Paper Session: Upper
Extremity/Lower Extremity

Displaced Midshaft Clavicle Fracture Union Can Be Accurately Predicted With a Delayed Assessment at 6 Weeks Following Injury: A Prospective Cohort Study

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Purpose: Our objective was to evaluate if clinical recovery following midshaft clavicle fracture is associated with nonunion and if the additional information that can be assessed at 6 weeks post-injury has superior predictive value for fracture healing compared to estimation at time of injury.

Methods: A prospective study of all patients (≥16 years) who sustained a displaced midshaft clavicle fracture was performed. We assessed patient demographics, injury factors, functional scores, and radiographic predictors with a standardized protocol at 6 weeks. Conditional stepwise regression modeling was used to assess which factors independently predicted nonunion at 6 months post-injury as determined by CT. The nonunion predictor 6-week model (NUP6) was compared against a previously validated model based on factors available at time of injury (NUP0), which included smoking, comminution, and fracture displacement.

Results: 200 patients completed follow-up at 6 months. The nonunion rate was 14% (27/200). Of the functional scores, the QuickDASH (an abbreviated version of the Disabilities of the Arm, Shoulder and Hand [DASH] questionnaire) had the highest accuracy on receiver operating characteristic (ROC) curve analysis with a 39.8 threshold, above which was associated with nonunion (area under the curve [AUC] 76.8%, $P < 0.001$). 69% of the cohort had a QuickDASH score of <40 at 6 weeks and 95% (131/138) of these patients united their fractures. On regression modeling QuickDASH ≥40 ($P = 0.001$), no callus on radiograph ($P = 0.004$), and fracture movement on examination ($P = 0.001$) were significant predictors of nonunion. If none were present the predicted nonunion risk was 3%, found in 40% of the cohort (n = 80/200). Conversely if 2 or more of the predictors were present, found in 23.5% of the cohort, the predicted nonunion risk was 60%. The NUP6 model appeared to have superior accuracy when compared to the NUP0 model for fracture healing on ROC curve analysis (AUC 87.3% vs 64.8%, respectively).

Conclusion: Delayed assessment at 6 weeks following displaced midshaft clavicle fracture enables an accurate prediction of patients that are likely to unite with nonoperative management. One in 4 patients are at an increased risk of nonunion and may benefit from operative intervention.