Union Rates Using Compression Technique with Minimal Screw Fixation for Bulk Allograft Reconstruction

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Background: Bulk allograft reconstructions have revolutionized treatment in adults with primary bone lesions, though the surgery still carries a significant morbidity due to the significant complications. Historically, standard fixation of large allografts generally includes multiple plates and screws placed in orthogonal planes in order to obtain rigid stabilization and immobilization of the construct to enhance union, however there is little literature describing the optimal plating and fixation technique. At our institution, we have performed allograft reconstructions using compression plating and minimal screw fixation in the allograft to theoretically decrease allograft-host bone junction nonunion rates, mitigate the risk of allograft fracture (as screw holes can act as stress risers in the allograft), and improve the union rates through compression across the junctions.

Questions/Purposes: The purpose of this study was to report our experience placing bulk allografts under compression technique while using minimal screw fixation.

Patient Methods: After Institutional Review Board approval, a retrospective review was conducted of all patients who underwent bulk allograft reconstruction using compression techniques with minimal screw fixation following long bone resection between 2009 and 2014. Thirteen patients with a mean age of 41 years (range 20-62 years) were included in this study. Patients' serial radiographs were evaluated for a host-allograft union and all complications were recorded, including infection, nonunion and fracture. Complications were classified according to the modified International Society of Limb Salvage (ISOLS) classification for limb salvage failures. Patients in this cohort were followed for a mean time of 26 months (range of 4-62 months).

Results: The overall complication rate in this cohort of patients was 31% (4 patients). This included 2 patients with allograft-host bone junction nonunions (15%), both a result of infection. One patient had postoperative glenohumeral joint instability after an allograft-prosthesis composite reconstruction and one patient was observed to have postoperative knee arthrofibrosis following a distal femur allograft reconstruction. According to the modified ISOLS classification for limb salvage failures, we observed two Type 1A failures, one Type 4A failure, and one Type 4B failure. No allograft fractures were observed in any of the patients. The average size of the reconstructed skeletal defect was 12.4 cm (range 5.1–19.7 cm), with an average of 3.15 screws (range 1-7 scews) placed in each allograft. In this cohort, the overall mean time to union was 7.9 months. Specifically, the time to union was 10.7 months for diaphyseal allograft-host bone junctions and 5.5 for metaphyseal junctions.

Conclusion: Bulk allograft reconstructions performed after tumor excision of long bones are difficult procedures with a high incidence of postoperative complications. Reported complication rates after allograft reconstructions for tumors have been reported as high as 70%, with allograft junction nonunion rates ranging from 10-40% and allograft fracture rates up to 30%. Our complication rate of 31% and nonunion rate of 15% compare favorably with previously reported rates. Also, we had no allograft fractures and our average time-to-union for the allograft-host bone junctions matched previously reported rates. This study demonstrates the potential benefits of placing bulk allograft under compressive technique with limited screw fixation in the allograft, obviating the need for excessive multiplanar fixation while also recognizing favorable nonunion and allograft fracture rates. This may improve the host-allograft union rate, time-to-union, allograft survival, and limit allograft fracture, thus reducing the morbidity associated with this difficult procedure.

Level of Evidence: Therapeutic Level IV.