Predicting Long-Term Functional Outcomes for Nonoperative Proximal Humerus Fractures: A Radiographic Evaluation

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Purpose: Controversy exists on utility of surgical treatment for proximal humerus fractures, particularly in the elderly. Understanding factors predicting long-term functional outcomes in nonsurgical patients would allow for more informed decision-making in identifying appropriate surgical candidates. Our primary aim was to evaluate the relationship between radiographic parameters and 1-year functional outcomes to assess the utility of radiographic parameters as reliable predictors. The secondary aim was to assess the intra- and interrater reliability of radiographic measurements.

Methods: In this prospective longitudinal cohort study design, inclusion criteria were (1) proximal humerus fracture and (2) nonsurgical treatment. Exclusion criteria were (1) delayed presentation (>3 weeks), (2) cognitive impairment, (3) severe medical comorbidities precluding surgery, (4) polytrauma, and (5) pathological fracture. Radiographs parameters (caput-collum-diaphyseal (CCD) angles, Y-scapular angles, and humeral head height) were assessed at initial presentation and final follow-up. Functional outcome (Oxford Shoulder Score [OSS], Constant Shoulder Score, and QuickDASH score [an abbreviated version of the Disabilities of the Arm, Shoulder and Hand questionnaire]) was assessed at 1 year. Intra- and interrater reliability were measured using intraclass correlation coefficients (ICCs). Correlation and adjusted logistic regression analysis were performed to establish relationships between initial, final, and change in angles with functional outcome. Radiographic data were divided into varus or valgus, anteversion or retroversion, and analyzed separately. Receiver operating characteristic (ROC) curves were utilized on significant radiographic parameters to determine optimum cut-off.

Results: 118 patients were recruited (mean age 69, 77% female). Median final radiographic assessment was 7 months. Mean initial/final CCD was 119°/112° (varus, n = 39) and 153°/140° (valgus, n = 79). Mean initial/final Y-scapula angle was 28°/25° (retroversion, n = 106) and 70°/43° (anteversion, n = 12). There was a significant relationship between 1-year OSS and final Y-scapular angle in retroversion group (adj coeff 0.053, P = 0.022) with optimum predictive retroversion angulation of 25° predicting poor functional outcome (OSS<40), area under the ROC curve of 0.611 (95% confidence interval, 0.46-0.76). Higher initial valgus and retroversion angle significantly predicted a higher change in angle (ie, displacement) (adj coeff –0.37, P = 0.001, adj coeff –0.523, P = 0.001). Intra- and interrater reliability for radiographic parameters was excellent (ICC >0.9).

Conclusion: Radiographic parameters, while having excellent reliability, have a limited ability to predict long-term functional recovery. Among the radiographic parameters, the extent of retroversion is the most important predictor for poor long-term functional recovery with 25° a useful cut-off to guide the potential need for surgical intervention. Proximal humerus fractures that have a higher initial valgus and retroverted angulation have a higher tendency to displace further. Targeted radiographic evaluation is a useful tool in predicting long-term functional outcome and aid decision-making for proximal humerus fractures.

POSTER ABSTRACTS