Use of Magnetic Growing Intramedullary Nails With Intercalary Allograft Reconstruction After Tumor Resection

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Purpose:
Reconstruction after excision of tumors has remained challenging. Intercalary allograft reconstruction has remained an option, but is not without complication. Osteosynthesis techniques have included plate fixation, nail fixation, or combined techniques. Non-union occurs more frequently in those fixed with intramedullary nails alone. A novel technique of using magnetic growing intramedullary nails to compress across the entire allograft is presented. This technique also provides the opportunity to lengthen the bone at a later date using the same implant. The purpose of this study is to evaluate union rates and complications using this technique.

Methods:
A retrospective review of 8 patients with 15 osteotomy sites on 5 femurs and 3 humeri was performed. The average age was 35 (9-71) with an average follow-up of 18 months (8-34). Diagnoses included two pleomorphic sarcomas, three osteosarcomas, one metastatic endometrial stromal sarcoma, and two metastatic renal cell carcinomas. Fourteen osteotomy sites were primary resections and one site was a chronic non-union previously treated with a carbon fiber nail. Five patients received neoadjuvant and adjuvant chemotherapy, and three patients received only adjuvant chemotherapy. One patient received neoadjuvant radiation. An intercalary allograft with a magnetic growing intramedullary nail was placed. No autograft was used. The average allograft length was 17 cm (6.5-29). The nails were compressed intraoperatively. Radiographs were evaluated monthly to determine union rates and time to union.

Results:
Thirteen out of 15 sites demonstrated evidence of healing with the only non-union sites occurring in the patient who had neoadjuvant radiation. Complications included one fracture through the allograft after a fall and one screw that backed out and required removal. Three patients underwent a second compression in order to obtain a union. Two patients underwent a successful lengthening after union had occurred.

Conclusions:
In this series, there were two non-union sites in one patient. Two patients were able to be successfully lengthened in order to correct a limb-length discrepancy. Musculoskeletal tumors requiring large bony resection typically has a high rate of non-union when intramedullary nails are used with intercalary allograft. Our technique using magnetic growing intramedullary nails to compress the osteotomy sites has had positive preliminary results with an acceptable complication rate.