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Title: Distal radius giant cell tumor resection and reconstruction with non-vascularized iliac crest graft wrist arthrodesis

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Level of Evidence: IV

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Abstract:

Background:

Giant cell tumor of the bone (GCTB) is an intermediate-grade benign tumor that frequently occurs in the distal radius<sup>1</sup>. The juxta-articular nature of this location, the small size of the distal radius, the proximity to the radiocarpal and distal radioulnar joints (DRUJ), and the lack of a soft tissue sleeve make management of grade III lesions of this tumor challenging. Wide en-bloc resection is favored by many authors for such lesions. Many techniques have been described for reconstruction following distal radius resection<sup>2-12</sup>, with none being clearly superior.

Total wrist fusion with non-vascularized structural iliac crest graft is the technique favored at the senior author's institution. The technique is straight forward, the graft structural robust, avoids complications associated with fibular harvest, and is particularly applicable in situations where allograft is unavailable or its use not desired by patients.

Questions/Purposes:

The purpose of this study was to evaluate our institution's experience with this technique with regard to the length of time required to reach radiographic union, the rates of local recurrence, the complication rates, and functional outcomes.

Patients and Methods:

We included all patients treated at our institution from July 2005 to July 2013 for stage III distal radius GCTB with this technique who were followed up for a minimum of 12 months, and 1 patient who did not complete functional scoring.

The study population included 33 individuals, and comprised 16 males and 17 females, with a mean age of 29 years ( $\pm 7.1$  years). 22 presented for management of the primary occurrence of the disease, while 11 presented with recurrent disease. Mean follow-up was 39.3 months ( $\pm 25.8$  months) Tissue diagnosis was confirmed by open or needle biopsy prior to resection and reconstruction.

Follow up included clinical and radiographic assessment, and functional assessment. This functional assessment included: 1. Grip strength measurement with a handgrip dynamometer and comparison to the uninvolved side, 2. Photographic documentation and measurement of the arc of active forearm rotation, and 3.

Functional scoring with Musculoskeletal Tumor Society (MSTS) scores, and 4. Functional scoring with the Chinese (Simplified) version of the disabilities of the arm, shoulder and hand (DASH) scores.

#### Results:

Among the study population, the mean length of bony resection was 6.3cm ( $\pm 0.9$ ). Union of the distal junction occurred at a mean of 4.6 months ( $\pm 2.7$  months). Union of the proximal junction occurred at a mean 9.4 months ( $\pm 4.5$ ) (Figure 1). Delayed or non-union of the proximal junction occurred in 6 patients (18.2%), with all requiring reoperation. Local recurrence rate occurred in 3 patients (9.1%), with one patient having 2 recurrences

Reoperations were required in 11 patients: 3 patients had tumor recurrence, 4 patients suffered hardware failure prior to union of the proximal junction, 1 suffered hardware loosening, 2 patients underwent bone grafting (at 10 and 21 months post-operative) for delayed union, and 1 patient underwent revision surgery after suffering a fracture through the graft. No complications were encountered from the donor site.

The functional outcome in this study was favorable. Mean DASH score was 8.6 ( $\pm 6.3$ ). Mean grip strength was 51.2% ( $\pm 22.9$ ) of the uninvolved side. Mean arc of forearm rotation was 108 degrees ( $\pm 50.0$ ). Mean MSTS scores being 28.7 ( $\pm 1.3$ ).

We evaluated the 4 functional outcome measures in patient subgroups divided by a variety of independent variables; Gender, side hand dominance, primary vs recurrent disease. Among these variables, only hand dominance was found to result in a significantly different DASH, (Mean DASH of 12.1 in dominant hand group vs 6.7 in non-dominant hand group,  $p=0.025$ ), while no other variables or outcomes were significantly different. We also evaluated the correlation between resection length with time for proximal union and with functional outcome measures, and did not find the length of bony resection and reconstruction to be correlated with any of the functional outcome measures.

#### Conclusions:

This study demonstrates the favorable results of this technique; low rates of non-union and complications, relative preservation of forearm rotation and favorable functional outcomes. Our study has illustrated the rate of complications and recurrence with this procedure. The advantages of this technique are that it employs a familiar technique for harvest bone graft, avoids the risk of fibular autograft harvest and subsequent instability of tibiofibular joints, is useful in settings where cadaveric allograft is not available or not accepted by patients, and has an acceptable complication rate. This study is limited by the lack of a control group and by its single institution nature. It is the largest single institution series of patients treated with this technique.

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Figure 1: Graph depicting time for patients to achieve radiographic and clinical union of the proximal host-graft junction or for a competing event to occur.

