone fixation are involved in pathogenesis of osteosarcoma too [6, 7, 9]. The metal ions of corroded implant have a carcinogenic effect [9].

The average interval between bone fracture and the appearance of neoplasms in dogs with fracture-induced osteosarcoma (FIO) was 6.3 years. More than 80 % FIO cases were diaphyseal and femur was most commonly affected [10].

In our study, the interval between the operative intervention and the appearance of tumour growth was about 7,5 and 8 1/3 years, respectively. The appendicular osteosarcoma in dogs is highly metastatic. Up to 10% of dogs have metastatic lung lesions during the first examination [11].

In 6 out of 42 (14 %) dogs with FIO, metastases were observed. In our study, one patient exhibited such findings.

It is unknown why the prognosis in dogs with FIO is better compared to dogs with "classical" appendicular osteosarcoma.

The following alternatives are used in appendicular osteosarcoma treatment: limb

amputation [12], chemotherapy [13, 14, 15], immune therapy; radiotherapy [16], combination of chemotherapy and limb amputation [17, 18].

The limb amputation is with a low effect. The average survival after such an intervention was 18-19 weeks [1]. A considerably better longevity was observed in 19 dogs with limb amputation and cisplatin chemotherapy (43 weeks) [13] and 14 dogs with limb amputation and immunotherapy with MTP-PE [1] (32 weeks, 4 out of 14 surviving between 17-32 months after the amputation) [18].

### CONCLUSION

1. In one of cases, lung metastases appeared 2 months after the amputation
2. The clinical appearance of osteosarcoma in our patients was at 8.5 years and 8.3 years.

### REFERENCES

1. Brodey RS and Abt DA. Results of surgical treatment in 65 dogs with osteosarcoma. *J Am Vet Med Assoc*, 168, 1032-1035, 1976.
2. Feeney DA. A mid-diaphyseal osteosarcoma of the humerus in the dog: a case report. *J Am Hosp Assoc*, 18, 910, 1982.
3. Prior C, Watrous BJ, Penfold D. Radial osteosarcoma with associated bone infarctions in a dog. *J Am Anim Hosp Assoc*, 22, 43-46, 1986.
4. Tjalma RA. Canine bone sarcoma: estimation of relative risk as function of body size. *J Natl Cancer Inst*, 36, 1137-1139, 1966.
5. Dubielzig RR, Biery DM, and Brodey RS. Bone sarcomas associated with multifocal medullary bone infarction in dogs. *J Am Vet Med Assoc*, 179,64,
6. Stevenson S, Hohn RB, and Pohler OEM. Fracture-associated sarcoma in the dog. *JAVMA* 152, 12, 1245-1258, 1982
7. Sinibaldi K. Tumors associated with metallic implants in animals. *Clin Orthop*, 118, 257, 1976.
8. Throll DE, Goldschmidt MH, Biery DN. Malignant tumor formation at the site of previously irradiated acanthomatous epulides in four dogs. *JAVMA*, 178, 2, 127-132, 1981.
9. Sinibaldi KR. Osteomyelitis and neoplasia associated with use of the Jonas intramedullary splint in small animals. *J Am Vet Med Assoc*, 181, 885, 1982.

10. Brodey RS and Riser WH. Canine osteosarcoma: a clinicopathologic study of 194 cases. *Clin Orthop*. 62, 54-64, 1969.
11. O'Brient MG. Resection of pulmonary metastases in canine osteosarcoma: 36 cases (1983-1992). *Vet Surg*, 22, 105-108, 1993.
12. Spondick GJ, Berg J, Rand WM. Prognosis for dogs with appendicular osteosarcoma treated by amputation alone: 162 cases (1978-1988). *JAVMA* 200, 7, 995-998, 1992.
13. Shapiro W, Fossum TW, Kitchell BE. Use of cisplatin for treatment of appendicular osteosarcoma in dogs. *JAVMA*, 192,4, 507-511, 1988.
14. Kraegel SA, Madewel BR, Simonson E. Osteogenetic sarcoma and cisplatin Chemotherapy in dogs: 16 cases (1986-1989). *JAVMA*, 199, 8, 1057-1059, 1991.
15. Berg J, Weinstein MJ, Schelling. Treatment of dogs with osteosarcoma by administration of cisplatin after amputation or limb-sparing surgery: 22 cases (1987-1990). *JAVMA*, 200,12, 2005-2008, 1995.
16. Mc Entee MC, Page RC, Novotney CA. Palliative radiotherapy for canine appendicular osteosarcoma. *Vet Rad& Ultrasound*, 34, 367, 1993.
17. Straw RC, Withrow RB, Richter SL. Amputation and cisplatin for treatment of canine osteosarcoma. *J Vet Int Med*, 5, 205-210, 1991.
18. Thompson and Fugent. Evaluation of survival times after limb amputation, with and without subsequent administration of cisplatin, for treatment of appendicular osteosarcoma in dogs: 30 cases (1979-1990). *JAVMA*, 200, 2, 127-132, 1992.
19. MacEwenEG. Therapy for osteosarcoma in dogs with intravenous injection of liposome-encapsulated muramyl tripeptide. *J Natrl Cancer Inst*, 81, 935-938 , 1989.