Patient-Reported Outcomes Measurement Information System Physical Function Scores Predict Tibial Shaft Fracture Nonunion following Surgical Fixation

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INTRODUCTION: Patient-Reported Outcomes Measurement Information System (PROMIS) scores have become a mainstay in assessing treatment efficacy in the clinical setting. The purpose of this study is to assess trends in PROMIS Physical Function (PF), Pain Interference (PI), and Anxiety Score (AS) in surgically treated tibial shaft fracture patients progressing to union vs. nonunion.

METHODS: A retrospective review of tibial shaft fracture patients treated at a single, tertiary, level 1 trauma center were identified using Current Procedural Terminology (27758, 27759) codes. Patients treated with intramedullary nailing for tibial shaft fractures were included. Patients were excluded if they had other concomitant, operative ipsilateral lower extremity injuries within one year of tibial shaft surgery. PROMIS PF, PROMIS PI, and PROMIS AS scores were collected for all included patients until 1 year following index surgery, until nonunion repair, or until a subsequent surgery of the ipsilateral lower extremity requiring bony work (i.e., hardware removal). Mean PROMIS and RUST scores at 0-1, 1-3, 3-6, and 6-12 months were compared between patients progressing to union and patients requiring nonunion repair. Means were compared using one-way ANOVA. Binary regression controlling for open fractures was used to calculate an odds ratio for each time period. All statistical analysis was done using same software.

RESULTS: A total of 234 patients (197 union, 37 nonunion) were included in the study. Patients did not differ in age, gender, BMI, alcohol use, smoking status, American Society of Anesthesiologists (ASA) classification, Charleston Comorbidity Index (CCI), Injury Severity Score (ISS), or AO/OTA classification (Table 1). The union group had 25 open fractures (12.7%) while the nonunion group had 17 (45.9%) open fractures (p<0.001). The average time to nonunion repair was 7.48 months. In terms of PF and PI, the calculated odds ratio for developing nonunion, after controlling for open fractures, were significant at 1-3, 3-6, and 6-12 months. For PROMIS PF, the odds ratio for every unit decrease in PF was 1.07 (p=0.046), 1.11 (p=0.002), and 1.11 (p=0.007) respectively. For PROMIS PI, the odds ratio for every unit increase in PI were 1.11 (p=0.004), 1.12 (p=0.004), and 1.26 (p=0.002) respectively. No statistical significance was reached at any time period in terms of PROMIS AS. Consistent with the above, patients progressing to union reported better PF and PI scores at 1-3, 3-6, and 6-12 month time periods than nonunion patients (Table 2, Figures 1 & 2). Within-subject comparisons assessing change in PROMIS scores between time periods (i.e., 6-12m vs. 3-6m vs. 1-3m vs. 0-1m) produced similar results (Table 3). Statistically significant differences in mean RUST scores were seen between groups at 1-3, 3-6, and 6-12 months (<.001) (Table 4).

DISCUSSION AND CONCLUSION: These study results establish a negative correlation between PROMIS PF, and a positive correlation with PROMIS PI, with the development of tibial shaft nonunion following surgical repair. As expected, there is no difference in PROMIS scores between the two groups at 0-1 month. However, the union group reported improved PF and PI scores at significantly faster rates, as early as 1-3 months follow up. Changes in mean PROMIS PF and PI begins to plateau in the nonunion group between the 1-3 and 6-12 month follow-up periods. These results demonstrate that trending PROMIS PF and PI in the clinical setting can help predict progression to nonunion following tibial shaft repair where imaging studies may lag behind in diagnosing tibial nonunion.