ANIMAL MODEL OF HUMAN DISEASE

Skeletal Osteosarcoma

Animal Model: Canine Osteosarcoma

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Biologic Features

Primary bone tumors are not uncommon in the dog, and they outnumber (5 to 1) metastatic skeletal tumors.[1] Malignant bone tumors in the dog are far more frequent than benign tumors.

Osteosarcoma is by far the most frequent malignant bone tumor in the dog. This type of tumor is mostly found in middle-aged and old dogs, several years after bone growth has ceased (Figure 1). Skeletal osteosarcomas occur especially in the metaphyses of the long bones in giant dogs and boxers.[2] In St. Bernards in the United States [3] and in Rottweilers in Holland a familial pattern of occurrence suggests the presence of specific genes within certain familial lines.

The diagnosis of osteosarcoma can be greatly aided by a combination of clinical, radiologic, and pathologic investigations.[4,5] Lameness and local swelling are the most prominent clinical signs. Osteolysis and osteosclerosis in variable degrees are the most frequent radiographic features.

Microscopically, osteosarcoma is characterized by the direct formation of bone or osteoid tissue by tumor cells. In addition, tumors may contain neoplastic cartilage and fibrous tissue. Most canine osteosarcomas have a hypoploid karyotype, but a few are hyperploid.[6] A multifactorial analysis of 14 variables disclosed that large tumors, tumors extending beyond the cortex, and those in the posterior extremities are associated with a relatively unfavorable prognosis.[7] Successful transplantation into fetuses and into immune-depressed puppies was reported.[8] A single intravenous injec-

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tion of a radioactive isotope resulted in death by osteosarcoma in the majority (131) of a group of 200 dogs.[9]

Comparison With Human Disease

The morphologic and biologic behavior of canine osteosarcomas is similar to that of human osteosarcomas.[10] In both species the fibrosarcomatous subtype is associated with a relatively favorable prognosis.[7] Age and site predilection are different. Most of the affected dogs are older animals, whereas in the human mainly adolescents are affected.

The forelimbs in the dog and the knee region in the human are the sites of predilection. The varying localizations in man and in the dog, cat, cow, horse, and rodent might be associated with the stress of weight burden. Males are slightly more affected than females in man and dogs. Especially in the dog [2] but also in man [11] individuals of larger weight and stature are more often affected. In man osteosarcomas are known [12,13] to arise in irradiated bone, in bone affected by Paget's disease, and in skeletal tumors (multiple enchondromas, multiple osteochondromas, fibrous dysplasia, and chondorsarcomas). In the dog [14] and man some osteosarcomas have been reported to originate in bone involved by bone infarcts. Osteosarcomas in dogs are sometimes found in previously fractured bones treated by intramedullary pinning.[15]

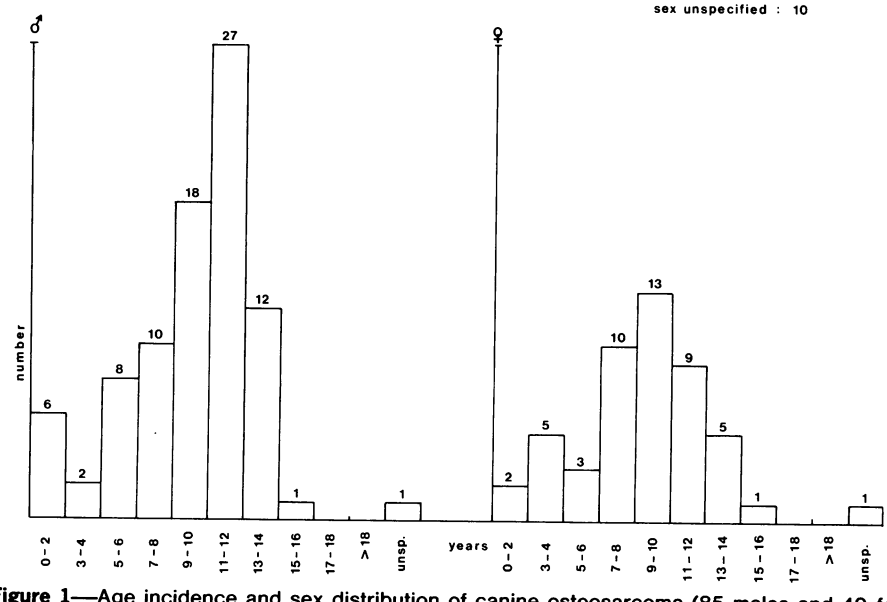

Figure 1—Age incidence and sex distribution of canine osteosarcoma (85 males and 49 females).

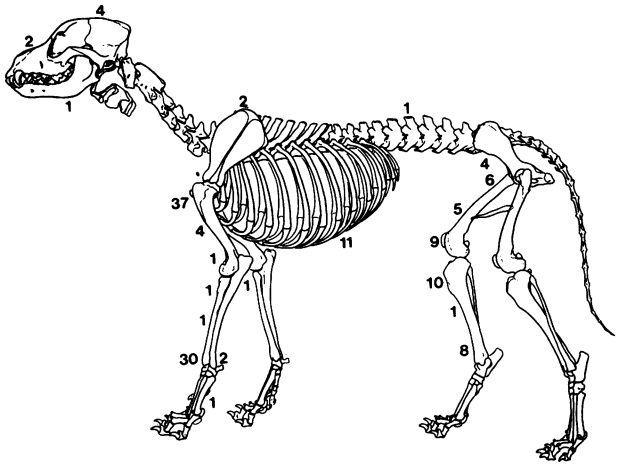

Figure 2—Localization of canine osteosarcoma. The numbers refer to the number of tumors at that site in a series of 142 osteosarcomas.

Usefulness of the Model

The similarities in biologic behavior make canine osteosarcoma a potential therapeutic model. Comparative study of osteosarcoma may lead to new etiologic and pathogenetic concepts.

Avaliability

Dogs with skeletal osteosarcoma are often treated at veterinary medical schools and could, under appropriate circumstances, be used to try out new methods of treatment. Current international cooperation under the auspices of the World Health Organization may lead to pooling of patients treated by advanced types of therapy, the effect of which can be analyzed in a relatively short time. Strains with a high incidence can probably be obtained by selective breeding.

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