Alignment, Forearm Pronosupination, and Patient Reported Outcomes: A Prospective, Multicenter, Observational Study of Pediatric Both Bone Forearm Fractures

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INTRODUCTION: Despite pediatric both bone forearm fractures being relatively common, there is a relative dearth of clinical evidence on which to base treatment protocols. We investigated the relationship of alignment at union with forearm pronosupination and patient reported outcome scores to inform outcome-based treatment recommendations.

METHODS:

We performed a prospective observational study of radiographically skeletally immature patients with both bone forearm fractures treated at two urban level 1 trauma centers. We excluded those within 2cm of the physis and those treated with ORIF. We recorded patient data (age, hand dominance, and sex), injury variables (mechanism of injury and open fracture), treatment variables (hospital location and number of anesthetic events), and radiographic measures of alignment after reduction and union (coronal and sagittal alignment, true angulation, and axis deviation). Outcomes assessed included forearm pronosupination, pediatric upper extremity PROMIS scores, and grip strength.

RESULTS: We enrolled 112 children with both bone forearm fractures. Six were lost to follow up (final population of 106). Median age was 6 (IQR 5-10). Among patient-related variables, only older age ($p = 0.030$) was associated with pronosupination deficit (incidence of 3/48, 6.3% when < 8 years and 10/31, 32.3% when ³ 8 years). Among measures of alignment, sagittal angulation > 15º ($p = 0.045$) and axis deviation > 6.5 ($p = 0.038$) were associated with decreased PROMIS scores, whereas other alignment measures and demographics were not. Pronosupination and grip strength were not associated with alignment measures or other covariates ($p > 0.05$ for all). We have developed an online tool for calculating measures of alignment that previously required look-up tables (true 3D angulation and axis deviation).

DISCUSSION AND CONCLUSION:

The findings support malalignment at union > 15º as an evidence-based threshold for greater risk of a poor functional outcome. Axis deviation was associated with PROMIS scores, and the online tool developed will allow it to be readily calculated for cases with borderline post-reduction alignment. Given a greater risk of limited pronosupination was found for patients aged 8 or older, we recommend future research focus specifically on this subpopulation.