

Limb Sparing Surgery for Treatment of Bone Tumors

Matthew Barnhart DVM MS DACVS

Skeletal tumors account for a significant portion of canine malignant neoplasms. Osteosarcoma (**Table 1**) is by far the most common type of primary bone tumor with chondrosarcoma (**Table 2**) being a distant second. The most effective treatment for prolonging length and quality of life is removal of the affected bone; generally requiring amputation. Limb sparing surgery offers an alternative to amputation for some patients with bone tumors.

The obvious advantage limb sparing surgery offers over amputation is it allows patients to maintain a functional limb. This may be important in those patients of very large size (giant breeds), those with diseases that might preclude amputation (degenerative joint disease, etc.), or in cases where owners cannot tolerate an amputation. Limb sparing also provides a comparable average survival time to that of amputation (**Table 1**). It is however, significantly more expensive than amputation and carries a greater number of potential complications (infection, implant loosening, and local recurrence). The selection criteria also strict (**Table 3**) but under the right circumstances clinical results can be very good and owner satisfaction is usually high

Table 1

Osteosarcoma Facts

- Accounts for 85-90% of bone tumors in dogs
- Large, giant-breed dogs most commonly affected
- Bimodal average age peaks: 18-24 months and 7 years of age
- Distal radius most common site, proximal humerus second most common site
- Highly metastatic: 90% + of dogs have undetectable metastasis at presentation
- 6 months with amputation/limb sparing surgery alone
- 12 months with surgery and chemotherapy
- 4 months with palliative radiation therapy

Table 2

Chondrosarcoma Facts

- Accounts for ~10% of bone tumors in dogs
- Similar patient signalment to osteosarcoma
- Flat bones most common site of origin (scapula, skull, nasal turbinates)
- Slower growing than osteosarcoma
- Less metastatic: approximately 20% metastatic rate
- Average survival times:
- Skull/nasal turbinates: 5-6 months (complete resection very difficult)
- Appendicular: >1.5 years (may be curable with complete excision)

(Figure 1).

There are a variety of ways limb sparing can be performed but all involve removal of the affected bone and replacement with another source of structural support. Cortical autografts with or without microvascular anastomosis, cortical allografts, and intercalary bone transport (slow movement of a segment of bone using an Ilizarov fixator) have all been used in limb

sparing techniques. The most commonly performed technique utilizes a cortical allograft harvested from canine cadavers that is then prepared and stored at a bone bank facility. A cortical allograft is essentially “dead bone” that fills in the void left after removal of the bone tumor. It provides structural support and “scaffolding” upon which osteoblasts can infiltrate and grow (osteoconduction) and ultimately incorporate it into the recipient’s own bone.

The first step of surgery is meticulous dissection/removal of the affected bone. Occasionally, excision of a tumor of the distal radius may also necessitate removal of part of the ulna. The cortical allograft is thawed in antibiotic solution, and then shaped to fit the defect in the radius. Allografts are acquired from a bone bank and specimens are chosen to approximate the size of the patient’s bone. The allograft is filled with bone cement to increase its structural strength and to help minimize future screw loosening. The carpal joint is prepared for arthrodesis and a large bone plate spans the carpal joint to well above the allograft filled defect (**Figure 2**).

The goals of limb sparing surgery are to eliminate the painful bone tumor, maximize the patient’s survival time, and provide an excellent quality of life. Approximately 70% of dogs are expected to have good to excellent limb function postoperatively. Chemotherapy follow-up is strongly recommended to increase survival time. Our

Table 3

Limb Sparing Selection Criteria

- Limited to medium to large sized dogs
- Generally limited to tumors of the radius or ulna
- Minimal soft tissue involvement
- Focal bone lesion is required
- No evidence of gross metastasis



Figure 1- Osteosarcoma of the distal radius. This patient is a good candidate for limb sparing surgery because of the small tumor size and minimal soft tissue involvement.

experience with limb sparing surgery at MedVet has been positive. While there are certainly more issues to address than with amputation, the feedback from owners suggests that it is well worth it.



Figure 2- Patient 6 months following a limb sparing procedure. Notice the incorporation of the allograft into the patients own bone proximally and the carpal fusion distally. This patient was using this leg well and had no evidence of recurrence.



300 E. Wilson Bridge Road., Worthington, Ohio 43085
(614) 846-5800, Fax (614) 846-5803

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