

Navigation assistance allows an en-block resection with minimum bone loss in metaphyseal local aggressive bone tumors

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Abstract

Background

Local aggressive bone tumors are a diverse category of lesions both in biologic activity and histologic presentation, and although they sometimes grow aggressively or recur, their action is mainly local and usually do not metastasize. Surgical treatment is a challenge between achieving ideal local tumor control and satisfactory recurrence rates, with acceptable surgical morbidity and durable function. The ideal treatment is still to be determined. Wide resection had a lower rate of local recurrence, but at the cost of possible functional problems and other complications that the benign nature of these lesions would not justify. A more conservative approach with intralesional curettage, with or without adjuvant therapy, implies higher risk of local recurrences. This dilemma is seen especially in cases where lesions are either meta or epiphyseal, and surgery may compromise the joint integrity. Computer-assisted tumor surgery (CATS) in the field of orthopedic oncology had tremendous advancement and it is expected to minimize unnecessary resection, preserve maximum function and achieve acceptable oncological results. CATS has been widely reported in malignant bone tumor resections and it may provide accurate multiplanar osteotomies in locally aggressive metaphyseal benign bone tumor with the potential benefits of a conservative en-block resection without altering joint function.

Question/Purposes:

The purpose of this study was to determine the clinical outcomes of patients with metaphyseal local aggressive bone tumors, treated with multiplanar osteotomies en-block resections guided by navigation, followed by bone-grafting. We specifically

evaluated: (1) joint survival, (2) complications during and after the surgical procedure, (3) the number of local recurrences, and (4) postoperative functional score.

Patients and Methods

We analyzed 29 patients (17 women and 12 men), with local aggressive metaphyseal bone tumors that were treated with conservative en-block resection guided by navigation. Mean age at presentation was 34 years (range, 3-71 years). The preoperative planned margin was between 3 to 5mm in all cases. Reconstruction was done with bone grafting. The mean size on imaging studies was a mean 9,74 cm² (range, 1cm² to 30cm²). Staging was performed for each patient according to a modification of the system of Enneking and the Musculoskeletal Tumor Society. Fifteen lesions were classified as benign musculoskeletal lesions (14 Enneking stage 2, and one Enneking stage 3), and fourteen were classified as low grade malignant musculoskeletal lesions (13 Enneking stage IA and one Enneking stage 1b). Tumor diagnosis included low-grade chondrosarcoma (n=14), osteblastomas (n=4), chondromyxoid fibroma (n=3), aneurismal bone cist (n=2), osteofibrous dysplasia (n=2), chondroblastoma (n=2), recurrent giant cell tumor (n=1), and neuroendocrine benign tumor (n=1). Sixteen tumors were located in distal femur, ten in proximal tibia, one in tibial diaphysis, one in proximal femur and the remaining one in distal tibia. No patient received local adjuvant therapy. The minimum follow-up was 24 months (mean, 39 months; range 24-61 months). No patients were lost to followup. Outcomes, including allograft healing, nonunion, tumor recurrence, fracture, hardware failure and infection were recorded. We used the revised system established by the Musculoskeletal Tumor Society (MSTS) and adopted by the International Society of Limb Salvage (ISOLS) to assess the functional outcome at the most recent followup.

Results

At final followup, all patients preserved the articular joint adjacent to the metaphyseal bone resection. After macroscopically and microscopically review by a musculoskeletal tumor specialized pathologist all the resection margins were tumor

free. Intraoperative navigation was performed successfully in all patients. In our series, two complications were observed. One patient with an osteofibrous dysplasia had a local recurrence, and one patient had a distal femur incomplete fracture treated with a new osteosynthesis. In all cases, allografts healed before 1-year follow-up. All patients resumed activities of daily living without restriction. Average MSTS/ISOLS score at the most recent followup was 29,6 points (range, 27–30 points).

Conclusions

Our results suggest that with navigation techniques, in selective cases, we can perform a conservative en-block resection for metaphyseal locally aggressive bone tumors with an excellent functional result as obtained with curettage, with a similar recurrence rate as obtained in patients treated with an extralesional resection.