Plateau Indicators for Intervention after Operative Treatment (PIVOT) Score Identifies Patients at Risk of Poor Functional Outcome After Tibial Plateau Fracture

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Purpose: The ability to predict postoperative outcomes following the surgical management of tibial plateau injuries would help identify patients at risk of diminished functional outcomes for whom aggressive interventions may provide benefit. This study seeks to develop a simple score that can accurately predict functional outcomes for patients following operative management of tibial plateau fractures.

Methods: 228 operative tibial plateau fractures treated at a single institution were prospectively followed and included in this study. Demographics, injury classification, radiographic measurements, and Short Musculoskeletal Function Assessment (SMFA) scores were collected at routine intervals. Since total SMFA scores were found to plateau 6 months postoperatively in our cohort, this time point was chosen as the predictive target. The diminished outcome cohort (DOC) was defined as any patient with a functional SMFA subdomain greater than 10 points above the mean. Logistic regression was used to build a predictive formula for cohort membership (PIVOT Score) (Figure 1). No outliers were removed. Odds ratios (ORs) were calculated and are reported as 95% confidence intervals. An area under the receiver operator characteristic curve (AUROC) value was calculated to define the overall predictive capacity.

Results: At the 6-month postoperative time point, significant predictors of poor outcome were male gender (OR = 0.09-0.75; P = 0.013), Caucasian race (OR = 0.03-0.36; P = 0.0004), smoking history (OR = 1.81-28.33; P = 0.005), age (OR = 1.02-1.11; P = 0.003), and fracture pattern involving the tibial spine (OR = 1.97-16.48; P = 0.001). The final formula (Figure 1), created through logistic regression, was found to be a significant predictor of poor outcome (Nagelkerke R Square = 0.45; Hosmer and Lemeshow = 0.39, AUROC = 0.86). After assigning every patient a PIVOT Score, we identified 2 cutoff values that divided the cohort into 3 groups. Below 25% (low risk), 7% of patients had a diminished outcome. Between 25% and 50% (intermediate risk), 46% of patients had a diminished outcome. Above 50% (high-risk), 72% of patients had a diminished outcome.

Conclusion: The PIVOT Score is a significant predictor of 6-month diminished functional outcome. Patients scoring >25% are considered either intermediate or high risk for a diminished functional outcome. Early interventions aimed at improving functional outcomes can be targeted to these patients.

Figure 1: Tibial Plateau Diminished Outcome Score
Probability of Diminished Outcome = 1 / (1 + exp(-(-3.38-1.38*MALE 2.27*WHITE+1.97*SMOKER+0.06*AGE +1.74*TIBIALSPINE)))
Male (dichotomous variable; 1- yes, 0 - no); White (dichotomous variable; 1- yes, 0 - no); Smoker (dichotomous variable; 1- yes, 0 - no); Age (continuous variable); Tibial Spine Involvement (dichotomous variable; 1- yes, 0 - no)