DIAGNOSIS AND MANAGEMENT OF CANINE APPENDICULAR OSTEOSARCOMA

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BACKGROUND

Osteosarcoma (OSA) is the most common bony tumor of dogs. OSA of the long bones (appendicular OSA) is far more common in large and giant breed dogs than in smaller dogs. The most common age of incidence is between 6 and 8 years, however there is another small group of dogs that can develop OSA at 18 to 24 months. OSA is a clinical problem not only due to its aggressive destruction of bone and the attendant pain and structural damage caused, but also due to its high potential for metastasis.

HISTORY – PHYSICAL EXAMINATION

Most dogs with appendicular OSA will present with a history of lameness. This may be acute in onset, or may have been chronic and progressive. It is common for owners to attribute some trauma to the development of lameness, and it is common for lameness to initially respond to nonsteroidal anti-inflammatory drugs or other analgesics. Owners may notice a firm swelling of the limb as well.

Physical examination will usually reveal lameness and an area of limb pain. Careful palpation and manipulation of the affected limb should be undertaken to determine the area of interest and detect any subtle swellings or asymmetries between limbs. Although lymph node involvement is uncommon, palpation of the regional lymph node should be undertaken as well. Thorough orthopedic and neurologic examination is indicated if amputation is to be considered.

DIAGNOSIS AND STAGING

At least two radiographic views of the affected area of the limb should be obtained. The classic radiographic appearance of OSA is a mixed lytic and proliferative lesion of the metaphysis of the long bone. OSA will typically not cross a joint space. OSA is most common in the proximal humerus and distal radius of the thoracic limb (away from the elbow), and in the proximal tibia and distal femur of the pelvic limb (toward the knee).

It is also reasonable to obtain thoracic radiographs (3 views) at the time of limb radiographs if neoplasia is suspected. Although 90% of dogs with OSA have microscopic metastasis at the time of presentation, only approximately 7% have macroscopic evidence of metastasis at diagnosis.

Following radiographs, a biopsy of the affected area is indicated. Unlike with most soft-tissue tumors, biopsies of bony tumors should be obtained from the center of the radiographic lesion. Biopsies of the periphery of the lesion or the apparent tumor:normal tissue interface will often yield diagnoses of "reactive bone". Some clinicians find fine needle aspiration cytology effective, using either the radiographs or ultrasound as a guide.

Standard presurgical screening (complete blood count, serum chemistry profile, urinalysis) should be obtained as with any patient that may undergo general anesthesia. One extremely important parameter to evaluate is serum alkaline phosphatase (SAP). High SAP has been shown in humans, and recently in 2 separate papers in dogs, to be a poor prognostic indicator for dogs with appendicular OSA. In one study, dogs treated with amputation and chemotherapy with normal SAP had a median survival time of 12.5 months whereas dogs with increased SAP had a median survival time of 5.5 months.

TREATMENT

Local disease is best dealt with by amputation of the affected limb. Amputation is a simple surgical procedure that is extremely well tolerated in the majority of patients. However, it has been well established that amputation alone results in only short-term gains. The median survival time with amputation alone is only 4 months, with only 10% of dogs living 1 year. Pulmonary metastasis is the eventual cause of death in most patients.

The addition of systemic chemotherapy to amputation significantly prolongs the time from diagnosis to death. For many years, cisplatin has been the standard of care for dogs with OSA. The addition of cisplatin increases the median survival time to 10-12 months on average, with approximately 20% of dogs living longer than 2 years. Cisplatin is nephrotoxic and strongly stimulates the emetic response. It must be administered with
vigorous intravenous diuresis to prevent kidney damage, and antiemetics to prevent vomiting. The drugs *carboplatin* and *doxorubicin* have also been shown to have activity against OSA.

For owners unwilling to perform amputation, other options may be available. Dogs with distal radius OSA may be candidates for a *limb sparing procedure*. In this procedure, the diseased portion of bone is resected, and a cortical allograft from a bone bank is implanted. The adjacent joint is fused, and then postoperative chemotherapy is employed. Limb sparing surgery is expensive, and has a high rate of complications, including local recurrence, implant failure, and infection. Despite this, the outcome after limb sparing procedures is similar to amputation. Another option is *radiotherapy (RT)* to the affected bone. A relatively conservative, inexpensive, and well-tolerated form of RT involving 1 or 4 weekly treatments can provide good to excellent pain control in approximately 75% of dogs with OSA, which persists for a median of 6 months.

Following the completion of post-operative chemotherapy, patients are rechecked regularly for evidence of pulmonary metastasis. Unfortunately, chemotherapy is rarely effective after pulmonary metastasis has been detected, and the average survival after the clinical detection of metastatic disease is only 2 months. However, certain patients may benefit from surgical removal of the pulmonary metastasis.

**NEW DIRECTIONS**

Since there is no useful systemic therapy for dogs with measurable osteosarcoma metastasis, we are currently evaluating a new *immunotherapy* approach, combining the intravenous administration of the nonspecific immunomodulator *L-MTP-PE* with a *tumor cell vaccine*. Animals initially receive 4 weekly treatments, then are evaluated for response.

Please feel free to contact Dr. Thamm at any time if you would like more information about osteosarcoma treatment or would like to refer a case.